JOURNAL OF THE TRANSACTIONS

OF

THE VICTORIA INSTITUTE.

VOL. XLII.

JOURNAL OF

THE TRANSACTIONS

OF

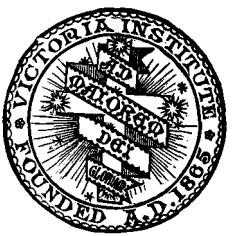
The Victoria Institute,

OR,

Philosophical Society of Great Britain.

EDITED BY THE SECRETARY.

VOL. XLII.



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PREFACE.

JUST as he was completing the work of editing this Volume Mr. H. Charlewood Turner was obliged through ill-health to resign his duties as Secretary of the Institute and Editor of the Journal. He retires with the best wishes of the Council for his speedy recovery and their sincere thanks for the good work he has done during his two years of office.

In putting the finishing touches to his work as Editor it devolves upon me to write this preface. I commence the work with the benefit which thirty years' membership of the Institute and two years' experience on the Council has given me; but I enter upon the duties with the greater confidence because it is the unanimous wish of my colleages that I should do so, and because I know I can rely upon their cordial help.

The Council regrets that owing to the causes mentioned above the publication of this Volume has been delayed beyond its usual time of issue. They desire me to express their acknowledgments to the writers of papers and to those taking part in the discussions, and invite the assistance of members in obtaining high-class papers suited to the needs of the times and an increase in the number of Members and Associates.

I have pleasure in recording the faithful and efficient help of the Assistant Secretary, Mr. A. E. Montague, to whom the Institute owes much for the unseen but none the less important work which he does so conscientiously and successfully.

FREDERIC S. BISHOP,
Secretary.

CONTENTS.

*** *The Institute's object being to investigate, it must not be held to endorse the various views expressed either in the Papers or discussions.*

VICTORIA INSTITUTE.

REPORT OF THE COUNCIL FOR THE YEAR 1909.

1. *Meetings.*

The meetings of the Institute during the present session have been well attended and the discussions keenly maintained.

The subjects dealt with may be arranged under the following heads:—

1. ARCHÆOLOGICAL.

"Assur and Nineveh." By THEOPHILUS G. PINCHES, LL.D., M.R.A.S.

2. BIBLICAL.

"The Attitude of Science towards Miracles." By Professor H. LANGHORNE ORCHARD, M.A., B.Sc. [The Gunning Prize Essay.]

"Light, Luminaries and Life." By Rev. A. IRVING, D.Sc., B.A.

3. CONTEMPORARY MOVEMENTS.

"Determinism." By the Ven. Archdeacon BERESFORD POTTER, M.A.

"Heredity and Eugenics." By the Rev. Professor A. CALDECOTT, M.A., D.Litt.

4. HISTORICAL.

"Arianism and Modern Thought." By Rev. Professor H. M. GWATKIN, M.A., D.D.

5. GEOGRAPHICAL.

"The Ivory Islands in the Arctic Ocean." By the Rev. D. GATH WHITLEY.

6. PHILOSOPHICAL.

"Plato's Theory of Public Education in Relation to the Christian Doctrine of Human Nature." By the Rev. H. J. R. MARSTON, M.A.

7. SCIENTIFIC.

"Abnormal conditions of water as a proof of Design in Creation." By Professor E. HULL, LL.D., F.R.S.

"Species and their Origin." By Rev. J. GERARD, B.A., F.L.S.

"Darwinism and Malthus." By Rev. JAMES WHITE, M.A.

"Modern Conceptions of the Universe." By G. F. C. SEARLE, Esq., M.A. F.R.S. [Read at 500th Ordinary General Meeting of the Institute.]

It will be seen that the subjects selected are of wide interest at the present time. A very large number of the Members and Associates had suggested the subjects to be discussed, and great care was taken in their selection by the Council.

2. *Grants of Literature.*

The usual grants of literature have been made to over thirty societies engaged in Missionary and other Christian work. Many letters of thanks have been received acknowledging the practical use of the papers published in our Transactions. Missionaries and others in distant places especially have found much profit from the reading of our papers which deal with modern investigations of Philosophy and Science, especially those which bear upon the great truths contained in Holy Scripture. The Council desire to bring this aspect of the work prominently before the Members and Associates.

3. *Officers and Council.*

President.

The Right Honourable The Earl of Halsbury, M.A., D.C.L., F.R.S.

Vice-Presidents.

Sir T. Fowell Buxton, Bart., K.C.M.G.
Lieut.-Gen. Sir H. L. Geary, K.C.B.
David Howard, Esq., D.L., F.C.S. (*Trustee*).
Right Hon. Lord Strathcona and Mount Royal, LL.D., F.G.S.
Professor E. Hull, LL.D., F.R.S., F.G.S.
Rev. Canon R. B. Girdlestone, M.A.

Honorary Correspondents.

Sir David Gill, K.C.B., LL.D., F.R.S.

Professor E. Naville (*Geneva*).
Professor Maspero (*Paris*).
Professor A. H. Sayce, D.D., LL.D.
Professor Fridtjof Nansen, D.Sc.
Professor Warren Upham, D.Sc.
Professor F. F. Roget (*Geneva*).

Honorary Auditors.

Lieut.-Col. G. Mackinlay, late R.A. | E. J. Sewell, Esq.

Council.

(*In Order of Election.*)

Very Rev. Dean Wace, D.D. (*Trustee*).
Edward S. M. Perowne, Esq., F.S.A. (*Hon. Treasurer*).
Martin Luther Rouse, Esq., B.A., B.L.
Rev. John Tuckwell, M.R.A.S.
Lieut.-Colonel G. Mackinlay.
General J. G. Halliday.
Arthur W. Sutton, Esq., F.L.S., J.P.
Professor H. Langhorne Orchard, M.A., B.Sc.
Rt. Rev. Bishop J. E. Welldon, D.D.
Sydney T. Klein, Esq., F.L.S., F.R.A.S., M.R.I.
William J. Horner, Esq.
Frederic S. Bishop, Esq., M.A., J.P.
A. T. Schofield, Esq., M.D.
Heywood Smith, Esq., M.A. M.D.
Rev. W. H. Griffith Thomas, D.D.

Secretary and Editor of the Journal.
H. Charlewood Turner, M.A.

Assistant Secretary.
Albert E. Montague.

4. *Election of new Members of Council.*

In accordance with the alterations in the rules passed on June 24th last one-third of the Council now retire and the Council have nominated the following to fill the eight vacancies thus created:—

Rev. Chancellor Lias, M.A.*
T. G. Pinches, Esq., LL.D., M.R.A.S.*
Ven. Archdeacon W. M. Sinclair, M.A., D.D.*
Rev. H. J. R. Marston, M.A.
E. W. Maunder, Esq., F.R.A.S.
Ven. Archdeacon Beresford Potter, M.A.
Rev. J. H. Skrine, M.A.
J. W. Thirtle, Esq., LL.D.

There is a further vacancy which the Council recommend that the Annual General Meeting should fill, and they have therefore nominated for that purpose:—

E. J. Sewell, Esq.

Due notice was sent to all Members asking them for nominations for these vacancies to be sent in before March 31st, but none were received.

5. *Obituary.*

The Council regret to have to record the death during the past year of the following supporters of the Institute:—

Professor A. Agassiz, D.C.L., F.R.S. (Hon. Correspondent), John Allen, Esq. (Hon. Auditor), W. G. Black, Esq., M.D., Edward Clapton, Esq., M.D., Ralph J. Fremlin, Esq., The Very Rev. W. Lefroy, D.D., Dean of Norwich, Alexander McArthur, Esq., D.L., J.P., Vice-President and Vice-Patron, Rev. H. Ross, D.D., Rev. Alexander Stewart, M.D., LL.D., J. Townsend Trench, Esq., Rev. R. Tapson, Rev. Canon R Taylor, Rev. G. F. Whidborne, M.A., F.G.S. (Member of Council), Rev. Canon Bernard Wilson, M.A.

6. *New Members and Associates.*

The following are the names of Members and Associates elected since the last Annual Meeting:—

Members.—Colin McLarty, Esq., U.S. Navy, Professor F. F. Roget, Rev. Prebendary L. E. Shelford, M.A., Rev. Cyprian L. Drawbridge, M.A., T. B. Bishop, Esq.

* Retiring Member of Council.

ASSOCIATES.—Rev. F. Cecil Lovely, B.A., Rev. F. W. Maunsell, M.A., Miss Margaret Spokes, Henry Wilson, Esq., Miss A. Habershon, Dr. W. A. Shann, Rev. S. H. Wilkinson, Colonel Henry Grey MacGregor, C.B.

7. *Numbers of Members and Associates.*

The following statement will show the number of the supporters of the Institute at the present time, May 9th, 1910, including hon. corresponding members, etc. :—

Life Members	33	in number.
Annual Members	99	„
Life Associates	66	„
Annual Associates...	273	„
Missionary Associates	13	„
Hon. Corresponding Members ...	108	„
Library Associates	20	„
Total	612	

8. *Changes in the Constitution.*

The long-considered changes in the constitution have at length been carried into effect at a Special General Meeting held on January 24th ; they are given in detail in the appendix. The chief point is that one-third of the members of Council retire at the Annual General Meeting each year, subject to re-election ; this rule to come into force at the Annual Meeting, 1910. The Council trust that by this means the bond between the Council and the Members and Associates at large will be strengthened and that fresh life and interest will be quickened in the Council itself. The rules have also been so altered that our Annual Meeting may in future be held early in the year. It is therefore proposed to have the next Annual Meeting early in February 1911, when the audited accounts for 1910 will be presented, and when another third will be elected to serve on the Council. It is intended that the commemorative address shall be given as hitherto, towards the end of the session in May or June.

9. *The Gunning Prize.*

The Prize Essay by Professor H. Langhorne Orchard, M.A., B.Sc., was read at the Society of Arts on January 24th, 1910. It drew together a large audience, and the discussion was well maintained. The essay has met with wide approval, it is

eminently suited to the needs of the times, and the Council feel assured that its circulation will be productive of much good. It is now printed and can be purchased (in pamphlet form). Copies have been sent for review to the leading periodicals and papers. The Council will be grateful to all Members and Associates who will do what they can to circulate this useful essay, which so well carries out the objects and aims of the Victoria Institute.

10. *Special features of the Current Year.*

As already noted the annual retirement of one-third of the Members of the Council is a special feature in the history of the Institute. This has been inaugurated this year.

The reading of the 500th paper was made a special occasion, when a most excellent paper was contributed by Professor G. F. C. Searle, M.A., F.R.S., on "Modern Conceptions of the Universe." Another paper, by the Rev. Professor Gwatkin, M.A., D.D., the chief authority on Early Church history, on "Arianism and Modern Thought," attracted the greatest attention, and lastly, there is the Prize Essay already mentioned by Professor H. Langhorne Orchard.

11. *Local Meetings for the Victoria Institute.*

The Council are making a forward movement in holding Meetings for the Victoria Institute in country towns and in the suburbs of London. They will gladly send lecturers, or help in any other way Members or Associates who will hold such meetings in their own localities. If two or three Members or Associates live near each other, a joint effort may be made with this object in view. The Secretary will gladly introduce Members and Associates to each other. Two Members have arranged for an invitation meeting at a hall in Upper Norwood, on May 12th next, at which Professor H. Langhorne Orchard, M.A., B.Sc., will give an address on the subject of his prize essay and W. Carruthers, Esq., Ph.D., F.R.S., and others have also kindly promised to speak. Another meeting is being arranged for in the autumn at Wimbledon. In places where courses of winter lectures are given the Council will gladly send a lecturer from the Victoria Institute to take part; by this means the aims and objects of the Victoria Institute will be directly furthered, and the work of the Institute itself will be made known to a wide circle.

12. *Financial.*

The Council are glad to report that there is improvement in the financial position, though the situation still demands care and attention. Nothing was taken from the small reserve fund as in previous years. The cash statement nearly balances, and would have quite done so had it been possible to publish the volume of Transactions at the usual time. After making a careful estimate the Council have every reason to believe that the income of the current year will meet the expenditure. They appeal with confidence for increased support in carrying on the work of the Victoria Institute. They warmly welcome the Members and Associates who have joined during the past year, and they trust that many more may be added during the coming one.

In addition to the donations received last year in response to the special Financial Appeal the following amounts have since been contributed and they are now acknowledged with thanks:—

	£	*s.*	*d.*
Arthur W. Sutton, Esq., J.P.	5	5	0
S. Joshua Cooper, Esq.		18	0

Further additions to this fund will greatly help the finances of the Institute.

The Balance Sheet to 31st December, 1909, has been duly audited, the Hon. Auditors being Lieut.-Colonel Mackinlay and Mr. E. J. Sewell, to whom the Council tender their thanks.

Conclusion.

The past year has been one of progress and advance: the work of the Institute is much needed at the present time—never more so. The Council look forward to the future with hope and confidence that this work may be in the words of our motto, "Ad Majorem Dei Gloriam."

Signed on behalf of the Council,

HALSBURY,

President.

1, *Adelphi Terrace House, Strand, W.C.*

CASH STATEMENT, *for the year ending December 31st, 1909.*

RECEIPTS.

		£	s.	d.	£	s.	d.
Cash Balance from 1908					4	7	9
Subscriptions:—1 Life Member, ...		21	0	0			
2 Members,	1908 ..	4	4	0			
92 ,,	1909 ..	193	4	0			
4 ,,	1910 ..	8	8	0			
1 Associate,	1906 ..	1	1	0			
4 Associates,	1907 ..	4	4	0			
14 ,,	1908 ..	14	14	0			
231 ,,	1909 ..	242	11	0			
11 ,,	1910 ..	11	11	0			
					500	17	0
Sales		..	..		33	16	4
Dividend		..	..		13	9	10
Donations		..	..		6	3	0
From Gunning Fund (Expenses)		..	..		10	0	0
					£568	13	11

EXPENDITURE.

	£	s.	d.
Printing, Binding, Stationery } of these £130 17s. 5d. were the unpaid bills of 1908	136	14	9
	37	10	5
	13	8	7
Postage	31	1	4
Expenses of Meetings	15	3	2
Salaries	200	10	6
Clerk's Insurance	2	10	4
Rent	78	15	0
Gas and Electric Light	6	11	9
Library	11	3	6
Fire Insurance	0	12	0
Bank Charges	1	12	10
Sundries	2	11	6
Cheque returned from Bank	1	0	0
Petty Cash in hand December 31st £5 18s. 1d. .. / Cash in Bank December 31st £23 10s. 2d.	29	8	3
	£568	13	11

There is a Capital sum of £570, 2½ % Consols, also the Capital of the Gunning Trust Fund, £508 Great India Peninsular Railway Stock. Unpaid bills amounted to £165 17s. 4d., arrears of subscriptions due were expected to realize £34 13s.

GUNNING PRIZE FUND.

	£	s.	d.
Balance from 1908	68	0	6
Interest Jan. 2nd, 1909	8	1	8
,, July 1st, 1909	7	3	6
	£83	5	8

	£	s.	d.
July 26th, 1909—To Referees	9	9	0
,, ,, ,, Clerk	2	2	0
,, ,, ,, Expenses—Victoria Institute ..	10	0	0
,, ,, ,, Professor Orchard	40	0	0
	61	11	0
Balance	21	14	8
	£83	5	8

We have verified all the accounts and compared them with the books and vouchers and find them correct. We have also verified the investments.

15th April, 1910.

GEORGE MACKINLAY, Lt.-Col., } *Auditors.*
E. J. SEWELL.

APPENDIX TO THE REPORT.

A Special General Meeting of the Victoria Institute was held on Monday, January 24th, at 4 p.m., to consider certain alterations in the Constitution recommended by the Council.

Lieut.-Col. MACKINLAY, who was in the Chair, in moving the adoption of the alterations on behalf of the Council, gave the following explanation of their purpose and effect.

The Council consider, as mentioned at the last Annual Meeting, that it would be wise to follow the example of many of the leading Scientific Societies of retiring a third of their number each year, subject to re-election, thus introducing fresh blood, and keeping in closer touch with the members and associates. The necessary alterations of our Constitution and Bye-Laws are now proposed by the Council for the sanction of the Special General Meeting now assembled.

It was stated at the last Annual Meeting that the Council contemplate holding the Annual Meeting at the beginning of the year instead of in May or in June, as has hitherto been the custom. The advantages of the new plan were mentioned at the Annual Meeting. According to § IV, Bye-Laws, 1, the Council may determine the most convenient day in the year, this change is therefore not alluded to in the proposed alterations, except that as the new § II. Constitution.—Rule 4.—December 1st, is mentioned as the limit of time for sending in the names of those nominated to serve on the Council; this day will be at a convenient interval before an Annual Meeting at the beginning of the year. The *next* Annual Meeting will however be held in May next, but in 1911 and subsequently the intention is to hold the Annual Meeting at the beginning of the year.

Advantage has been taken of the opportunity to make various minor alterations tending to simplification and also to sanction the practical arrangements of many years past.

For instance, as all the Meetings for reading the papers are exactly alike, the term *Intermediate Meeting* has been given up.

Unnecessary formalities connected with application for membership

have been done away with, and it is now laid down that the entrance fee of a guinea may be suspended by the Council at times.

Mr. A. W. SUTTON seconded the resolution.

The following alterations in the Rules were then taken in order, and passed.

The old Rules are printed below with the alterations on the opposite pages :—

§ II. Constitution.

Old Rules.

2. The government of the Society shall be vested in a Council (whose Members shall be chosen from among the Members and Associates of the Society and be professedly Christians), consisting of a President, two or more (not exceeding seven) Vice-Presidents, a Treasurer, one or more Honorary Secretaries, and twelve or more (not exceeding twenty-four) Ordinary Members of Council, who shall be elected at the Annual General Meeting of the Members and Associates of the Institute. But, in the interval between two Annual Meetings, vacancies in the Council may be filled up by the Council from among the Members of the Society; and the Members chosen as Trustees of the funds of the Institute shall be *ex officio* Members of Council.

3. Any person desirous of becoming a Member or Associate shall make application for admission by subscribing the Form A of the Appendix, which must be signed by two Members of the Institute, or by a Member of Council, recommending the candidate for admission as a Member; or by any one Member of the Institute, for admission as an Associate.

§ II. Constitution.

Rules as altered.

2. The government of the Society shall be vested in a Council (whose Members shall be chosen from among the Members and Associates of the Society and be professedly Christians), consisting of a President, two or more [not exceeding seven], Vice-Presidents, an Honorary Treasurer, one or more Honorary Secretaries, and twelve or more [not exceeding twenty-four] Ordinary Members of Council. The Trustees for the time being of the funds of the Institute shall be *ex officio* Members of the Council.

3. The President, Vice-Presidents and Honorary Officers [other than the Trustees for the time being of the funds of the Institute] shall be elected annually at the Annual General Meeting of the Institute, with power to the Council to fill up any casual vacancies.

At the Annual General Meeting in each year, one-third of the Ordinary Members of Council [or if their number be not a multiple of three then the number nearest to one-third] shall also retire, in order of seniority of election to the Council, and be eligible for re-election : as between Members of equal seniority the Members to retire shall be chosen from among them by ballot [unless such Members shall agree between themselves]. Vacancies thus created shall be filled up at the Annual General Meeting, but any casual vacancies may be filled up by the Council.

4. For the annual elections taking place under Rule 3, nominations may be made by members of the Institute and sent to the Secretary not later than December 1st in any year. The Council may also nominate for vacancies, and all nominations shall be submitted to the Members and Associates at the time when notice of the Annual General Meeting is posted.

If more nominations are made than there are vacancies on the Council the election shall be by ballot.

5. Any person desirous of becoming a Member or Associate shall send to the Secretary an application for admission, which shall be signed by one Member or Associate recommending the Candidate for admission.

Old Rules.

4. Upon such application being transmitted to one of the Secretaries, the candidate for admission may be elected by the Council, and enrolled as a Member or Associate of the Victoria Institute, in such manner as the Council may deem proper; having recourse to a ballot, if thought necessary, as regards the election of Members; in which case no person shall be considered as elected unless he have three-fourths of the votes in his favour.

5. Application for admission to join the Institute being thus made by subscribing Form A, as before prescribed, such application shall be considered as *ipso facto* pledging all who are thereupon admitted as Members or Associates to observe the Rules and Bye-Laws of the Society, and as indicative of their desire and intention to further its objects and interests; and it is also to be understood that only such as are professedly Christians are entitled to become *Members*.

6. Each Member shall pay an Entrance Fee of One Guinea and an Annual Contribution of Two Guineas. A Donation of Twenty Guineas shall constitute the donor a Life Member.

Rules 7–15 (incl. 14*a*).

16. Both Members and Associates shall have the right to be present to state their opinion, and to vote by show of hands at all General and Ordinary Meetings of the Society; but Members only shall be entitled to vote by ballot, when a ballot is taken in order to determine any question at a General Meeting.

§ IV.

1. A General Meeting of Members and Associates shall be held annually on 24th May (being Her late Majesty's birthday, and the Society's anniversary), or on the Monday following, or on such other day as the Council may determine as most convenient, to receive the Report of the Council on the state of the Society, and to deliberate thereon; and to discuss and determine such matters as may be brought forward relative to the affairs of the Society; also, to elect the Council and Officers for the ensuing year.

Rules as Altered.

6. Upon such application being transmitted to one of the Secretaries, the candidate may be elected by the Council, and enrolled as a Member or Associate of the Victoria Institute, in such manner as the Council may deem proper.

7. Application for admission to join the Institute being made as before laid down, such application shall be considered as *ipso facto* pledging all who are thereupon admitted as Members or Associates to observe the Rules and Bye-laws of the Society, and as indicative of their desire and intention to further its objects and interests; and it is also to be understood that only such as are professedly Christians are entitled to become Members.

8. Each Member shall pay an Entrance Fee of One Guinea, which the Council may from time to time suspend, and an Annual Contribution of Two Guineas. A Donation of Twenty Guineas shall constitute the donor a Life Member.

Renumbered 9–18.

Deleted.

§ IV.

1. Read for last clause :—

"Also to elect Members of Council and Officers for the ensuing year."

Old Rules.

2. The Council shall call a Special General Meeting of the Members and Associates, when it seems to them necessary, or when required to do so by requisition, signed by not less than ten Members and Associates, specifying the question intended to be submitted to such Meeting. Two weeks' notice must be given of any such Special General Meeting; and only the subjects of which notice has been given shall be discussed thereat.

3. The Ordinary Meetings of the Society shall usually be held on the first and the Intermediate Meetings on the third Monday evenings in each month, from November to June inclusive or on such other evenings as the Council may determine to be convenient: and a printed card of the Meetings for each Session shall be forwarded to each Member and Associate.

4. At the Ordinary and Intermediate Meetings the order of proceeding shall be as follows: The President, or one of the Vice-Presidents, or a Member of the Council, shall take the chair at 4.30 o'clock precisely, the minutes of the last Ordinary or Intermediate Meeting shall be read aloud by one of the Secretaries, and, if found correct, shall be signed by the Chairman; the names of new Members and Associates shall be read; the presents made to the Society since their last Meeting shall be announced; and any other communications which the Council think desirable shall be made to the Meeting. After which, the Paper or Papers intended for the evening's discussion shall be announced and read, and the persons present shall be invited by the Chairman to make any observations thereon which they may wish to offer.

The claims of Members and Associates to take part in a discussion are prior to those of Visitors. The latter when desiring to speak upon any Paper, must first send their cards to the Chairman and ask permission (unless they have been specially invited by the Council "to attend, and join in considering the subject before the Meeting," or are called upon by the Chairman). 1875.

6. The Council may at their discretion authorise Papers of a general kind to be read at any of the Ordinary or Intermediate Meetings, either as introductory lectures upon subjects proper to be afterwards discussed, or as the results of discussions which have taken place, in furtherance of the 5th Object of the Society (§ I.).

Rules as Altered.

2. The following Clause is inserted at the end of this rule :—

"And no alteration in, or addition to, the existing rules shall be made except at such Special General Meeting."

3. The Ordinary Meetings of the Society shall usually be held on the first and third Monday afternoons or evenings in each month, from January to June inclusive and in December : or on such other afternoons or evenings as the Council may determine to be convenient : and a printed card of the Meetings for each Session shall be forwarded to each Member and Associate.

4. line 1, omit "and intermediate."

line 3, for 4.30 read "at the time fixed for the commencement of the Meeting."

line 10, omit "the evening's."

End of note, omit "1875."

6. line 2. For "Ordinary or Intermediate" read "Ordinary."

Old Rules.

7. With respect to Intermediate Meetings, the Papers read at which are not necessarily printed nor the discussions reported, the Council at its discretion may request any lecturer or author of a Paper to be read thereat, previously to submit an outline of the proposed method of treating his subject.

8. At the Ordinary or Intermediate Meetings no question relating to the Rules or General Management of the affairs of the Society shall be introduced, discussed or determined.

§ VI.

3. The Council may authorise Papers to be read without such previous reference for an opinion thereon; and when a Paper has been referred, and the opinion is in favour of its being read in whole or in part, the Council shall then cause it to be placed in the List of Papers to be so read accordingly, and the author shall receive due notice of the evening fixed for its reading.

§ VII.

1. The government of the Society, and the management of its concerns are entrusted to the Council, subject to no other restrictions than are herein imposed, and to no other interference than may arise from the acts of Members in General Meeting assembled.

2. With respect to the duties of the President, Vice-Presidents, and other Officers and Members of Council, and any other matters not herein specially provided for, the Council may make such regulations and arrangements as they deem proper, and as shall appear to them most conducive to the good government and management of the Society, and the promotion of its objects. And the Council may hire apartments, and appoint persons not being Members of the Council, nor Members or Associates of the Institute, to be salaried officers, clerks, or servants, for carrying on the necessary business of the Society; and may allow them respectively such salaries, gratuities, and privileges, as to them, the Council, may seem proper; and they may suspend any such officer, clerk or servant from his office and duties, whenever there shall seem to them occasion; provided always, that every such appointment or suspension shall be reported by the Council to the next ensuing General Meeting of the Members to be then confirmed or otherwise as such Meeting may think fit.

Rules as altered.

7. The Council may, at its discretion, request any Lecturer or Author of a paper to be read at any Meeting, previously to submit an outline of the proposed method of treating his subject.

8. For "Ordinary or Intermediate" read "Ordinary."

§ VI.

3. line 5. For "evening" read "day."

§ VII.

1. last line. For "Members" read "Members and Associates."

2. line 15. For "Members" read "Members and Associates."

ANNUAL GENERAL MEETING.

MONDAY, MAY 9TH, 1910.

THE RIGHT HON. THE EARL OF HALSBURY, F.R.S. (PRESIDENT), IN THE CHAIR.

The Minutes of the preceding Annual General Meeting were read and confirmed.

An Address to His Majesty King George V. was moved from the Chair and adopted, all present standing.

The Annual Report was presented and adopted.

The following Members of the Council were elected :—

Rev. Chancellor J. J. Lias, M.A.*
Rev. H. J. R. Marston, M.A.
E. W. Maunder, Esq., F.R.A.S.
Theo. G. Pinches, Esq., LL.D., M.R.A.S.*
Ven. Archdeacon Beresford Potter, M.A.
Ven. Archdeacon W. M. Sinclair, M.A., D.D.*
Rev. J. H. Skrine, M.A.
E. J. Sewell, Esq.
J. W. Thirtle, Esq., LL.D., M.R.A.S.

The Annual Address was then delivered.

ADDRESS ON THE RETURN OF HALLEY'S COMET IN 1910.

By A. C. D. CROMMELIN, Esq., D.Sc., F.R.A.S.

WE have the privilege this year of welcoming a rare visitor, that few indeed of those now living have seen before, or can expect to see again. Its visits occur at intervals of three-quarters of a century, or more exactly it makes thirteen visits in 1,000 years. The idea of welcoming a comet is one that would have sounded strange to our ancestors, who regarded these visitors with terror as most ill-omened and precursors of plague, famine, and war. Their terror was not wholly unreasonable, for even from our modern standpoint, comets remain

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* Retiring Members re-elected.

in many respects very mysterious; to the ancients the mysteries that they presented were quite baffling, and seemed to traverse all that they knew, or thought they knew, about the heavenly movements, which they rightly regarded as the embodiment of majestic law and order. "Let them be for signs and for seasons and for days and years"; "He hath established them for ever and for ages of ages; He hath made a decree, and it shall not pass away." We may not all of us realise how fully these movements were understood even 2,000 years ago; thus Fathers Epping and Strassmaier published a work a few years ago on the Babylonian astronomy as revealed by the cuneiform tablets, in which they showed that a regular astronomical almanac like our Nautical Almanac was published year by year, predicting the places of the sun, moon, and planets for the year. (Father Kugler is now bringing out a still fuller treatise on the same subject.) When they came to the comets, however, their power of prediction utterly broke down. These were utterly unlike the other bodies in their appearance and their movements, which refused to conform to the Zodiac or track of the planets, but were at random in all directions, and in all parts of the heavens. They were often so extremely rapid as to suggest great proximity, possibly even within the confines of our own atmosphere, in which case the apprehension was quite natural that evil effects, such as pestilence and famine, might be the result of their approach. It was indeed almost impossible for the ancients to form a true idea of the cometary movements; their mathematical knowledge was not sufficient. Seneca, an illustrious Roman philosopher, who lived at the beginning of the Christian era, made a remarkable prediction about comets. "Some day there will arise a man who will demonstrate in what regions of the heavens the comets take their way; why they journey so far apart from the other planets; what their size, their nature" (*Quest. Nat.*, lib. vii, c. xxvi). For over 1,600 years this remarkable prophecy remained a dead letter; then at last the man appeared, of whom it is said:—

> Nature and Nature's laws lay hid in night,
> God said "Let Newton be," and all was light.

Newton showed that, under the force of gravitation attracting according to the law of the inverse square of the distance, four forms of orbit were possible; first, the circle, which is very nearly the course pursued by the earth and most of the planets. Secondly, the ellipse, or oval, which shades through all varieties of flattening from an almost circular form, as in the orbits of

Mars and Mercury, to an extremely elongated form. Thus in the case of Halley's comet the breadth is a quarter of the length, but the ellipse may be still more flattened than this; there is indeed no limit to the amount, and we are led on to the third form, the parabola, which we may look on as simply an ellipse of infinite length. The fourth form, the hyperbola, does not occur much in the heavens, and need not detain us. Newton soon saw that comets might be explained by supposing them to move in very elongated ellipses, or even in parabolas, remaining invisible for most of the time, and only being visible for a short time, when in the portion of their orbit nearest to the sun. Halley, who had more inclination than Newton for the huge arithmetical computations required, entered into the new ideas with enthusiasm, and computed the orbits of all the comets for which observations of the necessary accuracy were available. They were twenty-four in number, and went back for about 200 years before his time. By a piece of good fortune, which he had most richly merited by his assiduous labours, the same comet occurred three times in his list, and when he came to tabulate the results he noticed that the comets of 1531, 1607, 1682 were travelling in practically the same orbit round the sun. It should be mentioned that the assumption of parabolic motion was made in the first instance, as the necessary computations were simplified, since all parabolas are similar curves, and tables can be made which will serve for all cases, while in the case of ellipses different tables would be required for every case. When he noticed the resemblance of orbits he at once conjectured that this was the same body returning at intervals of three-quarters of a century. On finding the elements of the necessary ellipse to correspond with this period, he saw that it satisfied the observations of the comet better than the parabolic assumption, and this strengthened his conclusion. The only thing against it was that the intervals between the returns were not exactly equal; the first being fifteen months longer than the second. This puzzled him for a time till he recollected that, even in the case of the planets, one revolution was not exactly equal to another. It is true that the differences here were only minutes or hours, not months or years; the cause of the irregularities he knew to be the perturbations which the planets produce on each other's motion, and he saw that these would be greater in the case of the comet, which passed at times very much closer to the giant planets than these can do to each other; further, in an elongated orbit a small alteration in the velocity, when not very remote

from the sun, has a much greater effect on the period than would be the case in a circular orbit. Halley was quite right in these conclusions, and we now know that the planetary influences can alter the period by even more than the fifteen months required by the case before him; the total range is five years, the longest on record is seventy-nine years, four and a half months, between A.D. 451 and 530; the shortest is that in the revolution just completed, which is seventy-four years, five months. Making a rough allowance for the action of Jupiter, Halley said the comet might be expected to return to perihelion at the end of 1758, or the beginning of 1759; be it noted that this was the first time in the world's history that the return of a comet had been predicted; Halley was fully conscious of the new epoch in astronomy that he was opening, and said, "Quo circa si secundum predicta nostra redierit iterum circa annum 1758, hoc primum ab homine Anglo inventum fuisse non inficiabitur aequa posteritas." It is rather a curious commentary on these words that it is just in England that we find scepticism expressed as to the fulfilment of the prediction. The well-known *Gentleman's Magazine*, in its issue for Oct., 1758, has these verses, which show that the writer had not even taken the trouble to find exactly what Halley had predicted, fancying that he had dated the comet's return a year earlier than he had actually done :—

Comet that came in eighty-two,
Would come, it was foretold, anew,
Late in the last, or soon this year,
That sees, tho' late, none such appear
An insignificant delay!
It will come yet, some sages say;
Tho' it should not appear, say some
As sure as fortune, it will come.
Prediction, this, that bears the shape,
To vulgar eye, of an escape;
Or trick of cometary learning,
To set itself above discerning.
Now, Mr. Urban, you must know,
Wager was laid, a year ago,
That it would come; and time within
Last year, or present, is to win.
Should it then come, and not be seen,
Pray, in your ancient magazine,
To which both parties have referred,
Let the uncommon case be heard.

That public sense may try the cause,
And tell us by what wondrous laws,
We may be sure, in any year,
That Comets come which don't *appear*.
For tho' philosophers may sing,
That calculation proves the thing,
Pray, let them tell us how they show
That this, their calculation's true.

At the very time when these scornful words were being written in England, the well-known French astronomers, Clairaut and Lalande, were so convinced of the truth of Halley's prediction, that they undertook, and with the help of Madame Lepaute, successfully carried out the computation of the planetary perturbations for the two revolutions of the comet, 1607–1682, and 1682–1759. It was necessary to compute the earlier revolution to find the actual angular velocity of the comet in 1682, and the later one, in order to find how much that velocity was modified by planetary action during the ensuing round. Their result was successful, considering that the masses of Jupiter and Saturn were still imperfectly known, and that Uranus and Neptune were undiscovered. The date they assigned was just a month too late, the comet being found by the amateur astronomer Palitsch, on Christmas day, 1758, and passing its nearest point to the sun on March 13th, 1759. After the discovery the *Gentleman's Magazine* executed a remarkable *volte-face*, and forgot its earlier attitude. In its issue for May, 1759, it published these verses, which are dated New York, April 16th, 1759:—

Hah! There it flames, the long-expected star,
And darts its awful glories from afar!
Punctual at length the traveller appears,
From its long journey of near fourscore years.
Lo! the reputed messenger of fate,
Array'd in glorious but tremendous state,
Moves on majestic o'er the heavenly plane,
And shakes forth sparkles from its fiery train.
Ah! my misfortune that I live retired,
And nought avail me arts I once acquired?
Here, like a hermit, in my lonely cell,
Far from the mansions where the muses dwell.
I'm forced to act the common gazer's part,
Alas! unfurnished with the aids of art.
O for the tube, with philosophic eye,
To trace the shining wanderer through the sky!

O for the ampler arch, in nicer mode,
To mark its stages through the azure road!
But vain the wish! Oh! ye that can survey
The glorious orb, and track its radiant way;
While vulgar crowds with dull attention gaze,
And gaping wonder at the silver blaze:
Ye sons of science, from your high abodes,
Descry its oblique path, and mark its nodes,
Explore with what velocity 'tis hurled,
And how exact its period round the world.
Now, now in this delightful work engage,
Pursue the steps of the sagacious sage,*
And be this wiser than the former age.

I think these verses are of sufficient interest to reproduce, as showing the ideas that were prevalent in England both before and after the comet was seen. Perhaps Halley's reputation shone all the more brightly from the temporary scepticism; it was certainly a noble achievement to have robbed this comet of the superstitious dread which for centuries had accompanied its appearance, and to have transformed it from an aimless wanderer to a permanent member of the solar system, whose behaviour can now be foretold almost as accurately as that of the planets.

Halley recognised that his comet might be carried backwards as well as forwards, by studying cometary records, and he was successful in identifying the comet of 1456 as the same body. Before that time his efforts were less successful; failing to realise how greatly the period of the comet might be altered by the action of the planets, he proceeded with a uniform time-interval, and deduced a series of returns which were all erroneous, extending back to the comet stated to have been observed at the death of Julius Cæsar, and that very brilliant one that is said to have signalised the birth of Mithridates.

It was not till the nineteenth century that the early history of the comet was placed on a more satisfactory basis. M. Laugier showed that Halley was wrong in taking the comet of 1380 as his; the right one was that of 1378; he also showed that the comets of A.D. 451 and 760 were in all probability the same body. A few years later Dr. Hind, who was for many years the superintendent of the Nautical Almanac, drew up a list of conjectural identifications for every return from 12 B.C. to A.D. 1301, some fairly certain, from the exactitude with which their paths had been described, other admittedly vague

* Dr. Halley.

and doubtful. In the last few years a large piece of computational work, in which I have borne a part, has been carried out, with the object of testing Hind's list.

The effect of the planets on the period of the comet has been calculated for each revolution, and conjecture has given place to certainty. On the whole Hind's list was singularly accurate, but he was seriously wrong in two cases; in A.D. 608 he was one and a half years too late, and in A.D. 1223 nearly a year too late. The history of the comet now extends with certainty to 240 B.C., and with some degree of probability to 613 B.C., in the autumn of which year a comet passed through the Great Bear. The great cometographer Pingré fancied that this comet might be alluded to by the prophet Jeremiah (i, 13); "I see a boiling caldron, and the face thereof from the face of the north." He even conjectured that the "rod watching" in verse 11, might be the tail of the comet; Pingré suggested that the tail was seen before the head had risen; when the latter appeared it resembled a caldron with steam rising from it. The insertion of the word "north" lends colour to the suggestion that a celestial apparition may be indicated.

These guesses seem to me to be extremely doubtful, but the interest of finding a possible reference to our comet in Scripture justified us in quoting them. Two revolutions later, in 467 B.C., both Anaxogoras and Aristotle relate that a meteoric stone fell at Aegospotami, and that a comet was seen at the same time. It is interesting to find these events mentioned in juxtaposition at such an early date. This comet was also seen in China, but unfortunately no details are given of its track through the constellations, so its identification is doubtful. Three revolutions later we come to our first certain identification, in 240 B.C., when the Chinese annals state that a comet was seen first in the east, then in the north, and finally for sixteen days in May in the west. The return in 12 B.C. is interesting, being so near the birth of Our Lord, which according to the date assigned by Lt.-Col. Mackinlay, fell four years later. This comet is described with great fulness in the Chinese annals, to which we are indebted for most of our knowledge of ancient comets; the European records are far less precise, and in this case simply relate that "A comet was seen for several days, it appeared suspended over the city of Rome; then it appeared to break up into several little torches." Halley's comet next appeared in A.D. 66, January, four years before the fall of Jerusalem. It is not impossible that this was the comet resembling a sword, which according to

Josephus, appeared suspended over Jerusalem shortly before its fall. At least we have no certain record of any other comet nearer the time of the fall. Then follow returns on A.D. 141 March 25th, A.D. 218 April 6th (described as a terrifying spectacle, preceding the death of the Emperor Macrinus), A.D. 295 April 7th, A.D. 373 November 7th, A.D. 451 July 3rd. This comet came about the time of the defeat of Attila by Ætius; it is referred to by Idatius, who says it was seen as a morning star in June, and an evening star in July. The Chinese annals accurately describe its course from the Pleiades through Leo, ending near Beta Leonis. A.D. 530 November, when it was described as very grand and terrifying, resembling a burning torch; A.D. 607 March, A.D. 684 October. This appearance is interesting, from a rough sketch in the *Nuremberg Chronicle*, that purports to represent it; there is however no proof that it is really contemporary; A.D. 760 June, very full Chinese record, enabling Laugier to confidently identify the comet as Halley's; A.D. 837 February 25th, taken by Louis le Debonnaire as a sign of his approaching death. A.D. 912 July, a return which till lately rested on computation only, no observation being known. A Japanese astronomer, Hirayama, has now found a record of its visibility in Japan from July 19th to 28th. A.D. 989 September 2nd; A.D. 1066 March 25th; this is the apparition that is associated with the Norman Conquest. The terror that it caused in England is illustrated by the manner in which it was apostrophised by Elmer, a monk of Malmesbury; "Venisti, multis matribus lugende; dudum est quod te vidi, sed nunc multo terribiliorem te intueor, patriae hujus excidium vibrantem." It is perhaps permissible to note of this same Elmer that he invented a flying machine, the wings being operated by his hands and legs, and launching himself from a high tower, flew for a furlong; but caught in a sudden gust and becoming panic-stricken, he fell headlong, and was lamed for life, a disaster which he ascribed to his having omitted to give his machine a tail.

On the other side of the Channel William of Normandy took the comet as of good omen for himself, and one of his courtiers wrote the following doggerel lines upon it:—

Caesariem, Caesar, tibi si natura negavit
Hanc, Willelme, tibi stella comata dedit.

As is well known, the comet is portrayed on the Bayeux tapestry, and this is the oldest representation of it that is certainly authentic. Crude as it is, there are two features that are con-

firmed by modern photographs—the tail streamers, radiating like a fan from the nucleus, and the luminous masses which have the aspect of moving rapidly outwards.

A group of Normans gazes at the comet in wonder "Isti mirantur stellam." In the adjoining panel of the tapestry Harold is represented quaking on his throne under the combined terrors of the comet, the landing of the Norsemen, and the threatened Norman invasion.

A.D. 1145, April 19th. This return is of special interest, since the perihelion passage was on the same day as in the present year, and consequently the motion and behaviour of the comet are closely similar. Some interesting colloquial details are given by Hirayama. It was first seen about April 20th as a morning star; by May 9th its tail was 5° long; about May 15th it passed the sun, and became an evening star. The next day the chronicler says, "The tail was 5° long, directed towards the east; the end was concealed by clouds; I went out of the door and saw it." On May 17th the tail was 20° long. On June 4th the head was seen, but the tail had disappeared, to the astonishment of Moronaga, a friend of the chronicler. The tail reappeared on June 8th, and moonlight is stated to have been the cause of its disappearance earlier. We have, however, in modern times some undoubted cases of the disappearance of tails for a time. It was followed in Japan till June 18th, and in China till July 14th. It will scarcely be followed so long with the unaided eye at the present return. I have myself no doubt that the intrinsic lustre of the comet has greatly declined since the middle ages, though it is right to say that Dr. Holetschek, a great authority on the subject, takes an opposite view.

The return of September, 1222, is one in which we (Mr. Cowell and myself) may justifiably take some pride, as we were the first to show that this grand object was Halley's comet; the much feebler object of July, 1223, had previously been taken for it. That of 1222 must have been a very striking sight; the Japanese say that the head was white, and as large as the half-moon; the tail was red, 17° in length. The European records state that in August a star of the first magnitude appeared, very red, with a long tail pointing to the zenith. Compared with it the moon appeared as if dead, and seemed to have no more light. The fact that both in Europe and Japan it was compared to the moon shows what a splendid object it must have been.

Historians also give a glowing account of its splendour in October, 1301, when it appeared in mid-September in Gemini, and went through Ursa Major to Corona and Hercules, being

visible for forty-six days. It was seen in all parts of the known world, but, as in most of the ancient returns, the Chinese records are much the most precise; indeed without their aid it would have been quite impossible to carry back this long chain of identifications. Let us give them the credit they deserve for their patient, long sustained vigils, which have added so greatly to our knowledge of the history of this comet.

We have now an array of some twenty-nine observed returns, many of them recorded as objects of great splendour. The first reflection suggested by them is the close touch that we are brought into with far-distant centuries, in being able to contemplate the very same body that has so often filled the world with wonder and admiration; but besides the sentimental aspect, there are, I think, some deductions of value with regard to the constitution of this and other comets. Dr. Johnston Stoney some years ago developed the theory of planetary atmospheres from the standpoint of the kinetic theory of gases; the gaseous molecules are moving with speeds of miles per second, hydrogen having the greatest speed, and the speeds of the others diminishing as their density increases. Now each planet has a certain speed which suffices to carry objects away from its surface. In the case of the sun it is 383 miles per second, for Jupiter 37, for the other giant planets upwards of 13, for the Earth 7, Venus 6, Mars and Mercury 3, the Moon $1\frac{1}{2}$ miles per second.

An explanation is found of the fact that hydrogen is found in the sun and giant planets, but not in the smaller ones, its molecular speed being too high. The earth can retain the denser gases, but the moon cannot, and her airless condition is thus explained. Now there is no doubt, from what we know of the mass of comets, that their critical speed is much lower even than that of the moon; hence it is clearly impossible that they could permanently retain a gaseous envelope; that which we see surrounding them is not, therefore, of the nature of a permanent atmosphere, but is perpetually escaping from the head of the comet, and perpetually being renewed. The tail that we may see in Halley's comet to-day is a different one from what was seen a month ago. At every return for two thousand years it has been seen to eject a series of huge tails, which streamed away into space, and could not be recovered by it. Now there must be some storehouse to contain all this gas, and the storehouse must be of a much denser nature than the gas, since it moves as though under gravitation alone, while the tail does not. And, seeing that we know that a close connection exists between

the comets of 1862, 1866, and Biela's comet with the Perseid, Leonid and Andromedid meteor showers respectively, and further that the meteors that have fallen to earth and have been chemically analysed have been found to contain much occluded gas, especially hydrogen, which with its compounds is indicated in cometary spectra, it seems to me a most natural and probable deduction to draw that the reservoir containing the gas of comets' tails is a dense form of meteors; in fact, I should scarcely have thought it a matter of dispute, had not several well-known astronomers expressed doubts about the connection of comets and meteors. There is the further argument for the presence of a nucleus made of solid matter, that it appears to move exactly as if under the force of gravitation alone.

The calculations of its motion are made on this assumption, and the difference between theory and observation in the time of its perihelion passage amounts to only three days in a period of some 27,000 days, showing that the action of non-gravitational forces on the head is barely sensible; but on the tail matter these repulsive forces far exceed gravitation, showing that the particles of the nucleus are much denser than those of the tail, and no doubt solid. I even venture to assert that the solid matter in the head of Halley's comet is not mere dust, but is in the form of pretty large lumps, at least several feet across, since otherwise I should expect the supply of gas to have been exhausted after a few returns. I think it is likely that the loss of gas occurs only when the comet is near the sun, the occluded gas being drawn out, either by the action of heat or some other exciting cause. When in the cold of outer space it probably sinks into a torpid condition and is devoid of envelopes.

An exceedingly rare event is about to happen this month, which may throw some light on the constitution of the comet's head; I make out that this event, the transit of the comet over the disc of the sun, only happens if the perihelion passage falls in one particular half day of the entire year; that is, that one return in 700 or once in 50,000 years. Unfortunately the sun will be below our horizon when the comet crosses it, but astronomers in more favoured lands will be on the alert, notably at the Kodaikanal Observatory in India, whence Mr. Evershed writes to me that they are making preparations to photograph the sun in ultra-violet light, and in other methods that seem to give the best hope of success.

Let us however consider the conditions, and we shall see that failure is quite likely; the comet will be 15,000,000 miles distant, or sixty times as far away as the moon. At that

distance a lump of matter five miles in diameter would appear only one-fifteenth of a second across; this would be the very tiniest particle that would be separately visible; smaller particles might however be seen as a dusky patch, but only if they are closely congregated. There is no chance of seeing any of the gaseous envelopes of the comet against the brightness of the solar background. Even failure to see anything of the transit will teach us something, since we shall be able to fix superior limits to the size and density of the particles forming the nucleus. Since the tail of a comet points almost exactly away from the sun, it was at once seen that there was a possibility of our going through the tail at the time of the transit. The only element of doubt is whether the length of the tail will be sufficient to reach us; it will need to be 15,000,000 miles long, and Dr. Holetschek's researches show that it has only just attained this length at the more recent returns. Even if the tail does reach us, it is of such ethereal tenuity that it is quite doubtful whether we should be able to detect its presence when in the midst of it; there would be no contrast in this case, as when we see it from without on the black background of the sky, it would fill the whole heavens with a sort of diffused glare; something of the kind was recorded when we went through the tail of a comet in 1861 (it is instructive to see the apparent form of that comet when it was very near the earth; owing to perspective it appeared like a widely opened fan; we may look for a similar appearance if the tail of Halley's comet reaches us). Dr. Birkeland makes the suggestion that if we pass through the tail there may be a striking auroral display; this does not seem impossible, since the aurora is now thought to be due to the excitement of certain gases in our upper air by electrons emitted by the sun, of very similar nature to those supposed to form comets' tails. It is hardly likely that the presence of the tail would be sensible in any other way; arrangements have however been made by which any abnormal manifestation would be fairly sure to be detected.

So much has lately been written about the physics of comets' tails that it is almost necessary to include some discussion of it. There is no question that there is some agency driving the tail-particles outwards from the sun much more potently than gravitation can pull them in; but as regards the nature of this action it is difficult to decide between three contending hypotheses. (i) That it is the pressure of light acting on the very tiny particles emitted by the head; this action is quite insensible compared with gravity in the case of large bodies, but when the

diameter of the particle is of the same order as the wave length of light it becomes important, being equal to gravity when the diameter is $\frac{1}{20000}$ inch and twenty times gravity for a diameter of $\frac{1}{150000}$ inch, after which it appears to diminish again. There is a difficulty about this theory for explaining all the facts in that it would involve an almost constant acceleration of the tail matter through the whole length of the tail. (ii) That it is electrical repulsion from the sun acting on the charged particles emitted by the head. Mr. Eddington has pointed out that we might on this assumption explain the cessation of repulsion at a certain distance by gradual neutralisation of the charge. (iii) The third explanation, which has been put forward in a number of slightly varying forms in recent years, suggests that the sun and not the comet's head is the originator of the greater part of the tail matter; the function of the head being the repulsion of this matter to form the envelopes and also rendering it luminous; the theory involves the large assumption that the discharge of these ions or electrons is unceasingly going on in all directions round the sun, for comets emit tails whatever their direction from the sun may be; in this they differ from the streams of matter forming the corona or producing magnetic storms and auroræ on the earth; for these, as Mr. Maunder has shown, are ejected along definite stream-lines, and could only produce some momentary excitement in a comet's tail, not the long-enduring phenomena with which we are familiar.

To my mind both the telescopic and photographic, and I may add the spectrographic, study of comets seems to show that the head, coma, and tail form a single entity, and that the tail belongs to the head and is emitted by it, not by the sun. Halley's comet itself may add to our knowledge of cometary physics, for at the return of 1835 it was the scene of very active changes; on October 10th Smyth noticed a curious brush of light issuing from the nucleus, resembling the luminous sector drawn by Hevelius in 1682. The next day it had developed into a lucid sector, with two rays spreading on either side of the nucleus across the direction of the tail. On October 12th Struve saw it attended by two delicately-shaped appendages of light, one preceding, the other following the nucleus. At other times, he says, it was surrounded by a semicircular veil, which extended back in a double train of light to a vast distance. Bessel tried to explain some of the changes of shape by supposing a rotation of the comet in five days, and Professor W. H. Pickering adopted the same explanation for the changes of shape of some recent comets. There

are, however, difficulties in the way, for a volume of gas has no rigidity, and cannot rotate as a whole; even if we admit a controlling force, each molecule of the tail would rotate with a different period, according to its distance from the axis. It seems to me that a rotation of the head would produce a semblance of rotation in the tail emitted by it. The structure in this case would be spiral, a form suggested by some of the photographs of Morehouse's comet of 1908. On its emergence from the sun's rays in 1836, Halley's comet was best placed for southern observers, and Sir J. Herschel and Maclear at the Cape made drawings of it. It seems to have lost its tail in January, two months after perihelion, so we must be prepared for a similar phenomenon in June next. Morehouse's comet, in like manner, went through a tailless phase several times during its period of visibility. It appears that all predictions as to the brilliance of a comet at any particular time are quite uncertain; we can predict its distance from sun and earth, but not these physical changes, to which some comets seem to be much more subject than others.

We have the great advantage of photography during the present apparition for giving a continuous and reliable record of all the variations, as also for enabling the comet to be detected eight months before perihelion passage, at which time it was of the sixteenth magnitude, that is, it only gave $\frac{1}{10000}$ of the light of a sixth magnitude star, which itself is barely visible to the unaided eye. For the first few months the comet brightened up rapidly, and by mid-November it was an easy object in telescopes of moderate size, being as bright as the tenth magnitude. Then the increase seemed to be arrested, and it only increased very slightly in brightness up to the middle of January; but by the end of that month there were evident signs of a tail forming, and by mid-February the comet was seen by the naked eye by Professor Wolf, who had also been the first to detect its presence on the photographic plate.

A photograph taken at Juvisy showed quite a conspicuous tail, and a drawing at the beginning of March showed a remarkable double tail, not unlike some of the sketches made in 1835. The comet was then lost in the sunlight, but reappeared as a morning star about the middle of April. It had greatly brightened during its absence, and was now of the second magnitude. At 4.30 a.m. on April 20th it passed its perihelion, and commenced another revolution, which will not be completed till early in 1986. I have myself seen it early in May, when it was quite conspicuous, in spite of its being

very near the horizon, and the sky having begun to brighten. We have thus every reason to look for a fairly good display as an evening star during the last ten days of May, though it is right to warn those who saw the great comet of 1882, or Donati's comet in 1858, that there will be nothing to compare with these from a spectacular point of view. It may not even equal the bright object which formed a nine days' wonder last January. It is just because the old records speak of it as one of the brightest comets of its time, that I think it must have greatly declined since then.

A few words on the subject of computing the perturbations may be of interest. The planets are pulling the comet all the time, altering its speed and direction of motion and thus changing the ellipse in which it is moving round the sun. Whatever method we employ, we have to calculate the distance and direction of the comet from each of the larger planets at short intervals of time during the whole revolution. The old method assumed the comet to move for some time exactly in some definite ellipse, and the disturbances were calculated and added up; their combined effect applied to the ellipse gave a new ellipse, and the comet was then assumed to follow this for another space of time, and so on. This method was both cumbrous and inexact; Mr. Cowell devised the better plan of not making the assumption of elliptical motion at all, but determining the curvature at each point of the path, from the whole of the forces acting (solar and planetary) and then building up the path, arc by arc, from these curvatures. It is necessary when the comet is near the sun, and the curvature great, to compute it with extreme accuracy; the unit of length at this part of the orbit was taken as the eleventh decimal of the distance from the earth to the sun, or about 5 feet. Needless to say, we do not know the actual place of the comet to anything like this degree of accuracy, in fact, not within some 20 miles. But unless the curvature were investigated with a much higher degree of accuracy than the actual place is known, errors would arise in the deduced path, which would be very serious at the end of a revolution. Far the largest perturbations are those that arise when the comet is passing near Jupiter, and it is interesting to note that the perturbations arising at one of these approaches do not make a very appreciable alteration in the comet's place for the next year or two, but show their full effect when it comes back seventy-five years later. For the perturbations are really small changes in the amount and direction of the motion, and it takes time for these to develop into appreciable alterations in the comet's place.

The revolution just completed is much the shortest on record, and this is due to the fact that both in 1834 and in 1836 Jupiter was placed exactly behind the comet and reduced its speed considerably on each occasion. That a record passage should be the result of reduced speed sounds rather paradoxical, but the case is like that of a thrower's arm being held when he throws a stone into the air; it will not rise so high and comes back to earth sooner. So the comet has not gone so far into space as usual on the last revolution, and the sun's attraction has been able to bring it back more quickly. Our own earth assisted in the shortening of the revolution to the extent of one week, the comet having been near us in October, 1835. One of the chief points of interest in the calculation is to see whether there is any indication of unknown forces acting on the comet. The actual return is three days later than the calculated one, and from the precautions taken, it is inferred that at least two of these days are due to some unknown cause, not to errors in the calculation. The unknown cause may be a planet beyond Neptune, or a resisting medium or the reaction produced on the nucleus by the emission of the tail-matter.

Two quotations from Sir G. Airy's address on presenting the Astronomical Society's medal to Professor Rosenberger in 1835 come in very appropriately here: "How are these wild bodies to be disciplined to our service? They are to be sent forth as spies; they are to go in directions in which no planets move; they are to explore spaces in which no other bodies are known to exist; and they are to return bringing us an account, such as the physical astronomer can read, of the forces to which they have been subjected, and of the nature of the spaces through which they have passed. Have the anomalous motions of Uranus caused some astronomers to suspect the existence of a large planet beyond him? Then may we hope that Halley's or Olbers' comet will, in some revolution, feel its effect while far beyond our sight, and will return to our eyes still bearing in its disturbed motions a trace of the perturbations which it has undergone. Has it for ages past been conjectured that some matter exists in the planetary space which in time may sensibly affect the motions of the most dense bodies? Then will the comparative insignificance of the comets be more likely to feel its effects."

"We have seen a comet whose last appearance it is probable that no man living can distinctly recollect—whose period exceeds the limit of ordinary life—whose path extends into spaces far beyond any which in other parts of physical

astronomy we have need to consider—we have seen it return within a day of its computed time, and have traced it through the heavens, describing nearly the path which had been laid down for it. I confess that the sight of this strange body and the contemplation of the uniformity of the law which has guided its motions, and of the acquaintance with that law and the power of tracing its effects, which man has acquired, have been to me a source of intense pleasure. And I doubt not that the same gratification has been experienced by every astronomer who has been accustomed to regard his sublime science on the one hand as the most severe exercise of the intellect, and on the other hand as the study which leads most certainly to a knowledge of the general laws of the universe."

I hope I have now said enough to show that Halley's comet, while it cannot in these modern days offer us a spectacle of surpassing grandeur, ought nevertheless to awaken deep interest in all thoughtful minds, from the long vista of history down which it carries us, from its being the first comet in the world's history whose return was ever foretold, and perhaps most of all from its association with the great Englishman whose name it will bear for all time.

499TH ORDINARY GENERAL MEETING.

MONDAY, DECEMBER 7TH, 1909.

PROFESSOR E. HULL, LL.D., F.R.S. (VICE-PRESIDENT), IN THE CHAIR.

The Minutes of the preceding Meeting were read and confirmed.

The following elections were announced :—

Members :	Cecil Broadbent, Esq.
	Colonel F. B. P. White.
	Colin MacLarty, Esq.
	Professor F. Roget, of Geneva.
	Rev. Prebendary Shelford, M.A.
Associates :	F. P. Trench, Esq., M.B., F.R.C.S.Ed.
	Rev. F. Cecil Lovely, B.A.
	Rev. F. Webster Maunsell, M.A.

In the absence of the author the following paper was then read by the Secretary :—

THE IVORY ISLANDS IN THE ARCTIC OCEAN.

By the Rev. D. GATH WHITLEY.

IN many recent and valuable works of science, the distribution of the remains of the Mammoth in Siberia have been described. We now understand fully that the bones and tusks of Mammoths are found over the *whole* of Siberia, and that they are particularly abundant in the northern portions of that country. The remains of the Mammoth in fact increase in numbers as we travel from southern to northern Siberia, until we find them in their greatest abundance on the shores of the Arctic Ocean. We also frequently find that many perfect bodies of Mammoths and rhinoceroses are found in the frozen soil of northern Siberia.* These carcases are, when discovered, quite perfect, and have been preserved in this condition, by the perpetually frozen soil in which they are buried. It is therefore absolutely necessary to believe that the bodies were frozen up immediately after the animals died, and *were never once thawed*, until the day of their discovery. No other theory will explain the perfect preservation of the bodies of these great elephants.

* Isherski, J. D., *Mem. Acad. Imp. St. Petersburg*, vol. xl, 1892.

Strange as these facts are we have now to examine something still more remarkable, and to consider the extraordinary phenomenon of the occurrence of enormous masses of elephants' bones in desolate islands of the Arctic Ocean. In the icy waters of the Polar Sea to the north of Siberia, there lie islands which are enclosed in ice for the greater portion of the year. Nevertheless the soil of these desolate islands is absolutely *packed full* of the bones of elephants and rhinoceroses in such astonishing numbers, that no places in the whole world contain such quantities of elephants' remains, as do these icy islands in the Arctic Sea. The whole records of science contain no stranger chapter than that which describes the discovery and position of the remains of the Mammoth in the islands in the Arctic Ocean.

It would be difficult to imagine a more dreary expanse of the sea than that portion of the Arctic Ocean which lies directly to the north of Siberia. For nine months in the year it is continually frozen, and during the long winter it seems to be abandoned to the spirit of the North Pole. What adds to its loneliness also, is the fact that even in summer nearly the whole extent of its coast is uninhabited by human beings. Nordenskiöld says that, in his voyage along the northern coast of Siberia in the *Vega* during the summer of 1878, he did not see a single human being on the shore, in the whole stretch from Yug or Schar (at the westernmost point of Siberia) to Cape Chelagskoi. In fact it was only when the *Vega* reached the land of the Chukches, in the extreme north-east of Siberia, that human inhabitants were seen.* This loneliness of the Siberian coast is in striking contrast to the constant signs of man which are met with along the arctic shores of America, where the huts of the Eskimo cover the coast, and their boats are constantly passing to and fro over the waters. In sailing along the Siberian coast neither boats nor houses are seen, and until the Chukche country is reached no signs of man are visible.

The navigation of the Arctic Ocean to the north of Siberia is, in summer, both difficult and dangerous. At that season of the year the enormous fields of ice which cover the ocean during the winter are indeed broken up, but great masses of ice are always drifting to and fro, and these are often of great size, although the colossal icebergs which float over the Greenland seas are not encountered. Fogs in summer are thick and frequent, and render the progress of a vessel slow and difficult,

* *Voyage of the "Vega,"* vol. i, pp. 429, 430.

as they conceal the icebergs, and hide all indications of shoals and sandbanks. Animal life is, in summer, wonderfully abundant and varied. Whales swim and spout in the sea. Seals abound on the beach, and sport amid the waves. The white whale, and the beautiful narwhal with its spotted body and its long horn, plunge and toss to and fro in the waters, and the walrus in great numbers basks on the ice-fields or swims in the waves. Birds of all kinds exist in countless numbers, either soaring overhead, or perching in myriads on the ledges of the cliffs, where they keep up a perfectly deafening screaming.

The ice on the Arctic Ocean to the North of Siberia breaks up in the end of June or in the beginning of July, and the sea, in this region, may freeze at any time from the middle of September to the beginning of October. The *Vega* entered the Kara Sea on August 1st, 1878, and was frozen in a short distance to the north-west of Behring's Straits on September 28th, and the ice around the vessel did not break up until July 18th of the following year. When frozen the surface of the sea is not smooth, but is covered with ridges of ice which are often 70 or 80 feet high, and are most difficult to cross in the dog-sledges in which the natives traverse the frozen sea. Even in winter animal life is not entirely absent from the icy wilderness. Bears prowl over the ice-fields, seals appear here and there, stone-foxes wander about, following the tracks of the bear, to pick any leavings from its feasts, and the ptarmigan and snowy-owl winter amidst the icy wilderness.

The honour of discovering and of surveying the Siberian Arctic Ocean belongs entirely to the Russians. Sir Hugh Willoughby, with the English expedition of 1553, died before he could enter the Kara Sea, and although the Swedish expedition under Nordenskiöld in the *Vega*, was the first that made a continuous voyage in a single vessel from Novaya Zemlya to Behring's Straits, the coasts along which the *Vega* sailed had been surveyed and mapped by the Russians long before. In the latter part of the sixteenth century the merchants of Archangel carried on an extensive coast trade with northern Siberia. They dragged their large boats across the Kanin peninsula on the east of the White Sea, and having traversed the Kara Sea, they reached the coast of the Yalmal Peninsula. Ascending a river in this peninsula they dragged their light boats across the watershed, and descending another river they gained the Gulf of Obi. Thence they voyaged to the Yenesei, and made their way up that river to the town of Mangaseia, where they met merchants and natives from the south and east, and after

exchenging goods, the Russians returned to Archangel with valuable cargoes of furs and other merchandise. This trade was carried on for some time, until the conquest of Siberia by the Russians diverted it into other channels. When the conquests of the roving Cossacks had firmly established the Russian authority over the greater portion of Siberia, bands of traders searching for furs, began to explore the coasts of the Arctic Ocean. All through the last half of the seventeenth century these expeditions were carried on, and vague reports of islands, situated amidst the ice-fields of the Polar Sea, from time to time reached the Russian settlements. In the early part of the eighteenth century more scientific voyages were undertaken, and the coasts were more carefully examined. Vessels were built at Tobolsk, and Irkutsk, and in these the Obi and the Lena were descended to the icy sea, and the shores were surveyed in all directions. In these voyages the Russians often caught sight of islands far to the north, although they were not able thoroughly to examine them. In 1711 Permakoff, a Cossack who lived near the mouth of the Yana, made a voyage from the Lena to the Kolyma, and saw large islands off the mouths of the Kolyma and the Yena, which were according to his report, very mountainous. In 1712 a large expedition left the mouth of the Yana for the north, and discovered a large island, which was rugged and barren, and in 1760 a Yakut called Eterikan saw a large island to the north-east of the mouth of the Lena. These reports raised the interest of the fur-hunters, and before long a remarkable discovery was made.

One of the most active and successful of the fur-hunters of that time was named Liakoff, and he from time to time obtained great quantities not only of valuable furs, but also of fossil ivory from the tusks and teeth of the mammoths, which he himself collected or received from the native Siberians. In 1750 Liakoff had been particularly successful, and had gathered a vast quantity of mammoths' tusks and remains on the desolate plains between the rivers Anabar and Khatanga. From this region he returned with his spoils, to the southern districts, and in order to carry on his expeditions with greater celerity, he built huts near the mouth of the Yana, at a place called Ustÿansk, where he and his assistants could pass the winter. In 1770 in the month of March, he left this winter settlement accompanied by a friend named Protodiakonoff, and reached the promontory of Svaiatoi Noss. This is a bold headland which runs out into the Arctic Ocean, about 300 miles east of the mouth

of the Lena, and half-way between the mouths of the Yana and the Indigirka. It derived its name the "Holy Cape" from the fear with which the Russians regarded it, for the ice was piled against it in such masses, that it was most difficult to sail round it. It had been thought impossible to pass it, and one gallant voyager, Demetrius Laptieff, had declared that it could not be doubled. But in 1734 he himself sailed past the dreaded cape and voyaged in safety to the Kolyma. It was in the month of April when Liakoff reached Svaiatoi Noss, and at that time the sea was fast frozen. Standing on the promontory and looking out over the icy expanse of the frozen ocean, nothing could be seen save the dreary prospect of the icy waste, ridged into long furrows, and still and motionless as death. As Liakoff looked out over the vast frozen expanse, he saw a long line of black objects approaching over the ice and drawing near to the shore. and speedily perceived that the moving mass consisted of an enormous herd of reindeer on the march. He concluded that they had left some land far to the north, and were returning to the southern regions. Such a supposition was not necessarily correct, for it has constantly been observed by the fur-hunters, that the reindeer will frequently go over the ice to a long distance from the shore, in order that they may get at the salt, which is left by the evaporation of the sea water, and of which they are extremely fond. Liakoff, however, felt certain that the reindeer were coming from some northern land, and in the beginning of April he started in his sledge drawn by dogs over the ice, from Svaiatoi Noss, in search of the northern land. He started early in the morning, and after sledging over the ice nearly all day, in a northerly direction, came to an island, about 50 miles from the shore, where he spent the night. Next morning he followed the traces of the reindeer still further to the north, and having gone about 15 miles over the ice reached a second island, much smaller than the first. The reindeer track, which he still followed, continued to lead to the north, and Liakoff drove his dogs forward in this direction. He had not gone far from the second island, however, before he found that the ice was so rugged, and was ridged up into such high mounds and hummocks, that he was quite unable to proceed further as his dogs could not advance over the high ridges of ice which covered the frozen surface of the sea. No land could be seen in any direction, and the dreary prospect of snow and ice extended on all sides as far as the eye could reach. Liakoff therefore was placed in a position of great peril, and had to spend the night on the ice. He then returned, and after

passing through difficulties, owing to the want of provisions for his dogs, he succeeded in regaining the coast at Svaiatoi Noss. He next went to Yakutsk, and informed the Russian authorities there of his discoveries, and they forwarded the account to St. Petersburg. The Empress Catherine II. ordered the islands to be called by Liakoff's name, and she also granted to him the sole right of collecting mammoths' tusks and of searching for furs in the islands he had found, and in any others that he might discover.

In the summer of 1773 Liakoff resumed his discoveries. He was accompanied by Protodiakonoff and other companions, and as the ice had at this time melted, they made the voyage to the islands in a five-oared boat. They crossed the strait between the mainland and the first island, and found the water in the strait very salt, with the current setting strongly from the west. From the first island they went to the second—which was afterwards called Maloi—and then steered boldly towards the north, in search of still more distant lands. The air was clear, and they soon discerned land to the north, and before long the bold voyagers reached a third island, which was of great size. The land was barren and mountainous, and bore not the least vegetation, although the shore was covered with driftwood. No trace of man could anywhere be seen, but bears, wolves, and reindeer were wandering over the desolate wastes, and whales were swimming and spouting amidst the waves. Liakoff and his companions found tusks of mammoths on this island, which they called Kotelnoi, as one of the party left a copper kettle on it. Liakoff returned to his first island, and built a hut of driftwood for his workmen on it, and all were engaged in collecting mammoths' tusks, which were also found abundantly on the first island. Having passed the winter on the latter, Liakoff returned in the spring to Ustÿansk, with a rich supply of mammoths' tusks and valuable furs.

The enormous quantities of mammoths' bones and tusks found by Liakoff in these islands raised the curiosity of the Government, and the Russian officials at Yakutsk ordered a surveyor named Chwoinoff to proceed to the islands, and to survey them thoroughly. Chwoinoff left Yakutsk for this purpose in the early part of 1775, and reached Liakoff's station on the mainland at Ustÿansk in the end of March. He crossed the bay to Svaiatoi Noss, and reached the first island discovered by Liakoff, and which has always afterwards been called Liakoff's Island. He found that this island—which contained the huts of the diggers for fossil ivory—was of considerable

size, but with the exception of some high mountains, it seemed to be wholly composed of ice and sand. Such was the enormous quantity of mammoths' remains, that it seemed to Chwoinoff that the island was *actually composed* of the bones and tusks of elephants, cemented together by icy sand. The horns of buffaloes (or rather of musk-oxen) and rhinoceroses were also wonderfully abundant. The sandy shores and slopes were full of mammoths' tusks, and when the ice cementing the cliffs was thawed by the heat of the sun, the sand fell down in great quantities, bringing with it great numbers of elephants' tusks, of which these cliffs seemed to be full.

About fifteen miles from Liakoff's Island was the second island discovered by him, and afterwards called Maloi, and here also Liakoff's people had collected a rich supply of the bones and tusks of the mammoth. The surface of the island consisted of a bed of thick moss on which many beautiful flowers were growing, but underneath were cliffs of pure ice. It was possible to strip off the moss like a carpet from a floor, and beneath was pure ice which never thawed.

Chwoinoff now started northwards for the third island or Kotelnoi, and found the straits beneath it and Maloi to be about 75 miles in breadth. He travelled along the shore, and having discovered a considerable river, he named it in honour of the Empress, the Czarina River. All the shores were covered with driftwood. He discovered three large rivers which were full of fish, and the waters of which brought down large quantities of driftwood from the interior of the island. This last discovery shows that *trees* once existed in this island (Kotelnoi) in great abundance. Chwoinoff climbed to the top of a lofty mountain, and as the weather was clear he obtained an extensive view, which consisted of lofty mountains, which stretched away to the east, west, and north, for a long distance. He passed the summer on Kotelnoi, and returned in the autumn to Svaiatoi Noss.*

For thirty years Liakoff enjoyed the sole right of carrying away the vast stores of fossil ivory from these wonderful islands. He built huts and formed settlements for his people on them, and his agents went to them in sledges over the

* The account of these discoveries was given by Protodiakonoff to Martin Saur when the latter was at Yakutsk in 1788. Saur wished to hear of them from Liakoff himself, but Liakoff being old referred him to Protodiakonoff, who related the narrative to him. The account may be found in Saur's *Narrative of an Expedition to the Northern Part of Russia*, by Captain Joseph Billings, pp. 103–106.

ice in winter, and in boats in the summer. Every year great quantities of ivory were taken from the islands and sold in the markets at Yakutsk.

On the death of Liakoff, the Russian Government granted the monopoly of trading in these islands, in 1805, to a merchant of Yakutsk named Sirovatskoi, who sent his agent Sannikoff to explore the islands, and, if possible, to discover more islands in these wonderful regions. Discoveries now commenced which were as remarkable as those of Liakoff, and which amply repaid Sirovatskoi for his labour and outlay. In 1805, Sannikoff discovered to the east of Kotelnoi, a large island which he called Fadeyeffskoi; and in 1806, the younger Sirovatskoi discovered another large island still further to the east, which received the name of New Siberia.* Two smaller islands—Stolbovoi and Belkowa—were at the same time discovered. These islands were full of mammoth bones, and the quantity of tusks and teeth of elephants and rhinoceroses, found in the newly discovered island of New Siberia, were perfectly amazing, and surpassed anything which had as yet been discovered.

Before long—as was natural—disputes arose as to the monopoly of collecting the fossil ivory in these wonderful islands, and petitions were addressed to the Russian Government on the subject. This induced Count Romanzoff, then Chancellor of Russia, to order Hedenström, a Siberian exile, to explore the islands, and Romanzoff fitted out the expedition at his own expense. Hedenström started from Ustÿansk, near the mouth of the Yana, on March 19th, 1809, taking with him two companions, and for three consecutive seasons they examined the islands. Hedenström found that the quantity of fossil ivory on the first island found by Liakoff (*i.e.*, Liakoff's Island) was so enormous, that, although the ivory diggers had been engaged in collecting ivory from it for forty years, the supply seemed to be quite undiminished. On an expanse of sand little more than half a mile in extent Hedenström saw ten tusks of mammoths sticking up, and as the ivory hunters had left these tusks because there were other places where the remains of mammoths were *still more abundant*, the enormous quantity of elephants' tusks and bones in the island may be imagined. Sannikoff—who accompanied Hedenström—was equally amazed at the quantity of the remains of the mammoth in Liakoff's Island, and—like Chwoinoff thirty years before—he declared

* Wrangell's *Siberia and the Polar Sea*, pp. 481, 482.

that the *whole soil* of the island seemed to be formed of elephants' bones. Another of Hedenström's discoveries was equally wonderful. He found that on a sand-bank on the western side of the island after a strong gale, mammoth bones and tusks were always found to be washed up, so that it was plain that there was an enormous accumulation of elephants' remains *under the sea* in this region. The other islands further to the north were also visited by these explorers. Sannikoff explored Kotelnoi, and found that this large island was full of the bones and teeth of elephants, rhinoceroses, and musk-oxen. Having explored the coasts Sannikoff determined, as there was nothing but barrenness along the shore, to cross the island. He drove in reindeer sledges up the Czarina River, over the hills, and down the Sannikoff River, and completed the circuit of the island. All over the hills in the interior of the island Sannikoff found the bones and tusks of elephants, rhinoceroses, buffaloes, and horses in such vast numbers, that he concluded that these animals must have lived in the island in enormous herds, when the climate was milder. When on the island of Fadeyeffskoi, which lies immediately to the east of Kotelnoi, Sannikoff saw far to the north a distant land with high mountains, and started in sledges over the ice to explore it. He, however, could not reach the unknown island, for when he had gone about thirty-five miles over the ice, he came to a large expanse of open water which extended on every side. This was in the beginning of April, 1811, and another attempt to go northwards, made by him shortly afterwards, was also stopped by open water. Hedenström and Sannikoff thoroughly examined the large island of New Siberia, which contained wonders as surprising as Kotelnoi, and so enormous were the quantities of mammoths' tusks on it, that in 1809 Saunikoff brought away 10,000 lbs. of fossil ivory from New Siberia alone. It was on this dreary and icy island that Hedenström made another remarkable discovery. He found in this desolate wilderness, the shores of which are blocked by ice for the greater part of the year, the remains of enormous *petrified forests.* The trunks of the trees in these ruins of ancient forests were partly standing upright and partly lying horizontally buried in the frozen soil. Their extent was very great, and he described them as follows:—"On the southern coast of New Siberia are found the remarkable wood hills (*i.e.*, the remains of the forests). They are 30 fathoms high, and consist of horizontal strata of sandstone, alternating with strata of bituminous beams or trunks of trees. On ascending these hills fossilized charcoal is everywhere met,

covered apparently with ashes, but on closer examination this ash is also found to be a petrifaction and so hard that it can scarcely be scraped off with a knife. On the summit another curiosity is found, namely, a long row of beams, resembling the former, but fixed perpendicularly in the sandstone. The ends, which project from 7 to 10 inches, are for the greater part broken. The whole has the appearance of a ruinous dyke."* These " wood hills " rise to such a height that they were visible from a distance of nearly 80 miles : similar buried forests are found in the island of Kotelnoi. By these expeditions the islands were thoroughly surveyed.†

These discoveries were truly wonderful. These islands had never before been visited, and a most lucrative trade in fossil ivory was speedily opened up from them. So enormous was the quantity of tusks of elephants and rhinoceroses discovered in New Siberia that in 1821 one trader brought away 20,000 lbs. of fossil ivory from New Siberia *alone*.

In 1821–23 the Russian Government sent Admiral Wrangell to the Northern coast of Siberia, in order that he might survey the regions around the mouth of the Kolyma, and Lieutenant Anjou, who accompanied Wrangell, was directed to examine the New Siberian Islands. Anjou was instructed to survey the islands, and to endeavour to reach the unknown land which Sannikoff had seen from the northern coasts of Kotelnoi and Fadeyeffskoi. The instructions of the government were ably carried out by Anjou, but he was unable to advance far over the ice to the north of the New Siberian Islands, because he was always stopped by open water. He was consequently quite unable to discover Sannikoff's mysterious island. The " Wood Hills " in New Siberia, discovered by Hedenström, were visited by Anjou who thus describes them—" They are merely a steep declivity, 20 fathoms high, extending about 5 versts (3 miles) along the coast. In this bank, which is exposed to the sea, beams or trunks of trees are found, generally in a horizontal position, but with great irregularity, fifty or more of them together, the largest being about ten inches in diameter. The wood is not very hard, is friable, has a black colour, and a slight gloss. When laid on the fire it does not burn with a flame, but glimmers, and emits a resinous odour."‡

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* Wrangell, *idem*, p. 486 (note).

† The account of Hedenström's journey is given by Wrangell in his book, pp. 182–500.

‡ Wrangell, p. 486 (note). An account of Anjou's expedition is given in Wrangell's book above quoted.

In 1829 the scientific German traveller Erman visited Yakutsk, and obtained some valuable information about the wonderful stores of fossil ivory in the Liakoff and New Siberian Islands. The monopoly of trading in the islands had been abolished, and the traders from Yakutsk and Ustÿansk journeyed to the islands in dog-sledges every year. The soil of the islands was described to Erman as being full of the bones of elephants, rhinoceroses, and buffaloes, and the tusks of elephants could be seen sticking up out of the frozen sand. In order to find good deposits of mammoths' bones in the islands, the traders were in the habit of ascending the hills and marking the places where they saw the tusks projecting above the ground, and deposits of ivory in the desolate plains, were often discovered by the sight of a single tusk sticking up from the ground.* From information furnished him by the ivory traders, Erman thus describes the "Wood Hills" in the island of New Siberia: "In New Siberia, on the declivities facing the south, lie hills 250 or 300 feet high, formed of driftwood; the ancient origin of which, as well as of the fossil wood in the tundras, anterior to the history of the Earth in its present state, strikes at once even the most uneducated hunters. They call both sorts of *Adamovchina*, or Adamitic things. Other hills on the same island, and on Kotelnoi, which lies further to the west, are heaped up to an equal height with skeletons of pachyderms, bisons, etc. which are cemented together by frozen sand as well as by strata and veins of ice. It is only in the lower strata of the New Siberian wood-hills that the trunks have that position which they would assume in swimming or sinking undisturbed. On the summit of the hills they lie flung upon another in the wildest disorder, forced upright in spite of gravitation, and with their tops broken off or crushed, as if they had been thrown with great violence from the south on a bank, and there heaped up."†

In 1878 the *Vega* traversed the Arctic Ocean north of Siberia, and Nordenskiöld was anxious to land on the wonderful islands, which contained such masses of the remains of mammoths, rhinoceroses, and musk oxen. Before the *Vega* started, M. Sibiriakoff (who defrayed a portion of the expenses of the expedition) collected much information from the ivory hunters about the "islands of bones" in the Polar Sea. They informed him that the trade in fossil ivory still continued, and that many

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* *Travels in Siberia*, vol. ii, pp. 376, 383.
† *Ibid.*, vol. ii, pp. 379–380.

traders made their living by collecting mammoths' tusks on the New Siberian Islands, and the ivory hunters declared that in summer the sea between these islands and the mainland is generally free from floating ice.*

On August 28th, 1878, the *Vega* sighted the most western of the Liakoff Islands, *i.e.*, Semenoffskoi and Stolbovoi, but the sea was so shallow and was so encumbered with rotten ice that navigation was slow and difficult. Nordenskiöld thus describes his further experiences amongst the islands:—

"It was not until August 30th that we were off the west side of Liakoff's Island, on which I intended to land. The north coast and, as it appeared the day after, the east coast was clear of ice, but the winds recently prevailing, had heaped a mass of rotten ice on the west coast. The sea besides was so shallow here, that, already at a distance of 15 feet from land, we had a depth of only 8 metres. The ice heaped against the west coast of the island did not indeed form any very serious obstacle to the advance of the *Vega*, but in case we had attempted to land there it might have been inconvenient enough, when the considerable distance between the vessel and the land was to be traversed in a boat or the steam launch. The prospect of wandering about for some days on the island did not appear to me to outweigh the danger of the possible failure of the main object of the expedition. I therefore gave up for a time my intention of landing. The course was shaped southwards towards the sound, of so bad repute in the history of the Siberian Polar Sea, which separates Liakoff's Island from the mainland.

"So far as we could judge at a distance from the appearance of the rocks, Stolbovoi consisted of stratified rocks, Liakoff's Island, on the contrary, like the mainland opposite, of high hills, much shattered, probably formed of Plutonic stone-masses. Between these there are extensive plains, which, according to a statement by the land surveyor, Chwoinoff, who by order of the Czarina visited the island in 1775, are formed of ice and sand, in which lie embedded enormous masses of the bones and tusks of the mammoth, mixed with the horns and skulls of some kind of ox and with rhinoceros' horns. Bones of the whale and walrus are not mentioned as occurring there, but 'long small screw-formed bones,' by which are probably meant the tusks of the narwhal."†

* *Voyage of the* "*Vega*," vol. i, pp. 24, 27.
† *Ibid.*, pp. 415–418.

A few months afterwards the unfortunate American vessel *Jeannette* entered the Siberian Polar Sea. She left San Francisco on July 8th, 1879, and in September of the same year she was frozen into the ice, from which she was never extricated, as she sank on June 13th, 1881. Captain De Long (her commander) and the crew escaped over the ice, partly in boats, and partly in sledges. Just before the *Jeannette* was enclosed in the ice, she discovered two islands which were named Jeannette and Henrietta Islands, and which lie in longitude 160° E. After having threaded their way for some time amidst masses of floating ice, and being carried along by drifting ice-fields, the crew of the *Jeannette* discovered a very large island which had hitherto been quite unknown. This they named Bennett Island, and took possession of it on behalf of America.* This island contained high mountains which rose to a height of 2,500 feet above the sea, and were covered with snow, while glaciers descended from their snowy sides, and flowed down to the sea. Towering cliffs rose above the beach, and the precipices were alive with sea birds, which kept up a deafening screaming. The lower hills were quite bare of trees or bushes, but were covered with green moss, which made them look quite refreshing to the weary voyagers, who had been so long shut up in the ice-fields. The island is, in the main, volcanic, being chiefly composed of trap rocks. Bituminous coal also was found, which burnt readily. This occurred in a vein extending down the mountain side.† According to Baron Toll, who in 1902 visited Bennett Island, sedimentary rocks of Cambrian age occur in it, whilst in the brown coal he discovered the remains of conifers.‡ Further to the eastwards, and close to the shore the water deepens, and the islands are fewer and smaller.

Leaving Bennett Island on August 6th, the *Jeannette's* crew shortly afterwards left the ice, and in three boats began their voyage to the south. The north shore of the island of New Siberia, which is perhaps the richest of all the islands of the Arctic Ocean in mammoth remains, was seen on the 20th, but the ice around the island prevented a landing. Much beset in the ice the boats slowly drifted down the strait between the two islands of Fadeyeffskoi and New Siberia, until on the 31st of August, the wearied voyagers landed on the island of

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* See Gilder's *Ice Pack and Tundra*, chap. xxi.

† *The Voyage of the "Jeannette,"* by Emma de Long, vol. ii, p. 283.

‡ *Geographical Journal*, June, 1904, p. 770.

Fadeyeffskoi. This island was discovered by Sannikoff in 1805, and large quantities of the tusks and teeth of elephants (*i.e.*, mammoths) and rhinoceroses have been carried away from it. The *Jeannette's* crew, however, did not find it a very attractive spot, for, as far as they could observe, the island was mainly composed of mud hills, which were fast wearing away and forming shoals off the land. Beyond the low hills inland the island seemed to consist of mossy swamps. The searchers for ivory had been there not long before, as an empty hut stood not far from the shore The *Jeannette's* crew found on Fadeyeffskoi an elephant's tusk and a bone of the same animal.* Much troubled by floating ice and snow storms, and buffeted by winds and waves, the voyagers after leaving Fadeyeffskoi, landed on September 2nd on the S.E. coast of the island of Kotelnoi. The land was moderately high, with small beaches here and there, and flocks of snowy owls were sitting on the ledges in the cliffs. The searchers for mammoths' tusks had been at work in this island, for in some earth hills excavations were found. A hut was also seen, as well as some Russian relics. Two elephants' tusks and other fragments of fossil ivory were found in this island by different members of the *Jeannette's* party.†

Captain de Long and his companions left Kotelnoi in their three boats for the Siberian coast on September 7th, and, steering southwards amidst rough gales and snow storms, and encountering much trouble from the masses of floating ice, they reached on the 10th the island of Semenoffskoi. They landed, and found teeth of elephants, as well as horns and traces of reindeer. The earthy deposits on this island evidently contain mammoths' remains.

A terrible disaster now overtook the voyagers. A storm burst upon them on the 14th of September when they were near the coast of Siberia, and the three boats were separated. One sank, no traces of her being ever discovered. Captain de Long and the party in his boat reached the shore, and landed at the northern mouth of the Lena. They made their way southwards for a short time, but, overcome by famine and exhaustion, all died with the exception of two sailors. The party in the third boat, under Lieutenant Melville, reached the Russian settlements in safety. Thus we find, that although the

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* *Our lost Explorers*, p. 314.

† *The Voyage of the "Jeannette,"* vol. ii, pp. 740, 741.

Jeannette's crew did not meet any searchers for fossil ivory in the New Siberian Islands, they found the tusks of mammoths in all the islands on which they landed.

Dr. Henry Lansdell, who has given such a valuable account of Southern and Central Siberia, refers to the ivory trade from the New Siberian Islands.* He describes the trade as it existed in 1882, and refers to the vast quantity of fossil ivory brought to Yakutsk from the islands in the Arctic Ocean. That there is even now no falling off in the trade in elephants' tusks is shown by the fact that in 1898, some 80,000 lbs. of fossil ivory were offered for sale at the fair at Yakutsk. This is greatly in excess of the average annual sale of fossil ivory at Yakutsk, which, according to M. Stadling, is 40,000 lbs.

A valuable addition to our knowledge of the Mammoth Islands in the Arctic Ocean geologically, was made by Baron Toll and Professor Bunge, who thoroughly examined both the Liakoff and the New Siberian Islands. In 1886, Dr. Bunge visited Kotelnoi, but the bad weather and want of fuel prevented his expedition from being a success Dr. Bunge then proceeded to Liakoff's Island (*i.e.*, his *first* island) which he thoroughly explored. Granite peaks rose here and there on the island, but its greater portion was composed of alluvial soil. The sand and gravel was found to rest on blocks of ice, and the alluvial beds were full of the bones of mammoths, rhinoceroses, and musk oxen. Along with these animals there were also found the bones of oxen, horses, and deer; in fact, the island was *full* of the bones of animals, which must formerly have lived in this desolate island in enormous numbers. When we reflect that for *a hundred years* the ivory hunters have been every year taking away tusks and teeth from this island, and yet the supply continues, we may form some idea of the countless and incalculable masses of animal remains which it must have contained when discovered. Baron Toll in the same year visited both the islands of Fadeyeffskoi and New Siberia. He examined the "Wood Hills" on New Siberia, and found them to consist of carbonised trunks of trees, with impressions of leaves and fruits, and he considered that they resembled the fossil flora of the Tertiary Period of Greenland and Spitzbergen. Baron Toll made a complete circuit of the island of Kotelnoi in forty days. From the northern point of this island he was fortunate enough to obtain a view of the island which Sannikoff declared that he saw in 1806, and the existence of which had,

* *Through Siberia*, pp. 288–293.

up to that time, been doubted. This island has received the name of Sannikoff Land, and lies, according to Von Toll, 100 miles to the north of Kotelnoi and New Siberia. Baron Toll found the summer on Kotelnoi to be cold and cheerless. Snow showers fell nearly every day, and in most of the valleys the snow lay throughout the whole of the summer, while the shores were always blocked by ice; what the winter may be can be easily imagined. Neither trees, shrubs, or bushes exist on the island, and yet the bones of elephants, rhinoceroses, buffaloes, and horses are found in this icy wilderness in numbers which defy all calculation.

In May, 1893, Baron Toll again visited these remarkable islands in company with Lieutenant Shileiko. They first went to Maloi, which is one of the Liakoff Islands, and the second island that Liakoff discovered. In this island they discovered the bones of mammoths and other animals, and they also found the trunks of fossil trees, with leaves and cones. This striking discovery proves that in the days when the mammoth and rhinoceros lived in Northern Siberia, these desolate islands were covered with great forests, and bore a luxuriant vegetation. From Maloi, Baron Toll and Lieutenant Shileiko went on to Kotelnoi, the winter inhabitants of which seem only to be mice, although white bears were frequently met with on the ice near the islands. The return journey of the explorers over the ice to the mainland was difficult, because the ice was melting, and loose snow and open water were encountered. Nevertheless, the return journey from Kotelnoi was safely accomplished, and the expedition regained the Siberian coast.*

From these, and from the former explorations, it is clear that enormous deposits formed of the remains of fossil forests exist on the islands of Maloi, Kotelnoi, and New Siberia. The "Wood Hills" of New Siberia have been frequently described, and similar buried forests have been found in Kotelnoi in numbers perhaps even greater than in New Siberia. All this shows, that in times geologically speaking very recent, a vigorous vegetation reached far up into the regions of the North Pole, where at present neither trees, shrubs, or bushes are found. The remains of these great Tertiary or Post Tertiary forests, are constantly being discovered far up in the Arctic Regions. The relics of great forests of the Miocene Era have been found

* A notice of the journeys of Baron Toll and Professor Bunge will be found in the *Journals of the Royal Geographical Society* for September, 1887, and May, 1894.

in Alanekerdluk, near Disco Island, on the coast of Western Greenland, in N. Lat. 70° 2′, and have been well described by the late Professor Heer.* In Spitzbergen, as late as the Miocene Period, there was a vigorous vegetation, of poplars, limes, beeches, and alders, and it is with this mid-Tertiary vegetation, that Baron Toll would connect the fossil forests in Kotelnoi and New Siberia. Captain McClure found many fossil trees in Banks' Land (Lat. 70° 48′), and fossil forests have also been discovered in Prince Patrick's Island, in Lat. 76° 12′ N. A most interesting discovery was made by Sir Edward Belcher, on the shores of Wellington Channel, in the very heart of the Arctic Regions. At this place he found the dead trunk of a giant tree, standing upright in the place in which it grew when the climate was in former ages more genial, and he thus speaks of this tree of past days :—"I at once perceived that it (*i.e.*, the dead trunk) was no spar, and not placed there by human agency; it was the trunk and root of a tree which had apparently grown there and flourished, but at what date who will venture to say? It is indeed one of the questions evolved in this change of climate. As the men proceeded with the removal of the frozen clay surrounding the roots, which were completely cemented as it were into the frozen mass, breaking off short, like earthenware, they gradually developed the roots, as well as what appeared to be the portions of leaves and other parts of the tree, which had become embedded where they fell."†

While the facts are very remarkable which prove the existence of the remains of great forests in the New Siberian and Liakoff Islands, it is equally wonderful that the *bed of the sea* around the New Siberian Islands, seems to be covered with the tusks and teeth of elephants, which are being constantly washed up by the waves on the sandbanks round the shores of these islands. Nordenskiöld says that the making of new collections of mammoths' tusks year by year in Liakoff's Island, depends on their being washed out of the sandbanks, so that after an east wind, which has lasted some time, they may be collected at low water on the sandbanks, then laid dry.‡ He also tells us, that when the *Vega* was sailing past Liakoff's Island, the trawl-net brought up from the

* See Nordenskiöld in the *Geological Magazine*, 1872, pp. 520–522, also Sir J. W. Dawson's *Geological History of Plants*, pp. 242, 245.

† *The Last of the Arctic Voyages*, vol. i, p. 380.

‡ *Voyage of the "Vega,"* vol. i, p. 412.

bottom some fragments of mammoths' tusks, which confirmed the statements of the ivory hunters, and showed that there must be immense deposits of elephants' bones, under the sea, at this place.* It has also been remarked that the land of the North Siberian coast is rapidly rising, and that fresh sandbanks are being constantly laid bare. Between the New Siberian Islands and the mainland the sea is very shallow, averaging only from 10 to 15 fathoms in depth, and the bottom is composed of green mud. As this is the case, we may expect that fresh deposits of mammoths' tusks, will, from time to time, be exposed, and the supply of fossil ivory from the islands in the Siberian Arctic Ocean will continue for a long time.

It is a curious fact, that the tusks of the mammoths which are found in the New Siberia Islands are much whiter and much better preserved, than those found on the mainland. It has also been observed that the tusks from the islands are much smaller than those discovered on the mainland.† Nordenskiöld explains this smallness in size of the tusks from the islands, by supposing that these tusks belonged to younger mammoths, which being more agile, and more troubled with flies, went farther north than those which were older.‡ This is very improbable, for very large mammoths' tusks have been found on the mainland of Siberia, nearly as far north as Cape Chelyuskiu, and this promontory is farther to the north than the Liakoff and New Siberian Islands.

East of the Liakoff Islands, and close off the mouth of the Kolyma, near to the shore, lie the Bear Islands. They are six or seven in number, and are of insignificant size. They were often seen by the fur-hunters and voyagers in the seventeenth and eighteenth centuries; and they were thoroughly surveyed, by Wrangell in 1821–22. He has described them in detail, and says that in one of them numbers of mammoths' bones are found in the earthy soil.§ On one of these islands he discovered four great pillars of granite, naturally formed, the highest of which was 48 feet in height. He called the island Four-Pillar Island; according to Nordenskiöld it is also called Lighthouse Island.

The easternmost of the Mammoth Islands is Wrangell Land, which has had a singular history. In 1763 Andrejew

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* *Voyage of the "Vega,"* vol. i, p. 420.
† Wrangell's *Siberia and the Polar Sea*, pp. 499, 500.
‡ *Voyage of the "Vega,"* vol. i, pp. 412, 413.
§ Wrangell, p. 154.

sledged in dog-sledges over the ice of the Polar Sea from Nijnei Kolymsk, towards the north-east. He came to a large island of considerable extent, and saw other islands in the distance. Wrangell was very sceptical as to the truth of these discoveries, and in his fourth journey over the ice, made special inquiries of the Chukches as to whether any land existed in the Arctic Ocean north of the Chukche peninsula. He was informed that on a clear day the mountains of a distant land in the Polar Sea might be discerned from Cape Jakan, but when Wrangell reached this headland he could see no land to the north, and did not believe that any large island existed in that direction. In 1849, however, Captain Kellett sailed into the Arctic Ocean to the north of Behring's Straits in the *Herald*, and discovered Herald Island, and to the westward of this island he saw an extensive country traversed by a long range of snowy mountains;* to this new land the name of Wrangell Land was given. Dallman in 1867 conducted a trading expedition in the Arctic Ocean, and declared that he had landed on Wrangell Land, and that he found vegetation growing on it, and discovered there the tracks of reindeer and musk oxen. But all these doubts were set at rest, when the American steamer *Rodgers*, under Captain Berry, reached Wrangell Land in 1881. The island which lies in Long. 180° E., was found to be quite barren, as only moss and lichens formed its vegetation. The shores were blocked by masses of floating ice, and the beach was covered with driftwood. The island was about 150 miles in circumference, and contained lofty mountains, one of which was 2,500 feet above the sea; but it was an utter desolation, and its plains and hill-sides were perfectly barren. The only animals found on it by the officers of the *Rodgers* were bears, foxes and mice. Mammoths' tusks, however, were discovered. Some of these lay on the beach, and had probably fallen from the icy cliffs, or had been washed up by the waves. In the inland districts of the inland also, far from the shore, the explorers found many tusks of mammoths, one of which was of great size. It thus appears that Wrangell Land is full of elephants' remains, for the visit of the *Rodgers* to the island was of very short duration.†

In 1900 Baron Toll started on a third expedition to the New Siberian Islands. He left Tromsoë in the *Zarya* on July 21st,

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* *Voyage of the "Herald,"* vol. ii, pp. 114 116.

† For an account of the exploration of Wrangell Land see Gilder's *Ice Pack and Tundra*, chaps. vi and vii.

but had a troublesome passage through the ice in the Kara Sea. He was frozen up on the coast of Taimyr Peninsula, where he was compelled to winter. The *Zarya* was not released from the ice until August 25th, 1901, when she sailed for Bennett Island, which she reached on September 11th. Baron Toll had a fine view of the high snowy mountains and glaciers of Bennett Island, but the ice prevented approaching the shore closely, and the *Zarya* was, about a fortnight later, frozen up on the western side of the island of Kotelnoi. In this cruise Toll passed over the site of Sannikoff Land, the existence of which is therefore very doubtful; either it is a myth, or lies farther to the north. In the spring of 1902 Baron Toll left the *Zarya* for Bennett Land whither the ship tried to follow, but was prevented by the ice. Nothing more has been seen of the gallant explorer, although it is known that he reached Bennett Land in safety. In 1903 a relief expedition under M. Brusneff searched the New Siberian Islands fruitlessly for Toll, and then landed on Bennett Island. Here they found documents left by Baron Toll, but nothing more was found concerning him. It is now certain that he and his companions perished in attempting to force a passage through the frozen sea from Bennett Island to New Siberia. Thus died one of the most heroic and indefatigable of Arctic explorers.

The documents left by Baron Toll, and recovered by M. Brusneff, are most important. Bennett Island is formed of Palæozoic rocks, and masses of basalt. Mammoths' bones, and the remains of other Quaternary animals, are found in the valleys. It will thus be seen that Bennett Island is the farthest point north in which the remains of the mammoth have, up to the present time, been discovered.

One of the most remarkable features of these islands are the great masses of rock-ice, which are found both on the coasts and inland. These are best seen on the great Liakoff Island, where, with the exception of some granite peaks, they form the chief solid substance in the island. Baron Toll calls these wonderful masses of rock-ice "Fossil Glaciers," and he gives some striking photographs of them. They form part of the great ice formation of north-eastern Siberia, and they were noticed long ago by the Russian explorers. Baron Toll maintains that they originated during the Glacial Period, and that they represent the remains of the old ice-cap. In support of this theory he declares that he discovered a true moraine, with scratched and polished boulders in the bay of Anabar.*

* *Geographical Journal*, May, 1894, pp. 412, 413.

There are serious objects to this conclusion. The islands off the coast of north-eastern Siberia, are full of delicate granite spires and pinnacles, which would have been destroyed had an ice-sheet passed over them. Nordenskiöld declares that along the whole of the northern coast of Siberia he could discover no erratics or glacial traces, and uses these emphatic words, "to judge by the appearance of the hills there have not been any glaciers in former times, and this is certainly the case on the mainland. The northernmost part of Asia in that case has never been covered by such an ice-sheet as is assumed by the supporters of a general ice-age embracing the whole globe."* And again he remarks, dealing with the same question: "It may perhaps be uncertain whether a true inland-ice covered the whole country; it is certain that the ice-cap did not extend over the plains of Siberia, where it can be proved that no ice-age in a Scandinavian sense ever existed."†

Summing up all the results of exploration of the remarkable islands in the Arctic Ocean to the north of Siberia, which contain such numerous remains of the mammoth, we are compelled to conclude, that formerly, and speaking geologically in recent times, the regions north of Siberia enjoyed a milder climate than they possess now. In those days, which were since the appearance of man on the earth, although probably before man had forced his way into northern Siberia, the country had a different aspect and outline from that which now characterises it. At that time a great tract of country must have extended from the mouth of the Lena to the New Siberian Islands, and it stood at a considerable level above the sea, while the islands which now exist in the ocean in that region formed upland districts and mountain ranges. This ancient land was covered with forests, and was traversed by the great Siberian rivers. Vast herds of elephants, rhinoceroses, musk-oxen, and buffaloes roamed over the grassy plains and wandered amidst the forests, and for long they enjoyed a peaceful and secure home. A great catastrophe at last overtook them. The land in the extreme north of Siberia, sank beneath the waters of the Polar Sea. As the waters rose higher and higher, the animals crowded to the uplands for safety, and congregated in enormous numbers on the mountain tops. The land, however, continued to sink, and the waters rose higher

* *Voyage of the "Vega,"* vol. i, p. 418.
† *Ibid.*, vol. ii, p. 246.

and higher. The tops of the highest hills were at last submerged, and the destruction was complete. After a time the land began to rise slowly, and the New Siberian and Liakoff islands, which had formed mountains in the land, rose above the waters. As they had formed a last refuge of the animals when the land was submerged, they were naturally covered with the bones, teeth, and tusks of the animals which had been drowned upon them. Currents also, in the waters, swept the bones into various places, accumulating them here and there in large deposits. The climate also at this time underwent a great change, and altered from one of a mild and genial character to one of intense cold and Arctic severity.

Sir HENRY HOWORTH stated that many of the facts in Mr. Whitley's paper were to be found in his book *The Mammoth and the Flood*, and proceeded to mention the historical references to ground ivory as far back as the days of Herodotus. There was proof of a considerable trade in this article in A.D. 1000. In China it was used as a medicine. It is generally supposed that most of it is the remains of the mammoth, or Behemoth of Job, which means "a great, big beast." Cuvier refers to this ground ivory in some of his geological arguments, and to the flesh when thawed being good enough for wild animals to eat, even the eye in some cases had been found in good preservation. Sir Henry had himself corresponded with Darwin on this subject, who considered the problem insoluble. He further stated that the contents of the stomachs had been carefully examined; they showed the undigested food, leaves of trees now found in Southern Siberia, but a long way from the existing deposits of ivory. Microscopic examination of the skin showed the red blood corpuscles, which was a proof not only of sudden death, but that the death was due to suffocation either by gases or water, evidently the latter in this case. But the puzzle remained to account for the sudden freezing up of this large mass of flesh so as to preserve it for future ages.

These notes of Sir Henry's speech are felt to be very inadequate, but owing to his subsequent prolonged illness they have not had the benefit of his personal revision.

The Meeting adjourned at 6.15 p.m.

Note by Professor Hull, F.R.S.

Having read with interest Mr. Whitley's Essay, I wish to add a few remarks thereon. I think the facts he relates regarding the observations of the navigators who have visited the region north of the coast of Siberia justify the author in the conclusion that at the time when the mammoth inhabited this region the climate must have been much milder than at the present time—in order to admit of the growth of trees and vegetation for the sustenance of these huge pachyderms and ruminants. It is also shown that the sea-bed surrounding the Siberian Islands was in the condition of land over which these animals roamed, and is only covered by shallow water at the present time; the submerged land around the islands forms a portion of the "great continental platform"—determined by Dr. F. Nansen (*Bathymetrical Features of the North Polar Sea*, 1904)—which extends outward from the coast of Europe and Asia, and breaks off at a depth of about 100 fathoms, at which depth the land descends rapidly to depths of 1,000 fathoms or more, a depth which may be presumed to extend under the pole, forming a deep polar basin covered by ice. The conditions described by the author lead us to infer a great upheaval of the sea-bed during the "mammoth period," followed by subsidence resulting in the destruction of the mammoth and rhinoceros, and here a difficulty presents itself, for elevation might have been supposed to result in a climate of increased cold, rather than one which appears to have been almost temperate, and this difficulty is increased when we suppose that the elevation of the sea-level would have produced a barrier between Iceland and Norway sufficient to prevent the entrance of the Gulf Stream and cause it to be diverted southwards. The conditions of the Arctic Ocean, as determined by Nansen, are described in a paper read before the Institute (*Journal of Transactions*, vol. xxxvii, p. 214, with map) to which the reader is referred.*

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* For further discussion of the interesting questions raised in this paper see *The Mammoth and the Flood*, by Sir Henry Howorth, K.C.I.E., F.R.S., now unfortunately out of print.

500TH ORDINARY GENERAL MEETING.

MONDAY, JANUARY 10TH, 1910.

HELD IN THE LECTURE THEATRE OF THE ROYAL UNITED SERVICES INSTITUTION, BY PERMISSION OF THE COUNCIL, R.U.S.I.

LIEUT.-COL. MACKINLAY, CHAIRMAN OF THE COUNCIL, IN THE CHAIR.

The Minutes of the preceding Meeting were read and confirmed.

The following elections were announced :—

Associates : Miss A. Habershon.
Miss M. Spokes.
H. Wilson, Esq.

The Chairman congratulated the Institute on its having reached the 500th Ordinary General Meeting, an occasion which, besides being marked by the very valuable paper about to be read, would, he hoped, be made celebrated by increased efforts on behalf of the Institute by all its supporters.

The following paper was then read by the Author :—

MODERN CONCEPTIONS OF THE UNIVERSE.

By G. F. C. SEARLE, M.A., F.R.S., University Lecturer in Experimental Physics, Cambridge.

§ 1. *Introduction.*—In our discussion this afternoon, I purpose to follow the line of thought adopted in a paper on "The Modern Conception of the Universe," which I read before the Pan-Anglican Congress in 1908. I do so for several reasons. Many people who are anxious to know something of the relation between religion and science are so little acquainted with science that the common-places of physics come as a surprise to them. They are further astonished to find that these common-places of physics do bear a very distinct and definite testimony

which is of great significance in religious thought. Many of my audience at the Pan-Anglican Congress were probably in this position. They had probably heard much of the supposed defeat of religion by science but comparatively little of the facts of science itself, and hence they were genuinely astonished at the profusion of the testimony which some of the simplest facts of science bear to the fundamental article of religious belief.

This astonishment is only what might have been expected, for during the last century the popular mind was more and more influenced by the impression that science had settled these questions, and had decided that there was little, if any, place left for a Creator of the Universe. This impression was largely due to the opinions held by some biologists, and to this cause we may, I think, attribute the fact that the supposed conflict between science and religion was generally regarded very much more as a conflict between biology and religion than as a conflict between physics and religion. But as physics was not supposed to be antagonistic to religion, the facts of physics were, quite naturally, less pressed upon the attention of non-scientific persons than the opinions of some biologists, and thus it is not surprising that such persons should have come to believe that physics has nothing to contribute either constructively or destructively to religious thought.

I felt that, in these circumstances, it might be profitable this afternoon to go over once more the ground covered by my Pan-Anglican paper, even at the risk of wearying those members of the Victoria Institute who may be familiar with the facts of science. I have, however, made some additions to that paper in the hope of making the argument clearer.

I trust that I may be able to make it plain that the progress of science has made it very much more difficult than it was in the last century for men to profess materialistic views as to the world and its meaning. The change which has come about can hardly be described more vividly than in the following words used by Mr. Sidney Low.* He was writing with reference to psychical research, but the words apply almost without change to our subject. He says:—

"It is a curious sign of the times, the absorption of one eminent man of science after another in the problems of psychical research. It points, I suppose, to that feeling of the unsatisfactoriness of mere physical science when brought into relations with ethical, spiritual, and ontological questions. We are in the

* *The Standard*, December, 1909.

rebound against the mechanical theory of the universe, which held imperious sway during the thirty years that followed Darwin's first great attempt at systematisation. The influence of Darwin, and Spencer, and perhaps even more, of Huxley and Tyndall, of Haeckel and Weismann, had led to a belief that physics and physiology between them solved everything. Now a good many people go to the other extreme, and assert that they have solved nothing. And the scientists themselves, though they have not abandoned the nineteenth century conceptions of force, matter, and development, are anxious to supplement them by pushing their enquiries into the psychic region. Science itself cannot deal with the facts it has discovered without travelling beyond force and matter and development. It has to postulate something else, something in the nature of mind, and something beyond that; something which is not matter nor force, and yet can act upon both. So it begins to join hands with religion, and reluctantly suggests that there may be such a thing as a spiritual power, operating outside the limits of space and time."

Before we proceed, let us pause to do honour to those men and women who, though ignorant of the facts of science, had heard what science was supposed to have proved and yet held steadfastly to their faith through years of storm. They were not dismayed at the supposed results of scientific progress because they had faith, and faith is so far above intellect that, unlike the latter, it never suffers confusion. We are not, however, now concerned to discover what information can be gained from the lives of saintly people; our business is to discuss what may be learned from scientific investigation.

§ 2. *Purpose of the Paper.*—In discussing the modern conception of the universe, I shall endeavour to examine how far that conception leads to or is consistent with the idea of an almighty Creator having a just claim to the obedience and worship of men. We must not expect that the testimony of science, unaided by spiritual insight, can lead to anything more than the simplest form of religion, but if it does go so far the testimony is of immense value. If men grasped no more than the idea of the existence of an almighty Creator and allowed its significance to have a place in their lives, the gain would be very great.

But this paper is not intended to be in any way an apology for religion. I shall merely endeavour to set down, as simply as possible, some of the conclusions to which modern scientific investigation unhesitatingly points. The survey will, however,

be incomplete, for it will be necessary to omit all but a bare mention of the moral and spiritual feelings and experiences of men, though these are phenomena of the universe, just as much as any physical or chemical actions, and generally lead to actual events in the world of matter, as, for instance, when a call to the mission field leads to the transport of a human body, with clothes and books, across the ocean.

One of the greatest needs at the present day is, I believe, an insistence on the idea of God as the Creator of the universe. If this idea were more forcibly brought home to the minds and consciences of men, they would perhaps pay more attention to religion generally. If the influence of religion has appeared to suffer at the hands of science, it has been mainly because many have been led to an attitude of doubting through the suggestion that scientific investigation has left no place for a God as the Creator of the world. With this doubt in their hearts, it is easy for men to profess the opinion that there are no such things as God's laws to be obeyed or to be broken.

But it is becoming more and more plain that so far from science leading to any such conclusion, the facts all point in the opposite direction, and thus science is more and more bearing testimony to the fundamental article of religion. We may here quote Lord Kelvin's statement* that "if you think strongly enough, you will be forced by science to believe in God, which is the foundation of all religion."

§ 3. *The Universe and Human Thought.*—It should be noted, before we go further, that the essential character of the universe does not depend in the least upon our intellectual conceptions, for the universe remains the same whatever may be our individual views concerning it. It is important to bear this in mind, because some persons, who have not grasped the distinction between an hypothesis and a fact, are in danger of imagining that these great questions are settled by the pronouncements of the popular speaker who is fashionable at the time. The distinction between fact and hypothesis must be continually remembered in discussing scientific discoveries, for, apart from the inevitable errors of observation, the simplest experiment is in reality so complex an affair that we can do no more than frame an hypothesis which will account for its main features. Yet, if the hypothesis is verified when the experiment is repeated under a variety of conditions, it acquires a high degree of credibility. That is all that we can say.

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* *Nineteenth Century*, June, 1903, p. 1068.

Those who are much occupied with literary work are exposed to the danger of treating realities as if they were merely subjects for academic discussion. In physics, however, there is so constant an appeal to experiment, either directly or through mathematical reasoning, that students of physics are to a considerable extent freed from this danger, and in biology experiment is now rescuing that science from the thraldom of opinion. But in regard to theological studies, it is perhaps true to say that mere opinion has in some cases been allowed a position which does not belong to it. Thus many assert that miracles never happened, the only ground for the assertion being their opinion that they are impossible. Much would be gained if it were realised that what occurred in the past is not in the least affected by the opinions of persons, however exalted, who live in the twentieth century.

There is a popular notion that some strange impersonal thing called Modern Science has examined the universe in the cold light of experiment and has arrived at infallible conclusions. But this is not a true picture. for there is no one of the conclusions of modern science which can be said to be absolutely established, and the utmost that can be said of any conclusion is that the experiments are in approximate agreement with it. It is true that some conclusions become more and more firmly established as the accuracy of the experiments is increased, but, on the other hand, an increase of accuracy sometimes requires us to modify a conclusion. A striking example is furnished by the discovery of the gas argon in the atmosphere. In spite of an old experiment of Henry Cavendish, it was believed that atmospheric air was a mixture of oxygen, nitrogen, carbonic acid gas and water vapour, with *very small* additions of other known gases. But the accurate work of Lord Rayleigh and Sir W. Ramsay showed that more than one per cent. of what was supposed to be nitrogen was the previously unknown gas argon, and this has led to the detection of other gases.

§ 4. *The Complexity of the Universe.*—In the earlier stages of scientific progress it was to some extent possible to divide science into branches and to confine attention to one branch at a time; it was possible to attend to the phenomena exhibited in one or more bodies without much regard to the relations between those bodies and the rest of the universe. But modern investigation makes it logically impossible to work any longer in water-tight compartments, and is gradually leading us to appreciate the fact that the number of actions to which every particle in the universe is continually subject is very great.

One instance will show how the progress of discovery compels a wider outlook. Newton accounted for the motions of the planets and their satellites by the law of gravitation, and the work of subsequent mathematicians and astronomers has abundantly verified his formula in the case of bodies of considerable mass. But recent investigation has verified the theoretical prediction of Maxwell that, when one of the bodies is intensely heated, as the sun is, the stream of radiant energy which falls upon the second body exerts a force upon it. As the second body becomes smaller, this force rises in importance relative to the force due to gravitation till at length it rivals and surpasses it, and it follows that the motions of those particles of cosmical dust, which are scattered through space, depend not only upon the action of gravitation, as was formerly supposed, but also upon the pressure of radiation.

Modern discoveries have led us to a point of view from which we are compelled to regard every particle in the universe as continually subject to a great variety of actions, though of course at any given instant some actions may be more strongly in evidence than others, and thus we realize that the history of even a single molecule, considered as a whole, is one of great complexity.

The evidence of the spectroscope indicates that each molecule has a very complex structure. Thus, each line in the spectrum of a substance corresponds to one mode of vibration of the molecules, and in the spectra of some substances, such as iron, hundreds of these lines may be counted. But the molecules are not merely complex in themselves; they have very complex connexions with their surroundings. Thus oxygen can combine with nearly all the other chemical elements either singly, as in the case of hydrogen in the formation of water, or in groups, as in the case of hydrogen and sulphur in the formation of sulphuric acid. The total number of such combinations is enormous. Thus we may say that each element is so constructed as to respond to the influence of each of the great majority of the other elements, and to a great number of their compounds. Of recent years the discovery of radio-active substances has greatly raised our estimate of the complexity of molecules.

When we combine the complexity of each molecule with the vastness of the number of molecules in the world of stones and trees and men and sun and stars, and consider that each molecule acts on every other one, the complexity of the conception is enough to make us despair of further progress. But science

has not stopped here, and has not left us without some sign-posts to guide us in our perplexity. I shall now endeavour to indicate some results obtained from experimental work which lead to conceptions shedding a little light upon the nature and character of the universe.

§ 5. *Nature of Matter.*—In the bodies around us, on the earth or in the sky, whether they be inanimate or whether they be living organisms of any kind, we see a bewildering variety of substances. But the labours of chemists have led to the belief that all bodies are built up of a comparatively small number of elements, such as oxygen, carbon, or iron, and have shown that, if the elements be arranged in a series according to a certain law, there are very remarkable relations between the properties of an element and its place in this series. The existence of gaps in this series was thought to indicate that some elements remained to be discovered, and the theory of the series enabled the general character of the missing elements to be clearly described. The predictions have been confirmed by the actual discovery of some of the missing elements. These results of chemical science at once simplify our ideas about the material bodies around us, for instead of thinking of countless millions of different substances we need only think of about one hundred. That the elements found on the earth occur in the sun and stars is shown by the spectroscope and by chemical analysis, which proves that many meteorites which have fallen on the earth are almost identical in composition with the most deep-seated terrestrial rocks.

In the case of helium, the existence of the gas was first revealed by spectroscopic examination of the sun, in whose spectrum a line was found which did not correspond to any terrestrial element then known; the name of helium was given to the element causing the line. Helium has now been found in terrestrial minerals, and has been liquefied by Kammerlingh Onnes at Leiden, the temperature of the liquid being only three or four degrees above the absolute zero of temperature. This extremely low temperature, the lowest reached, so far, in any experiments affords a strange contrast to the temperature of 5000° Centigrade or more which prevails in the sun, where helium was first discovered.

The numerical relations between the elements suggest that they are all built up of some primordial substance. The most promising speculation is that which regards a molecule as consisting of a larger or smaller number of minute parts, separated by relatively large distances, these parts being

associated with electrical charges or, possibly, being nothing else but electrical charges. The variety of the elements can then be accounted for by variations in the number and arrangement of these component parts. Even if the component parts were merely electrical charges, the inertia and momentum of matter could be explained by the principles of electro-magnetism.

§ 6. *Radio-active Substances.*—It used to be thought that the molecules of all substances were absolutely incapable of any change, but now it has been found that some substances such as uranium, radium and thorium, which according to most tests behave as elements, suffer transformations into other forms which again appear to be elements. This, of course, only strengthens the belief that all matter is only a single substance under a great variety of forms. The theory that molecules are built up of minute parts associated with electrical charges promises to account for these transformations and for the remarkable effects which are found to accompany them.

Of the radio-active substances, radium is perhaps the most amazing. As radium is being transformed into its child, the radio-active gas known as radium emanation, it emits vast numbers of positively electrified particles. In a single second one milligramme of radium emits about thirty millions of these particles, that is, one particle for each inhabitant of England. The activity of the radium decays because some of the radium ceases to be radium and becomes emanation, which in its turn suffers further transformations, but 1,800 years would pass before half the radium would be transformed. In spite of the excessive smallness of the emitted particles, Rutherford has found a way of observing an effect due to a single one.

To say that these particles are emitted gives a very faint notion of the stupendous velocity with which they are shot out, for their velocity is about one-fifteenth of the speed of light or about ten thousand miles per second. Some of the other radio-active substances shoot out negatively charged particles whose speed rises, in some cases, to nearly the speed of light. The impact of these projectiles upon the surrounding matter produces heat and thus a radio-active substance, such as radium, maintains itself by self-bombardment at a temperature above that of its surroundings. In a single hour one gramme of radium produces enough heat to raise one gramme of water from the freezing to the boiling point.

These experimental facts of radio-activity have given us

almost entirely new ideas as to the character of matter, and hence demand consideration in any account of what is known about the universe. Their bearing on our subject will be considered presently.

§ 7. *Abrupt Changes.*—The elements differ one from another by abrupt steps just as polygons of 3, 4, 5 . . . sides differ. We cannot pass from one element to another by an infinite series of infiuitely small steps. If we could, there would be no science of chemistry. The idea has been held that living organisms have been derived from earlier forms by a continuous process of evolution, but nothing like this occurs among the elements, for there the steps are *abrupt*. The transformations of the radio-active substances appear to be due to *abrupt* changes in the number of electrified particles in the molecule. These abrupt steps and others we shall meet in our survey are of great interest. Thus the abrupt changes of the molecules of radio-active elements warn us that deductions based upon observed uniformity may be unsound, even though the period of observation may have extended over hundreds of years. If we start to-day with a gramme of radium, there will still be half a gramme left after 1,800 years, and if we were to observe for this period one of the molecules forming part of the remaining half gramme, we should naturally conclude that this molecule would continue for all time "unbroken and unworn." But, if we maintained our watch for another century, we might witness the catastrophe which results in the expulsion of a positively charged particle and our earlier conclusion would then be proved to be false.

§ 8. *The Universe as a single System.*—The view that all matter is built up of a single primordial substance is a great step in advance, but it does not at once replace complexity by simplicity, for the fact remains that the number of molecules in the universe is inconceivably great. You will not think the word inconceivable to be inappropriate in view of the estimate that a drop of water no larger than a grain of mustard seed contains enough molecules to supply each inhabitant of the earth with one molecule every second for many thousands of years. Who then shall grasp the number of molecules in the whole universe?

But the results of scientific investigation lead us to regard all these molecules in their vast array less as so many separate entities than as forming one great and indivisible whole. One instance will make this clear. We believe that if there were only two molecules in the whole universe the force of gravita-

tion would still draw each towards the other. There is therefore some connexion or relation between the two molecules, and to speak of them as two separate systems is only a convenient mode of speech which does not express the whole of the conditions. If they were two entirely independent systems, the motion of one molecule away from the other would have no effect upon the latter. But the law of gravitation assures us that the second molecule would experience a distinct effect, for the attractive force acting on it would gradually diminish as the distance increased. An extension of this idea leads us to realise that all the molecules in the universe are so linked together by gravitation as to form but a single system. Yet gravitation is not the only link, for electric and magnetic actions between molecules produce their effects, whatever the distance between the molecules. In addition, there are other actions which are sometimes practically in abeyance, as when two molecules, one of oxygen and one of hydrogen, are too far apart for chemical combination to take place. Nevertheless, the power of combination remains ever ready to do its work, when the distance between the molecules is sufficiently reduced and certain other conditions are fulfilled.

We could, of course, suppose that these actions between molecules arise from something inherent in the molecules themselves, and that the intervening space has nothing to do with the affair. But the facts of optics and of electromagnetism compel us to recognise the existence of an all-pervading medium to which the name of ether has been given. This medium is conceived to extend through all space, and there are good reasons for the belief that the forces between electrified bodies are in reality due to stresses in it. The ether enables radiant energy to be transmitted from one body to another, as when the earth receives heat from the sun, or telegrams are sent, with or without the aid of wires, from one station to another. There is thus a most intimate connexion between molecules and the ether, and hence the ether may be regarded as the substance, if it can be called substance, which binds the whole universe together.

The rate at which energy is supplied to the earth by radiation from the sun is very great. On each square yard of illuminated surface, energy is supplied at the rate of about one-fifth of a horse-power. For the whole of the illuminated hemisphere, this amounts to something like twenty million horse-power.

Thus we come to recognise that the whole tribe of molecules is linked together by the ether in such a way that they and the

ether form a single indivisible system. The word *atom* was originally coined to express the belief that certain minute particles are incapable of a physical division into smaller parts. But in the light of modern science the whole universe is to be regarded as an atom, or in other words, as something which cannot be divided.

The conception of the unity of the universe, to which modern science leads us, must of necessity have a most important place in any speculation concerning the origin of the universe.

§ 9. *The Origin of the Universe.*—All the evidence is against the idea that the existence of the constituent parts of molecules is due to any physical or chemical actions occurring in the present state of the universe: we are thus compelled to believe that they have been created, unless indeed, we suppose that they are self-existent or in other words, that there never was a time when they did not exist in their present forms—a supposition which has no place in the conception of the universe in the minds of modern physicists.

The fact that all the molecules of any given element have absolutely identical properties makes it clear that matter has been made on some plan, and the certainty that there is no molecule which is not associated with energy indicates that both plan and energy come from the same Source.

The uniformity of the molecules of any given element is the basis of chemistry. The spectroscope also bears witness to this uniformity, for the lines in the spectrum would be broad and not narrow if among the molecules of the substance under examination there were appreciable difference of the periodic time of the particular vibration corresponding to each line of the spectrum. Schuster has illustrated in a very forcible manner the conclusion that if there are inequalities in the periodic time of thallium, corresponding to the green line in its spectrum, these inequalities must be exceedingly small. He states that the want of uniformity is greatly over-estimated, if we say that twelve per cent. of the molecules differ from the average by one part in two millions in periodic time, and he brings out the meaning of this statement in the following way :—"If you had a great many clocks and found that, taking their average rate to be correct, not more than one in eight would be wrong by a second in twenty-three days, that would represent the maximum amount of variation which our interpretation of the experiment allows us to admit in the case of molecular vibrations. But would any maker undertake to supply you with a number of clocks satisfying that test . . .

Though Sir John Herschel's saying that atoms possess the essential character of manufactured articles is still correct, yet no manufactured article approaches in accuracy of execution the exactitude of atomic construction. We may conclude with Maxwell that "each molecule throughout the universe bears impressed upon it the stamp of a metric system as distinctly as does the Metre of the Archives at Paris."

This exactitude of atomic construction is not merely of academic interest, but is of real importance in the very practical work of maintaining definite standards of length. The metre of the Archives has been measured in terms of the wave-length corresponding to a particular line in the spectrum of cadmium, and it is to the constancy of this wave-length that we now trust rather than to the constancy of the length of the metal bar known as the metre of the Archives.

In thinking about the creation of the universe, we shall perhaps be helped if we first consider what would be involved in the creation of a single new molecule at the present day. This event would not only require the creation of new matter but would also involve the establishment of relations between the new molecule and the countless millions already in existence, and this would change all those molecules to the extent of enabling each of them to act upon the new molecule. If we speak in terms of the ether, we may say that such a connexion must be established between the new molecule and the ether that the molecule is able to cause disturbances in it which produce effects throughout the whole of space.

The phenomena of radio-activity have disclosed far more of the skill of the great Architect and Electrician than was even suspected a few years ago. For the formation of a molecule of uranium involves not only the construction of the minute electrified particles which it contains, but the assembling of them together and the supply of that vast store of energy which will enable the molecule at the right moment, perhaps a thousand million years after the formation of the molecule, to shoot out an electrified particle at a terrific speed. But this is not all, for the design of the uranium molecule is such that the modified molecule, which remains after the expulsion of the particle, will after a few days in its turn shoot out a particle and so on for several stages, the time of halting in each stage being sometimes large, as with the 1,800 years of radium, and sometimes small, as with the four days of radium emanation.

The Power which is capable of creating a single molecule is

able to originate effects extending through all space, and to this degree may therefore be described as bearing rule over the whole universe. We could, of course, suppose that the ether was created by one such Power and that each molecule had its own Creator, but the evidence of the unity of the universe leads to the conviction that the whole universe, the ether included, is the work of a single Creator, and that the energy in the universe is His gift.

§ 10. *Law and Order in the Universe.*—What has been said about the unity of the universe and its creation is surely enough to justify the expectation that the universe will be found to be the scene of the operations of laws of such a character as to appeal to the intellect as rational laws, or laws which have good reasons behind them. So far from modern science having any doubts on this point, one of the chief aims of scientific investigators is to discover laws. In fact, many of the greater advances have sprung from speculations and experiments inspired by the belief that the actions occurring in the universe take place according to some intelligible plan, while many of the laws which have been discovered are capable of being expressed by very simple mathematical formulæ.

One of the most conspicuous instances of belief in such a plan is furnished by the doctrine of the conservation of energy. According to this doctrine, the total energy in the universe is fixed in amount, and any chemical or physical change involves merely a redistribution of energy or a change from one form of energy to another. Such a law is obviously of the utmost significance, and it is not surprising that many of the modern advances in science are due to its recognition. Men would have been dull indeed if they had not seen in the law, as revealed by experimental investigations, an ordinance of an intelligent Power bearing rule over the whole universe. But to some extent the process took place in the reverse direction, and, instead of experiments leading to the doctrine of the conservation of energy, it was the expectation that the plans ordained by the Creator would be found to be intelligible to human minds which led the way to the establishment of the law as an article of scientific belief, for it was his faith in a Creator and his belief that the Creator had made energy subject to the law of conservation which led Joule to make the series of experiments which went far to secure the acceptance of the doctrine. His own words deserve to be quoted. "I shall lose no time," he says, "in repeating and extending these

experiments, being satisfied that the grand agents of nature are, by the Creator's fiat, indestructible."*

§ 11. *The Beginning and End of the Universe.*—The modern conception of the universe sets before us a wonderful system working in a manner so regular and so orderly that we are almost tempted to believe that this regular working has continued not merely for many centuries or for many millions of millions of years, but that there never was a time when the universe was not guided by the same laws, neither more nor less, as are in operation to-day. This temptation must, however, be resisted, for if we yield to it we abandon the conclusion that the universe was created, since to assert that there never was a time when matter did not exist is equivalent to saying that it is self-existent.

If the universe consisted merely of the ether and of a single sphere of matter without any motion either of its centre or of the parts of its molecules, we could set no limit to its age, because no changes could occur in it. But the universe is not of this character; on the contrary, it contains matter in very vigorous motion—both in bulk, as seen in the earth's motion round the sun, and in detail, as seen in the molecular vibrations which give rise to light. Hence the state of the universe to-day differs from its state yesterday, and so on. We might, of course, conceive that all these motions are periodic, and that any particular state of the universe recurs continually, though perhaps at long intervals, and, apart from the difficulty of accounting for them, we might suppose that these periodic changes had occurred regularly for an infinite time, and that they would continue for an infinite time. But modern investigations prove such a view to be untenable. For they have shown that, while the total amount of energy remains unchanged, there is at present a progressive diminution in its availability, and they point remorselessly to a time when the energy will be so distributed that further redistribution will be impossible. The meaning of availability may be illustrated by reference to water in a reservoir on a mountain near the sea. The water in the reservoir represents available gravitational energy, and in its descent to the sea-level may be made to drive machinery and to produce electrical or other energy, but as soon as the water reaches the sea-level it ceases to be available for doing work.

When the further redistribution of energy ceases to be

* Joule's *Scientific Papers*, vol. i, p. 157.

possible, the universe will be physically and chemically inert in simple words we may say that it will be dead.

The power of chemical combination of the carbon of coal with the oxygen of the air is a great reserve of energy, but in a few generations this source of wealth for England will be practically exhausted, and then the humblest households will learn by the experience of hardships something of the meaning of the loss of availability of energy.

When the operations of the physical laws are traced backwards into past time, they lead to greater and greater availability of energy. But there is a limit to this process, for the total sum of energy is limited. Speaking generally, the rate at which redistributions of energy occur increases with the availability of the energy, but even if the rate of loss of availability had never been greater than at present we should, in going back, arrive in a finite time at a state in which all the energy was, so to speak, in one basket. We thus conclude that only a finite number of years has elapsed since the creation of the universe.

The existence of radio-active substances points to the same conclusion. For since uranium is continually being transformed into other substances, and since an appreciable quantity of uranium is still left, only a finite number of years has elapsed since uranium was first formed.

§ 12. *Life and Matter.*—So far we have considered matter apart from life. But on the earth there are living organisms ranging from lowly bacteria to stately trees and splendid animals and man himself. The bodies of these organisms are composed of some of those elements of which inanimate objects are formed, and to that extent living organisms are identical in nature with the inanimate world around them. But it is evident that there is a profound difference between life and matter, in that life involves individuality. Life is capable of employing the molecules of various elements to form the organism and to maintain it as the abode of life for a longer or shorter time, but the organism does not always consist of the same molecules, for it is continually taking in some molecules, and rejecting others. Thus, for instance, after the carbon which an animal takes in as a constituent of its food has been assimilated, it is combined in the body with the oxygen taken in from the air and the resulting carbonic acid gas is breathed out. Both the carbon and the oxygen form parts of the body for a time, but only for a time. Yet the life of the individual preserves its identity, though the body which it controls is never, for two minutes together, composed of exactly the same molecules.

At the death of an organism, no immediate change occurs in the materials composing the body, but it is evident that in the corpse something is missing which the living organism possessed.

Matter, such as oxygen or carbon, is often spoken of as "dead" matter, but this description is inadequate. Many of the chemical elements are capable of being absorbed into the bodies of living organisms, and though only a small part of the total sum of any one element, such as carbon, is associated with life at any given time, yet every molecule of that element is so far under the spell of life that, under proper conditions, it will be compelled to take its place as part of a living body. It thus appears that there is a very real relation between life and a great part of matter, and the statement may be extended to *all* matter if the elements are merely various forms of a single substance. We are led to the conclusion that the capability of most, if not all, matter to enter into association with life was provided for in the design and original formation of the molecules, and further, that life and matter have proceeded from the same source.

§ 13. *Origin of Life.*—Experiments have led to the conviction that in the present order of things the linking of life with matter can only arise from the action of living organisms, and thus we arrive at the conception that living organisms did not appear on the earth as the unaided result of actions between mere molecules. We therefore conclude that the first living organisms were created.

The question at once arises whether the creation of the first living things took place at the same time as the creation of inanimate matter, or whether inanimate matter was in existence before the creation of living organisms. The only guide with which science provides us is the existing order of things, and if we follow this in tracing back the history of the earth, we come to a time when the earth's surface was red-hot. Lord Kelvin made this conception more precise by estimating how many millions of years have elapsed since that time. The discovery that radium gives off vast quantities of heat in the course of its transformations makes it necessary to revise Lord Kelvin's numerical estimate, but it does not invalidate the conclusion that only a finite number of years has elapsed since the earth's surface was red-hot.

In addition to Lord Kelvin's method a number of quite independent methods of solving the problem have been devised, and they all indicate that, at the most, not more than a few

hundred million years have elapsed since the red-hot stage. In one of these methods the mass of sodium in the sea is estimated as well as the mass of sodium carried to the sea in one year by the rivers. These data give us the time which has elapsed since rivers first began to flow.

Now the connection between matter and animal or vegetable life is destroyed when the organism is exposed to a red heat, and thus, if the existing order of things had prevailed without interruption from the time when the earth's surface was red-hot, there would be no living organisms on the earth at the present day. Hence we conclude that the creation of the first living things on the earth has occurred since the time when the earth's surface was red-hot.

It has been suggested that life first appeared on the earth in elementary forms carried hither on meteorites, but this is no explanation, for it merely pushes the difficulty one stage further back.

§ 14. *The History of Species.**—The history, as far as it can be ascertained, of the various species of creatures now inhabiting the earth, is of very great interest on account of the light which it may shed upon the nature of those most complex parts of the universe. This history demands consideration in the present paper because some of the speculations which were current in the last century, regarding this history, were used as arguments against religion. It is still widely believed that those speculations are fully accepted by all intelligent persons, and it therefore becomes necessary to give a brief account of the results reached in recent years.

The idea was at one time held, that each living species had been separately created, and that apart from small variations, such as occur in the height of men or in the colour of their hair, each species, whether living or extinct, is incapable of change. This idea involved acts of creation taking place at different points of time, and hence it was natural that some should suppose that all the creatures now living are descended in an unbroken succession, from those which first existed, and that there has been but one solitary act of creation of life. This idea, of course, requires the supposition that the present species are descended from those which are, in some cases, now extinct, and therefore required the further supposition that the descendants of living forms may differ greatly from their ancestors.

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* In this section I have been greatly helped by Mr. R. H. Lock's book on *Recent Progress in the Study of Variation, Heredity, and Evolution.*

Darwin endeavoured to account for the observed differences between forms which were supposed to be related as descendants and ancestors by the action of a kind of selection, operating upon the small variations to which each species is liable. He supposed that "there will be a strong tendency for those individuals which show slight modifications in the direction of a better adaptation to their environment to survive at the expense of those of their brethren which do not exhibit similar modifications. This was the principle called "Natural Selection" by Darwin, and by Herbert Spencer the "Survival of the Fittest." It was further supposed that under the influence of natural selection the small differences might in a sufficient time be accumulated and increased to almost any extent. Darwin* did not deny that many and serious objections might be advanced against his theory, but he thought that he had given them their full force. Of his theory he says, "nothing at first can appear more difficult to believe than that the more complex organs and instincts should have been perfected, not by means superior to, though analogous with, human reason, but by the accumulation of innumerable slight variations, each good for the individual possessor." In spite of this difficulty, "this suggestion of a natural means of modification had, within a few years, the effect of convincing practically the whole thinking world of the truth of the theory of organic evolution."

Darwin himself endeavoured to consider how far biological facts were in accordance with his theory, but "the more popular accounts since his time have dealt almost exclusively with theoretical considerations and with matters of opinion." Mr. R. H. Lock remarks that "if the truth must be told, the experimental method was given up for a long time by the majority of specialists themselves in favour of the controversial."

Of recent years there has been a return to experiment. The phenomena of variation and inheritance have been studied, and the result has emerged that improved features are not evolved by gradual selection. The theory of modification by selection has, when put to the test of experiment, very largely if not completely, failed.

The place of selection has been taken by an alternative process. "The evidence in favour of an alternative process has multiplied even faster than the evidence against the continuous accumulation of minute differences." "The new view is that the evolution of new species has taken place principally by the

* *Origin of Species*, chapter xiv.

help of variations of the discontinuous kind. By this process there can arise at a single step new forms which have already the complete and definite character usually associated with a species specially adapted to particular conditions." There is nothing speculative about these abrupt variations or mutations, for they have been frequently observed and are more common than was formerly supposed. An example is furnished by the Shirley poppy. "In 1880 the Rev. W. Wilks, Vicar of Shirley, near Croydon, noticed among a patch of common wild field poppies growing in a waste corner of his garden a solitary flower with petals showing a very narrow border of white," and from the seeds of this flower the strain of Shirley poppies originated.

These mutations of living forms bring us back again to the idea of abrupt steps which we discussed earlier in the paper. No way, apparently, is known of causing these mutations to appear; all that can be done, and what is done by practical breeders, is to watch for them and to give them every chance when they do appear.

It was thought at one time that the value of an individual was as nothing compared with that of the race. But the facts of mutation show that this estimate needs revision. For any living creature may have an offspring which may exhibit mutation and so may be the progenitor of an entirely new race.

One of the most remarkable results of recent experimental work is the recognition of the fact that each living organism is no longer to be regarded as a unit but as a composite being made up of a great number of unit characters, each capable of separate description and all inherited independently of one another.

The manner in which these unit characters are inherited was discovered about 1865 by Mendel, first a member and then the Abbot of Brunn. The change which the recognition of unit characters and the discovery of Mendel have brought about has been described by Mr. Lock as follows:—"On the mind of a biologist familiar with what was known of heredity only ten years since, these facts must fall with a sense of complete novelty. The ideas current even so short a time ago are not so much extended, or even altered, as replaced by an entirely new set of ideas. And it may be remarked in passing that the biologist of fifty years ago and more was much nearer to our present line of inquiry.

§ 15. *The Fate of Living Organisms.*—From the creation of living organisms we may pass to their fate. Though they die

one by one, life is handed on from parent to offspring in such a way that we might expect it to continue in an unbroken succession for all future eternity, provided the prevailing physical conditions are not destructive to it. But the present order of things, which is the only guide of science, points, as we have seen, to a future time when the energy of the universe will be no longer capable of further transformations, and without such transformations living organisms cannot continue to exist. Thus a time will come when there will be no longer any living organisms on the earth. The present order of things does not, however, suggest that the universe will not continue as a mass of inanimate matter after the death of the last organism.

What happens to its life when an organism dies, is a question to which physical or chemical science has so far given no answer, for the sufficient reason that life evades the measurement and analysis of those sciences.

§ 16. *Man and the Universe.*—A survey of the universe would be incomplete without an examination of the surveying instrument itself. That instrument is the human race, which has been so created and developed that it is able to make scientific observations and from them to discover laws obeyed by the universe. It is worth while to notice how those laws have been recognized. They have been established by experiment, and modern science, flushed with success, is steadily pressing its claims for more money and better opportunities for research in the hope of establishing further laws. But if we were to inquire why some man had made certain experiments or made certain calculations, the answer would often be that he had had an inspiration. The man is, however, conscious that it is the opening of his eyes which is the new thing, and not the fact or principle which he has perceived. The inspiration comes suddenly, like a flash of light, and makes an *abrupt* change in his intellectual conceptions. But no conclusions could be drawn from experiments unless it be admitted that some of the conditions can be varied in an arbitrary manner, and this amounts to a declaration of the power of free-will on our part. Thus, if we stroke a steel needle with a magnet, the needle becomes magnetized, but if the act of stroking was inevitable we could not decide whether the magnetism of the needle was directly due to the action of the magnet or whether other causes were involved. The power of free-will is of great significance, for the effects of a single act of free-will extend through the whole of space, and will last as long as the present order continues. Thus the voluntary motion of a man's hand

not only affects the motion of the earth by a calculable amount, but also the motions of the sun and of the remotest stars, and the motions of all these bodies will differ for the rest of time from the motions they would have had if the man had not moved his hand.

But there are many other impressions received by man's consciousness, and all of them are undoubtedly phenomena occurring in the universe. Among them are the demands of conscience, the sense of temptation and the knowledge of yielding to it, the power of prayer and the consciousness of answers to it, and the other spiritual experiences of men. Our knowledge of these things did not arise from the recent work of a few scientific men; the whole human race, for many centuries, has been conscious of their reality. The universe is so clearly the domain of order that it would be strange indeed if spiritual things were not subject to laws, though it is to be expected that these laws will differ from those obeyed by inanimate matter, just as free-will differs from gravitation or chemical affinity. The unity of the universe makes it impossible to suppose that we can ever cut ourselves off from the operations of those laws. Did we but realize this, we should covet earnestly the spirit of holy fear. When men have this spirit they not only pay reverent attention to spiritual things, but also think and speak reverently of all the things of the material world, as, for example, of the weather. They are conscious that they are dwelling in the Temple of God and it is the joy of their lives to give Him their worship and their obedience.

The unity of the universe proclaims that there is absolute harmony between what is true in science and what is true in religion, and the fact that many of the greatest men of science have publicly acknowledged God in their scientific work shows the fallacy of the supposition that there is any antagonism between science and religion. Among these pioneers was Newton, who concluded his great *Principia*, or Mathematical Principles of Natural Philosophy, with a wonderful passage on the nature of God, "to discourse of whom," he wrote, "from the appearances of things does certainly belong to Natural Philosophy." Another pioneer has lately passed away from us in the person of Lord Kelvin, who for fifty-three years began the first lecture of each day by reciting a collect from the Prayer Book. In such lives as these there was wisdom and there was holy fear. May it not be that, after all, the fear of the Lord is the beginning of wisdom?

At the conclusion of the paper the thanks of the audience were unanimously voted to the lecturer on the motion of Professor ORCHARD.

Mr. SEARLE then dealt with a number of questions which were put to him, and the meeting adjourned at 6.15.

501ST ORDINARY GENERAL MEETING.

HELD IN THE HOUSE OF THE ROYAL SOCIETY OF ARTS ON MONDAY, JANUARY 24TH, 1910, AT 4.30 P.M.

PROFESSOR E. HULL, LL.D., F.R.S. (VICE-PRESIDENT), IN THE CHAIR.

The Minutes of the previous Meeting were read and confirmed, and the following announcements made on behalf of the Council: —

The Rev. Canon R. B. Girdlestone, M.A., late Chairman of Council, had been appointed a Vice-President in the place of the late W. H. Hudleston, Esq., F.R.S.

The Rev. Griffith Thomas, D.D., Principal of Wycliffe Hall, Oxford, had been appointed to a seat on the Council in the place of Colonel T. H. Hendley, C.I.E., resigned.

Dr. W. A. Shann, of Woking, had been elected an Associate of the Victoria Institute.

The CHAIRMAN then introduced Professor H. Langhorne Orchard, the author of the subsequent paper and winner of the Gunning Prize 1909. He was certain that all those present would derive the greatest pleasure and assistance from the paper, which he might mention had been placed first in their independent reports by all three of the arbiters appointed to consider the essays submitted for the Gunning Prize, so that at their subsequent meetings the task of recommending the award had not proved a difficult one, though none of them had agreed as to the order of the other excellent essays submitted.

Professor H. LANGHORNE ORCHARD, who was received with great applause, then proceeded to read the following paper:—

THE ATTITUDE OF SCIENCE TOWARDS MIRACLES.

By Professor H. LANGHORNE ORCHARD, M.A., B.Sc.

(*Being the Gunning Prize Essay*, 1909.)

I. *Preliminary.*—Definitions; Relations between Science and Miracles; Nature of Scientific Evidence.

II. *Miracles in General.*—Are they possible? Are they probable? Have miracles actually occurred?

III. *The Bible Miracles.*

Appendix on miraculous occurrences and "Miracles," other than those recorded in Holy Writ.

I. *Preliminary.*—The aim of the following Essay is to arrive at a conclusion, as definite as possible, with regard to the attitude of Science towards Miracles. It is premised that the attitude of Science may, or may not, be coincident with that of Scientists.

We begin by defining our terms. What is Science? What is a Miracle? Science, says Whitney,* is "knowledge gained by systematic observation, experiment, and reasoning; knowledge co-ordinated, arranged, and systematized." In the *Encyclopædic Dictionary* we read that Science is "co-ordinated, arranged, and systematized" knowledge, and, again, "Science is a systematic species of knowledge which consists of rule and order"; the verb "know" meaning "having experience of," "perceive with certainty." "Science," says *Chambers' Encyclopædia*, "in its widest significance, is the correlation of all knowledge. To know a truth in its relation to other truths is to know it scientifically." Bouillet† enounces that "on appelle Science soit une connaissance certaine (par opposition à l'opinion, qui n'est que probable), soit un ensemble de connaissances contrôllées et systematisées par l'application d'une méthode." By Huxley‡ Science is regarded as "the knowledge of fact."

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* *The Century Dictionary.*

† *Dictionnaire Universel.*

‡ *Essay on Universities.*

These definitions seem to justify the following:—*Science is the investigation and study of things and phenomena in nature, with a view to their explanation and correlation in the great order of the universe.* In doing this, she seeks to arrange and classify them, for the two-fold purpose of retaining knowledge gained and of employing it as a progressive means to further knowledge.

What is a Miracle? Thomas Aquinas* answers:—"Things that are done occasionally by Divine power outside of the usual established order of events are commonly called Miracles. We wonder when we see an effect and do not know the cause. The absolutely wonderful is that which has a cause absolutely hidden. Now the cause absolutely hidden to every man is God." Hume says, "Nothing is esteemed a miracle if it ever happen in the common course of nature"; and, in his affirmation that miracles are "violations" of the laws of nature, has the intellectual sympathy of Spinoza.

A better definition is that given by Locke†—"A *miracle* I take to be a sensible operation, which, being above the comprehension of the spectator, and in his opinion contrary to the established course of nature, is taken by men to be Divine."

According to the *Encyclopædic Dictionary*, a miracle is etymologically "anything which excites wonder, surprise, or astonishment," and it is "a supernatural event or act."

Butler‡ considers that "A Miracle in its very notion, is relative to a course of nature, and implies something different from it, considered as being so." Isaac Taylor calls a miracle "a fragmentary instance of the eternal order of an upper world." Smythe Palmer would define a miracle "as a new effect introduced by a new cause, and that cause the will of God." Other interesting definitions are the following:—"The best idea which we can form of a miracle is that of an event or phenomenon which is fitted to suggest to us the action of a personal spiritual power" (Westcott). Miracles may be defined, "provisionally," as "Physical phenomena which are unaccountable by the known laws and processes of nature" (Girdlestone).§ A miracle is "An exception to the observed order of nature brought about by God in order to reveal His will or purpose"

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* *Summa contra Gentiles.* † *Discourse of Miracles.*

‡ *Analogy*, Part ii.

§ "The Scriptural Idea of Miracles." *Transactions of the Victoria Institute*, vol. xxxix.

(Lias).* "By a miracle (using the word in its strictest sense), we mean a phenomenon which, either in itself or from the circumstances under which it is presented, suggests the immediate working of a personal power producing results not explicable by what we observe in the ordinary course of nature" (Westcott).†

On careful consideration of what is suggested, or implied, by the term "miracle," it is possible that none of the preceding definitions may be held to be adequate or satisfactory. In seeking one that is so, we note that it includes (1) something marvellous, (2) something exceptional, (3) something taking place in nature, (4) something not explicable by natural (or, human) causes, (5) something directly referable to supernatural action.

(1) That the thing is marvellous is affirmed by the name "miracle" (*miraculum*). (2) It must also be exceptional. The phenomena of the seasons and of day and night, are indeed very wonderful, yet they are not miracles. It has been pointed out that a sudden stoppage of the earth's rotation on her axis would be called a miracle, but we do not apply the term to the rotation, though the rotation is quite as wonderful. (3) A miracle is further thought of as taking place in nature. (4) It is not explicable by natural (or, human) causes. Though it fulfils the previous conditions, yet, if explicable by natural (or, human) causes, it is not a miracle. An eclipse, or the appearance of a new comet is not accounted a miracle; the telephone, the latest *Dreadnought*, an aeroplane, wireless telegraphy, or anything that man can do, or that any part of "nature" can do, however marvellous, we do not consider classifiable as "miracle." (5) It follows that, since every event must be referable to some cause, and the cause in this case is not a natural (or, human) one, it is supernatural.

Hence the following definition, put forward not without diffidence:—*A miracle is an exceptional marvel in nature, not explicable by natural causes, and therefore directly attributable to a supernatural‡ cause.*

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* *Are Miracles Credible?*

† *The Gospel of the Resurrection*, 4th Edition, p. 35.

‡ Better thus—*A Miracle is an exceptional marvel in nature which, not being explicable by any human or any natural cause, is attributable to some supernatural cause.* (See the Author's further reply.)

A miracle is a connecting link between the natural and the supernatural. Speaking of Bible miracles, Trench says that a miracle "is a kind of finger-post of God."

Relations between science and miracles: Are there in fact any relations? According to the late Archbishop Temple* science can deal only with such materials as are "reducible to invariable laws. If any observation made by the senses is not capable of being brought under the laws which are found to govern all other observations, it is not yet brought under the dominion of science." The investigation of any newly observed fact "proceeds on the assumption that nature will be found uniform, and on no other assumption can science proceed at all." He points out that "this assumption of something permanent in things around us comes from the consciousness of something permanent within us. We know our own permanence, whatever else we know or do not know about ourselves, we are sure of our own personal identity through successive periods of life. And as our explanation of things outside begins by classing them with things inside we still continue to ascribe permanence to whatever underlies phenomena even when we have long ceased to ascribe individual wills to any except beings like ourselves. And without this assumption of permanence our whole science would come to the ground." He then goes on to say that experience shows the uniformity of the separate laws of nature, and that "the evidence for the uniformity of nature is the accumulated evidence for all the separate uniformities." With regard to the occurrence of miracle, his conclusion is—"science has shown that the vast majority of events are due to derivative action regulated by laws. Here is an event which cannot be so explained any more than the action of our own free will can be so explained." "Science may fairly claim to have shown that miracles, if they happen at all, are exceedingly rare. To demonstrate that they never happen at all is impossible, from the very nature of the evidence on which science rests. But for the same reason science can never in its character of science admit that a miracle has happened. Science can only admit that, so far as the evidence goes, an event has happened which lies outside its province."† From this it might be inferred that the present inquiry need proceed no further,—that science and miracle are like two travellers, ignorant of and incapable of learning each other's language, who pass each other upon different sides of a

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* "Relations between Religion and Science" (Bampton Lectures for 1884).

† *Ibid.*

great common highway. They bow, salute, and may smile,—and that is all! But, is science in such bondage to uniformity as the Archbishop seems to suppose? Is she the impotent vassal of the natural formulæ which she justly glories in having discovered? Was there no science during the patient investigations preceding these discoveries, when as yet the rounds of the ladder were unshaped? Was science unborn when walks and talks with nature were leading on to the acquisition of her secrets? Though not mature, science was certainly not then unborn; she was beginning to know nature, and thus to carry out her great mission of subduing the earth; she was laying the foundations without which the future edifice had been impossible.

To Dr. Temple "Science" appears to have stood for "Natural Science" only, and to a narrow concept of science he added a narrow concept of scientific procedure. Yet even were science so "cribbed, cabined, and confined," she still might be permitted to investigate into extraordinary phenomena such as earthquakes, eclipses, and miracles; for there could be no certainty *a priori* that these events might not be included in a uniformity greater and vaster than is that presented to us by "the laws of nature." Science is constantly telling us that lesser uniformities are included in higher,—*e.g.*, the law of weight, the law of tides, the law of the earth's centripetal force, are included in the wider law of gravitation. Dr. Temple himself endorses this thought when, alluding to "the uniformity of nature," he remarks that "this regularity is seen to be more and more widely pervading all phenomena of every class, until the mind is forced to conceive the possibility that it may be absolutely universal* . . . ."

If so, it may include miracles, even upon his own definition that a miracle is "an event which we cannot assign to that derivative action to which we have been led to assign the great body of events; we cannot explain it except by referring it to direct and spontaneous action, to a will like our own will."

Since Miracles are phenomena—exceptional phenomena—in nature, Science properly concerns herself with them. For (1) Science takes note of individual facts, otherwise she could not classify; (2) Science is busy with the ordinary and common, and therefore must also recognize the extraordinary and uncommon, as differing; (3) Science seeks material for classifi-

* "Relations between Religion and Science" (Bampton Lectures for 1884).

cation, and miracles are classifiable*; (4) Science aims at explanation, and miracles may explain what nothing else can explain; science sets herself to take account not of some facts only, but of all; she shirks no part of this task, be the subject radium, hypnotism, miracles, or aught else. She occupies herself not with the usual only, but also with the unusual.

The aversion from miracles which is cherished by some scientists does not rest upon a scientific basis. It is accounted for by two considerations—the one negative in character, the other positive—(1) Unwillingness to admit that something can take place in nature which is not subject to the laws of nature, and is refractory from scientific formulæ; (2) Desire to test every article of faith by experimental methods.

The first objection is a natural prejudice, but, when opposed to truth, is unworthy of a scientific mind; the second, when applied to miracles, is absurd, since excluded by the nature of the case. That belief in the fact of miracles is thoroughly compatible with the true scientific temper may be now stated as a truism. It is illustrated in such leaders as Newton, Faraday, Murchison, Sedgwick, Dawson, Carruthers, Turner, Stokes, Kelvin. The mission of Science is investigation, her perpetual watchword:—Examine and Report.

How is this to be done? is a question which leads us to look at the nature of scientific evidence. Briefly, scientific evidence may be described as—(1) Evidence of observation; (2) Evidence of testimony; (3) Evidence of inference. Examples of these three kinds of evidence are continually coming before us. Practical instances of mechanical principles, of chemical reactions and combinations, of biological processes, and of the behaviour of strange bodies such as radium, are believed by many of us from the evidence of our personal observation, by many more from the evidence of testimony; we may not have seen the phenomenon, but some one else has, and we believe that he has, and we substitute his observation for our own, regarding it as equally valid. A great many things are

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* Aquinas (*Summa contra Gentiles*) arranges thus:—"Miracles of the highest rank are those in which something is done by God that nature can never do. Miracles of the second rank are those in which God does something that nature can do, but not in that sequence and connection. A miracle of the third rank is something done by God which is usually done by the operation of nature, but is done in this case without the working of natural principles." See also a classification (under seven heads) of miraculous phenomena connected with the Mission of Christ, by Canon Girdlestone ("The Scriptural Idea of Miracles").

believed upon grounds of inference. Solutions of mathematical and physical problems, and logical deductions—more or less logical—are of this kind. No human being (so far as I am aware) has ever seen the orbit of our earth, or followed with his eye the path of a comet, or has had ocular demonstration of the strange properties of that ether the existence of which ranks high among scientific certainties.

In her investigation into the subject of the miraculous, it behoves science to take account of the three kinds of evidence. To a person who has witnessed (or believes he has witnessed) a miracle, the first kind of evidence—that given by his own observation—will probably be the strongest, being first-hand, and appealing directly to consciousness; yet it may be greatly reinforced through the testimony of others who have either observed the phenomenon themselves or are acquainted with people who have done so, or through a logical affirmation that it was probable or even necessary.

Those who have not personally witnessed the miracle are of course without direct consciousness of the first kind of evidence, and must rely on testimony and reasoning; though here also the testimony is based on observation. It does not follow that the whole evidence in this case is weaker than in the first, for that supplied through testimony and inference may be of sufficiently greater strength. We may remind ourselves of this when we come to consider the Scripture miracles.

It is to be noted that each kind of evidence has its danger, against which science in her investigation has to guard. Observation may be rendered worthless by hallucination, or by inattention. As Mill remarks, some people see more, and some see less, than there is. Testimony may be rendered worthless by excessive credulity or incredulity, by prejudice, by a habit of lying, by a desire to make a sensation, or by other causes. Inference may be vitiated by bias, by insufficient evidence, by mis-estimation of due weight and proportion in the evidence, by mistake as to its character, by illusions. In considering a miracle, or any other extraordinary and exceptional event, precaution on these points is more urgent than it is with regard to ordinary events. An exceptional occurrence cannot lay claim to scientific belief unless the testimony to it is also exceptional. Whether certain testimony is, or is not, exceptional, is a matter for investigation. Science is as much within her right in inquiring into the character of an alleged miraculous phenomenon as she is in inquiring as to whether iron

is a metal, or soda is an alkali, or mesmerism is a species of (animal) magnetism.

Should it be objected that miracles imply the supernatural, the answer is that the existence of the supernatural is among the strongest affirmations of science. Though daily occupied with matters cognizable by the senses, science is ever endeavouring to penetrate the veil of the unseen. Unsatisfied with her tiny heritage of the known, she presses through all limitations toward the vast stretches of the unknown, and in a great solitude lifts up her hands unto God. "The desert," says the Arab, "is the garden of Allah." To science "an atheist in the desert is unimaginable." That science testifies to the existence of the supernatural is recognized by leading scientists and others. Lord Kelvin tells us that "science, if you think truly, forces to a belief in God." Stewart and Tait* say that "the existence of the Creator of all things is absolutely self-evident." Newton† declares that "The First Cause certainly is not mechanical." H. Spencer speaks of "the one absolute certainty that we are ever in the presence of an Infinite and Eternal Energy from which all things proceed." It is also evident that God is a Person; for, being the First Cause, He cannot be limited, but He would be limited were He without consciousness, will, or any other attribute of personality. Another thing worth our notice in this connection, as has been recently pointed out by A. T. Schofield, M.D.,‡ is that science, in its inquiries into nature, always proceeds on the supposition that she is intelligible to us, and therefore that she is the work of Mind infinitely greater than, but not infinitely dissimilar from, our own minds. Since it is the function of science to examine into every phenomenon which takes place in nature, and since she bears witness to the existence of a Supernatural Person, it follows that miracles are proper objects of her attention.

II. *Miracles in General.*—(*a*) Are miracles possible? (*b*) Are miracles probable? (*c*) Have miracles actually occurred?

(*a*) The first thing to be determined in a scientific investigation of miracles is—"Are they possible?" They are occurrences which, by hypothesis, are exceptional and strange, apparently interrupting the continuity of nature. There are,

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* *The Unseen Universe.*

† *Optics*, 384.

‡ "Science and the Unseen World," a paper read before the Victoria Institute, January 18th, 1909.

however, many such occurrences which are recognized by science as established facts. Earthquakes, the Noachian Deluge, the burning up of stars, the odd behaviour of radium, etc., come under this category. So far, then, there is no impossibility in the occurrence of a miracle. But is any existent cause adequate to its production? Our definition finds the adequate cause in the supernatural, and there only. If the supernatural exist, miracles are possible; if the supernatural do not exist, miracles are impossible. Occurrences may take place which look like miracles, but they are not really miracles. They are either impostures, or merely natural marvels. To atheism Divine miracles are, in the nature of the case, impossible; the atheist must necessarily reject them, for every effect, and therefore every miraculous effect, requires for its production an adequate cause, and the adequate cause in this case the atheist denies. But atheism and science are two very different things. Science (as we have seen) affirms the existence of the supernatural, and therefore of a cause adequate to the production of miracles. She tells us that such occurrences are (intrinsically) possible. "If," says our late President. Sir George Stokes,* "we think of the laws of nature as self-existent and uncaused, then we cannot admit any deviation from them. But if we think of them as designed by a Supreme Will, then we must allow the possibility of their being on some particular occasion suspended."

And he goes on to say that it is not necessary, "in order that some result out of the ordinary course of nature should be brought about, that they should even be suspended; it may be that some different law is brought into action whereby the result in question is brought about without any suspension whatsoever of the laws by which the ordinary course of nature is regulated." According to J. S. Mill,† "An impossibility is that, the truth of which would conflict with a complete induction, that is, with the most conclusive evidence which we possess of universal truth." But a "complete" induction must obviously take account of and include the alleged miraculous occurrence itself. Mill points out‡ that in the case of an alleged miracle, the usual effect of a natural law is defeated "in consequence of a counteracting cause, namely, a direct interposition of an act

* Gifford Lectures, 1891, pp. 23, 24.
† *System of Logic*, vol. ii, 7th Edition, p. 169.
‡ *Ibid.*, p. 164.

of the will of some being who has power over nature; and in particular of a Being, whose will being assumed to have endowed all the causes with the powers by which they produce their effects, may well be supposed able to counteract them." In this connection, he quotes Brown's* remark that a miracle is no contradiction to the law of cause and effect; it is a new effect, supposed to be produced by the introduction of a new cause.

The law of causation proves the existence of the supernatural:—Consideration of any natural phenomenon shows us that a series of phenomena follow it, and another series precede it. It is a link in a "causation chain" or chain of effects, with a multitude of sequences and a multitude of antecedents. Now this multitude of effects must be either infinite or not infinite. If infinite, then the power producing this infinite effect is infinite, and is therefore the attribute of a Supernatural Being. If, however, the chain have a beginning, a great First Cause exists which, by the supposition, is supernatural.† In any case, then, the supernatural exists. An adequate cause for miracles exists.

But the possibility of miracles has been contested on two grounds—(1) That they are violations of the laws of nature, therefore contrary to experience; (2) That they are dissonant from the character of God, and their occurrence would imply that He is inconsistent with Himself.

The first argument has been made famous by Hume, and contains a *petitio principii*. There is need to define this definition: What is "violation"? What is a law of nature? What is contrariety to "experience"? A change in the usual order of natural phenomena does not connote a violation of any law. The natural force which was working before continues to work still, but a new force having come to work with it, these two forces are (in accordance with the principles of physics), equivalent to a third force—their resultant, of which the phenomenal expression is of course different from that of the original single force. There is no "violation" in the phenomenon being altered; there would have been violation, if to a new and different force there did not correspond a new and different effect. A cricket ball, falling right upon the wicket, is stopped by the bat, and sent high up in the air presently to end

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* *Inquiry*, Notes (A) and (F) in the Appendix.

† This latter is, as we have seen, the case affirmed by science. The "causation chain would fall, were there no Hand that held it up."

its journey in the palm stretched out to catch it. But there has been no violation of the law of gravitation, the force of gravity has been acting on the ball at each stage of its adventures. An eagle beating the air with its wings and soaring toward the sun, is not violating the law of gravitation; on the contrary, the force of gravity itself assists the rising. What in truth do we mean by a "law of nature"? Mill* defines it as a uniformity, *i.e.*, it is a uniform mode of force-action. When a natural force acts in a uniform manner, this uniform way of action is its law and is called a "law of nature"; *e.g.*, "the law of gravitation" expresses a force called gravity which acts uniformly with an intensity varying as the product of the attracting masses divided by the square of the centre-gravity distance. In general, "natural laws" and phenomena represent several natural forces in combination with each other; and natural phenomena are, as we have seen, continually being modified by *will*, whether of man or of some other creature. Obviously then they may be modified, altered entirely, or created, by the Will of the Creator.

Not only does science affirm this will-modification of nature, but without it, science cannot move hand or foot. For the processes whereby she works are voluntary processes. She cannot stand or walk, write down hypotheses, prepare experiments, adjust the apparatus, or make her notes of the results, unless she modify the force of gravity by new forces introduced by will. Lotze has remarked that there is in nature a real determinism without which we could not adjust means to ends with any certainty. But this determinism is not more necessary to science than is the power of modifying it and varying its phenomena through the introduction of new forces by the will of the scientist.

If the scientist can produce natural modifications, so also can nature herself. Man is a break in its continuity. Sir Charles Lyell† tells us that "atavism" "is an instance of discontinuity." Referring to "the dissipation of energy," Clerk Maxwell‡ tells us that "the duration of the universe according to the present order of things is . . . essentially finite both *a parte ante* and *a parte post*." Speaking of Fourier's famous theory of the conduction of heat, where the formulæ indicate a possible solution of all positive values of the time which continually tends to a uniform diffusion of heat,

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* *Logic*, Book iii, c. xiv. † *Geology*. ‡ *Nature*, ix, p. 200.

Maxwell* points out that "if we attempt to ascend the stream of time by giving to its symbol continually diminishing values, we are led up to a state of things in which the formula has what is called a critical value; and if we inquire into the state of things the instant before, we find that the formula becomes absurd.† We thus arrive at the conception of a state of things which cannot be conceived as the physical result of a previous state of things, and we find that this critical condition actually existed at an epoch not in the utmost depths of a past eternity, but separated from the present time by a finite interval."

If scientists and nature herself are producers of modifications in phenomena, a supernatural being may be so also. Therefore, Hume's assertion that "a firm and unalterable experience" has established the laws of nature, that a miracle is a "violation" of these laws, and that consequently "the proof against a miracle from the very nature of the fact is as entire as any argument from experience can possibly be imagined," must be regarded as no more tenable than some other confident assertions to which we have had to listen. An endeavour to prove that an alleged occurrence is contrary to experience, by the shallow device of excluding that part of experience which is alleged to embrace it, is a pretty conspicuous instance of bad logic. "All," says Mill,‡ "which Hume has made out is that (at least in the imperfect state of our knowledge of natural agencies, which leaves it always possible that some of the physical antecedents may have been hidden from us) no evidence can prove a miracle to anyone who did not previously believe the existence of a being or beings with supernatural power, or who believes himself to have full proof that the character of the Being whom he recognizes, is inconsistent with His having seen fit to interfere on the occasion in question." Lord Grimthorpe observes that Hume's "experience" "*is only the one-sided experience* of all the non-miraculous events in the world. A man who propounded a new scientific theory on the ground that it explains all the known phenomena except one obstinate set of them which he cannot get rid of, would be laughed at—or rather ought to be, and would be if so-called science had not become so depraved by prejudice and timidity."

An argument against the possibility of miracles which is more plausible than Hume's, though not so well known, was

* Bradford Lecture, see *Nature*, viii, p. 441.

† This is in agreement with Mill's remark that a uniformity may cease to be a uniformity, as when a white blackbird was discovered.

‡ *Logic*, 7th Edition, p. 165.

put forward by Spinoza* as a consequence of his pantheistic system. He says—"But if you will have a miracle to be such a rare effect, which is absolutely above or (which really is all one) contrary to the laws of nature, or which cannot possibly follow from her fixed immutable order, then I dare not believe that any such miracle hath ever happened in nature, lest I oppose God to God, that is, admit that God changes His own decrees, which from the perfection of the divine nature, I know to be impossible." This curious argument asserts that if at any time it has pleased God to work in nature in some particular manner, the perfection of His nature (or character) for ever precludes Him from working in any other manner, however different the conditions or circumstances. Such an assumption is absurd. Nature herself refutes it by pointing to catastrophes. Man's free will is continually altering natural phenomena, removing old phenomena and producing new, changing physical configuration and the character of soils and climates. Shall we recognize freedom in the creature, and deny it to the Creator? The "fixed immutable order" in nature, spoken of by Spinoza, may be fixed and immutable for a time only, then to be followed by "a new thing," after which the order may, or may not, go on as before; or the old order may not have been intermitted, but merely modified by a new force. Also the old order and the new force and the miraculous event may each be included in and form part of a wider higher† order. There is nothing "impossible" in any of these suppositions. In his Gifford lectures‡ already referred to, Sir George Stokes gives, as illustrating the effect produced by a new force, the case of a clock with an iron pendulum, the rate of which, determined by the laws of motion and gravitation, was well known. "Suppose," he says, "that on one occasion it went much faster for an hour or two, and then resumed its usual rate. It may have been that someone designedly put a powerful magnet under it, which after a time was taken away again. The acceleration of rate was here produced, not by any suspension of the laws of motion or of gravitation, but by bringing into play for a time a special force which left the laws of motion and of gravitation perfectly intact, and yet brought about the result that we have supposed to have been observed." Different

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* *Miracles*, Premonition.

† Babbage reminds us that "A miracle, instead of being a violation of a law, is in fact the most eminent fulfilment of a vast law." (*Passages from the Life of a Philosopher*, 1864, p. 394.)

‡ p. 24.

phenomena may even appear to be quite contrary to each other, when in reality they work in harmony and are in fact mutually promotive; for example, the motion of any part of a carriage wheel is continually taking opposite directions, yet these opposite motions assist each other, and harmoniously work to set forward the motion of the carriage in a straight line.

It is interesting to notice, as illustrating the cogency of his argument, that Hume himself admits that (according to his principles) "the Indian who refused to believe that water could freeze reasoned justly." His error lay, Hume thinks, in his not taking account of the new* conditions, conditions different from those of Siam; and Hume's own error lies in the same direction.

Spinoza also answers himself when he declares that by an impossible thing he means anything supposed to happen "in nature at large" repugnant to its laws, for the laws of nature being the laws of God, such an event would be "equally repugnant to the decrees and intelligence of God"; and tells us that by "nature at large" he means not matter merely but "an infinity of other things as well."†

Another argument, besides those which have been considered, is sometimes adduced against the possibility of miracles, namely, that they are inconceivable. Although H. Spencer sought to erect conceivability into the decisive test of truth, Mill has shown that it is not anything of the sort, and therefore there is nothing in the argument based upon it. He points out that our conceivability varies with our knowledge. Things now familiar, *e.g.*, antipodes, and talking by lightning, once seemed inconceivable.

There remains yet an objection—it cannot be termed an argument—against the possibility of miracles, which is cherished by a certain type of mind. It consists in simple denial. "Miracles do not happen." By a sweeping statement devoid of all proof the question is settled. Even M. Arnold was not ashamed to resort to alogism of this description. Another alogist, R. W. Macan (in his essay on *The Resurrection of Christ*, 1877, p. 116, note) asserts that "If miracles are possible, history is impossible,"—an assumption which begs the question. Westcott (in his *Gospel of the Resurrection*, 4*th*

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* See *Inquiry*, Sec. X.

† "Me hic per Naturam non intelligere solam materiam, ejusque affectiones, sed præter materiam, alia infinita" (*Tractatus . . De Miraculis*, c. vi).

edition, p. 278) remarks that the alogist bars his own progress into truth, being self-committed to a foregone conclusion which he ought first to have established.

Nothing is impossible with science that does not contradict some truth.* Huxley says "denying the possibility of miracles seems to me quite as unjustifiable as speculative atheism." Stupid incredulity may disfigure some scientists who refuse to recognize truth outside their own little specialized fields of study, but this narrowness is in no sense an attribute of science. It is not the fault of the world if the villager has never travelled. We conclude, from fair and careful examination, that science affirms the possibility of miracles.

(*b*) Are miracles probable? What does science tell us on this point? Certainly a phenomenon may be very rare or unusual, *e.g.*, an eclipse or a comet, and yet its occurrence may be probable. A miracle, however, is more than an unusual occurrence—it is produced by the action of the supernatural; and it is contended that science does not reach to such action. It may be replied that, in the case contemplated, the action is expressed by some phenomenon in nature, and that science is competent to take note of and report upon the phenomenon.

That miracles are improbable has been strongly urged by Hume, whom we have already seen denying their possibility. Hume argues that it is more probable that the evidence for the occurrence of a miracle is false than that there has been any deviation from the course of nature, and that testimony to the miraculous should not be accepted unless it were more miraculous that the testimony be false than that the miraculous event be true. And he says that "even in that case there is a mutual destruction of arguments, and the superior only gives us an assurance suitable to that degree of force which remains after deducting the inferior." In another place, however, he gives a hypothetical case in which he allows that an event of very great improbability ought, if supported by very strong testimony, to be believed. Mill points out† that "many events are altogether improbable to us, before they have happened, or before we are informed of their happening, which are not in the least incredible when we are informed of them, because not contrary to any, even approximate, induction. In the cast of a perfectly fair die, the chances are five to one against throwing

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* Science does not reject anything simply because it is new. She investigates.

† *Logic*, vol. ii, pp. 170–1.

ace, that is, ace will be thrown on an average only once in six throws. But this is no reason against believing that ace was thrown on a given occasion, if any credible witness asserts it." And he reminds* us that "In the instances on record in which a great number of witnesses, of good reputation and scientific acquirements, have testified to the truth of something which has turned out untrue, there have almost always been circumstances which, to a keen observer who had taken due pains to sift the matter, would have rendered the testimony untrustworthy." We may also notice that Hume's way of putting the matter, since it regards testimony as the sole evidence for miracle, is not just; since this evidence may not be restricted to testimony, but may include the conditions and circumstances of the case, the relation of the event to other events before or after, and also its power of explaining what may otherwise be inexplicable.

Spinoza's† objection to miracles as probable is based upon his conception of the Divine character. We must beware, he says, of "running into the dangerous error of the Multitude that God hath created Nature so impotent, and given Laws and Rules so barren, as that he is compelled sometimes to help her by new ordinances and supplies of Vertue, in order to her Support and conservation, and that things may succeed according to his Intention and Design. An Error than which nothing is more alien from Reason, nothing more unworthy the Majesty of the divine Nature." "The power of God and the power of Nature are," he says, "one and the same." From this postulate, he draws the conclusion that whatever takes place in nature, since it takes place by the power of God, takes place by the power of nature. "Nature," in his pantheistic theory, is a form of God; therefore, if a miracle were to occur in nature, it must be explicable by natural causes,—in other words, it could not really be a miracle. "For," he says,‡ "if we understand the natural causes of the fact, however rare it be; or if we have often seen the like done before, though we do not conceive the natural cause thereof, we no longer admire it, nor call it a miracle." That God should change His own decrees, "from the perfection of the Divine nature" Spinoza holds to be absurd.

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* *Logic*, vol. ii, p. 169. † *Miracles no Violations*, pp. 7, 8.

‡ *Miracles*. Similarly, Hobbs (in *Leviathan*, Part iii) regards a miracle as "a work of God which men admire or wonder at," and again, in the same chapter, as "a work of God beside His operation by the way of Nature ordained in the Creation."

This reasoning evidently rests on a *petitio principii*. It is assumed that, because God works in nature, He is limited by nature, so that it would be contrary to His perfection to work in any other way. This is as absurd as to say that because a scientist works in some particular field of activity, therefore he cannot, without loss to some extent of character, work in any other,—that a mechanician may not be also an astronomer, that a biologist may not be a chemist. In fact, the limitation in working which Spinoza seeks to attribute to God is even more absurd, since God is almighty and His attributes are infinite.

Another argument made use of by Spinoza against any occurrence of miracles is that this would imply an after-thought on His part. It would imply that He found He had made some mistake which He desired to correct. It would not imply anything of the kind. The assertion has no scintilla of evidence.

The reasoning is far from convincing. A belief in the immutability of "natural laws" requires to be corrected and modified. Science instructs us that there are such things as earthquakes and other catastrophes, that discontinuity is a factor in nature—that all things do not continue as they were "from the beginning of the creation." Inattention to the teaching of nature with regard to God does not unfrequently accompany familiarity with her laws. And nature worship is not among very rare occurrences, nor has idolatry been found to be at all dependent upon miracles. Obviously, men's spiritual and moral condition might be such that it might be more important that they be reminded of God's existence than of His immutability. There might be urgent need to call their attention to the presence and power of the supernatural—to impress deeply the forgotten truth that God is the Living God and interests Himself in His creatures. It is worth remarking that Spinoza, in arguing from miracles wrought by false prophets, does tacitly admit that miracles may after all take place, and that he has no justification for the assumption that, since these miracles are injurious, all miracles are so.

An argument for the improbability of miracles, that has had attraction for some minds, is stated by Wegscheider as follows: —Miracles are "irreconcilable with the idea of an eternal God *consistent with Himself*." Undoubtedly God is consistent with Himself. The words of Hooker* are true—"Let no man doubt but that everything is well done, because the world is ruled by so good a Guide, as transgresseth not His own

* *Ecclesiastical Polity*, book i, c. 2 *sub fin.*

laws." But, as is acutely remarked by McCosh*, the objection "assumes that because nature is an expression of God's will, there can be no other expression." What is the meaning of consistency? The objection finds it in natural laws, but not in miracles. Yet, as is pointed out by Lias†, "not only is the principle of the counteraction of force by force a principle of nature, but the *same* forces sometimes act in the most opposite way." Heat, for instance, usually expands, but it contracts iodide of silver and some other bodies. A charge of electricity sometimes attracts, sometimes repels. Virgil told us long ago that "This wax softens, and that clay hardens, through one and the self-same fire." It is not that heat acts inconsistently; it is that it acts consistently. The force acts consistently, the difference (or contrast) in the resulting phenomena is produced through the difference of the conditions in which the action takes place.

Water when being cooled down to 0° C. becomes denser and denser until it reaches 4° C., and then becomes rarer. The change is not in the force, it is in the conditions. If, the essential conditions remaining the same, the effect was a different phenomenon, this would argue inconsistency in the acting force; but inconsistency would be no less indicated if, the essential conditions being changed, the resulting phenomenon were not changed also. If from the sphere of matter, we rise to that of psychology and ethics, and consider human conduct, we recognize that the man whose outward actions are always the same toward the same persons, irrespective of any change in them and taking no account of altered relations and conditions, is not a consistent man but an inconsistent fool. The really consistent man is he whose outward action embodies consistent principle, who regulates conduct by consistent character. If this be true of man and by parity of reasoning, of any rational and spiritual creature, may we not reverently believe that it is true with regard to God that His actions are not cast in a rigid monotony, but are ever accordant with His character, and therefore take account of the varying circumstances and special needs of His creatures? If, then, the special circumstances arose, God, in working a miracle, would be perfectly consistent with Himself.

We may look briefly at yet another argument adduced to prove the improbability of miracles.

From time to time in human history "miraculous" occurrences

* *The Supernatural in Relation to the Natural*, p. 128.
† *Are Miracles Credible?* p. 23.

have been alleged which have turned out to be no miracles at all. Examination has shown them—so far as "miraculous"—to be the progeny of ignorance, or superstition, or fraud. Science has discovered that in some cases the "miracle" is a natural marvel explicable by natural causes, that in others the extraordinary effect is referable to psychic forces stimulated by credulity, and in others the explanation lurks in a network of lies. This has been insisted on as a proof that all miracles are shams, or at all events the occurrence of a genuine miracle is a matter of great improbability. The conclusion is however more than the premises will bear. Indeed, it may be said that the wide-spread belief in the miraculous is itself an argument that the miraculous exists or has existed.

It may also be said that it were not very convincing to contend that, because science discovers that there are untrustworthy banknotes and bad shillings, therefore all banknotes and shillings are of this character.

The existence of the counterfeit does not disprove, but proves, that of the thing counterfeited—there would be no counterfeits were there no realities. The objection thus retorts upon itself.

Thus, each one of the various arguments which have been held to show that miracles are *a priori* improbable is seen to fail, and we are warranted in affirming that science does not say that miracles are *a priori* improbable.*

Does science say that they are probable? In pronouncing upon the probability or the occurrence of any *phenomenon*, miraculous or non-miraculous, science takes account of (1) the *nature* of the phenomenon; (2) the *conditions* under which it is alleged to have occurred; (3) the character of the *testimony* to its occurrence.

(1) In the case of a miracle, the nature of the phenomenon involves the marvellous and the supernatural. (2) The conditions include the character of the worker and the characters of the persons for whom the miracle is worked, and the relations mutually subsisting between worker and witnesses. (3) The character of the testimony is dependent upon the trustworthiness—moral and intellectual—of the witnesses. A scientific investigation will examine and report upon each and all of these matters, and it is obvious that any particular

* Mill remarks that "the only antecedent improbability which can be ascribed to a miracle is the improbability of the existence of a New Cause," namely, "a direct interposition of an act of will of some Being who has power over nature." (*Logic*, 8th Edition, vol. ii, 167–8.)

"miracle" or set of "miracles" must be investigated separately, and stand or fall on its own merits according as it does, or does not, satisfy the tests.

In connection with the value of testimony, it may be pointed out that it varies with the probability that what the witness states is fact, which probability will have two factors—the antecedent probability of the event, and the probability that the witness is truthful and competent, *i.e.*, that he is neither a deceiver nor deceived.

If a person relates that he has just seen a brown dog running along the road we believe it as a matter of course, unless we have grounds for thinking him to be a liar; if he says that he has seen a white blackbird we may think that he is mistaken or false, and if he told us that without any visible means he had been communicating in converse with people more than a thousand miles away (and we did not know anything of wireless telegraphy) then, on account of the antecedent improbability —as we suppose—of this event, we should probably attach no value to his testimony, unless upon other grounds we knew that it must be trustworthy. Yet, granted the narrator's truthfulness, our reluctance to believe would be attributable to our ignorance. Thus, what is probable (or improbable) to us is dependent upon our knowledge of the matter. What seems to us to disagree from known truth (or, from what is believed to be so) is to us improbable; what neither disagrees nor agrees is neither improbable nor probable; what agrees is probable, and if the measure of agreement is, on the whole, very great, then the probability is very great. As regards the event itself, its occurrence or non-occurrence is certain, and entirely independent of our ideas; but our view of its probability (or otherwise) is necessarily conditioned by the quality and the quantity of knowledge, with regard to this or to some similar event, already in our possession.

We see then that, since what is to us improbability or probability is dependent upon our actual knowledge of the matter, the judgment of science concerning miracles in general, *i.e.*, miracles considered simply as miracles, is that they are not *a priori* improbable, and may or may not be probable. And, concerning any particular case, science enjoins that it be considered specially and on its own merits, with the application of the three tests already mentioned.

(*c*) Let us now ask science whether miracles have actually occurred. Science answers in the affirmative. She tells us that events have undoubtedly taken place which come within

the definition of miracles given early in this Essay. Among these events are creation of this world of matter, creation of living organisms, and the character of the Lord Jesus Christ. That these things are miracles (according to our definition) will be admitted by all scientists, even by evolutionists, except those who assert that matter is eternal, and even they must perforce admit the last two examples. It is, however, pretty evident that if the material atom is, as has been pointed out by Herschel and Clerk Maxwell, "a manufactured article," and if matter's changes and its modifications are not self-originated, science is certain that it has been created. Science also asserts that the great doctrine of biogenesis put forward by Redi "is victorious all along the line,"* and that life upon this earth must have had a beginning. And, with regard to the character of Christ, science recognizes that (to quote the words of Renan's famous admission) "it would require a Jesus to invent a Jesus."

Adopting the definitions at which we arrived on pp. 3 and 4 of science and miracle respectively as "the investigation and study of things and phenomena in nature, with a view to their explanation and correlation in the great order of the universe," and "an exceptional marvel in nature, not explicable by natural causes, and therefore directly attributable to a supernatural cause,'† we have been led, by a scientific investigation into Miracles in general, to give the following answers to the questions with which we set out, namely:—(*a*) Are miracles *possible?* Yes, they are. (*b*) Are miracles *probable?* They are not improbable, and may or may not be probable. Any particular case of alleged miracle should be examined specially on its own merits, as to‡ (1) the nature of the phenomenon, (2) the conditions under which it is alleged to have occurred, (3) the character of the testimony to its occurrence. (*c*) Have miracles actually *occurred?* Yes, they have.

III. *The Bible miracles.*—That science affirms their possibility we have seen already, since she affirms that of miracles generally. Our investigation will therefore concern itself with their probability *a priori*, and their actual occurrence.

(*a*) Were the Bible miracles probable? (1) Might they be expected from what we know of their nature? They were not purposeless manifestations of mere power, but were always *ancillary* to Divine *teaching*, helping men to recover that knowledge of God which through sin they had lost, the

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* Huxley. † See, however, footnote to p. 83. ‡ See p. 99.

knowledge of God as Spirit, Light and Love. Though miracles might not themselves directly teach these truths—truths of the highest importance for man to know, they would certainly enforce them. A miracle would have no little value as a credential of the prophet's authority, and as a "summons* to attention" to the revelation of which he was the bearer. It is, therefore, probable that if a Divine revelation were given to beings who did not love God and were inattentive to His Will, this revelation would be accompanied by miracle, in order to render it effective. This appears to be recognized even by so stubborn an opponent of the miraculous as Matthew Arnold. He allows† that "Popular religion rests" (the belief in God's existence) "altogether on revelation and miracle," and "That miracles, when fully believed, are felt by men in general to be a source of authority, it is absurd to deny . . . It is almost impossible to exaggerate the proneness of the human mind to take miracles as evidence, and to seek for miracles as evidence." They are, then, to be looked for in connection with a Divine revelation. In other words, the Bible miracles are probable from the nature of the phenomenon.

(2) If we consider the conditions and circumstances under which these miracles are said to have been wrought, we must take account of the characters both of the Worker and those on whose behalf the work was wrought, and also of the relations between them and Him. We see God's character known as holy and good, and man's as sinful and disobedient. The relation of God to man being one of love, and that of man to God being one of alienation, God is seeking to bring His lapsed creature back unto Himself; that, in renewal of the broken Communion, the spiritual law—law of the spiritual nature—violated at the Fall, may be re-established, and the true spiritual order be restored. Lias remarks‡ that the purpose of the Divine revelation would be "to discipline the mind to that seriousness, earnestness, humility, teachableness, self-restraint, industry, perseverance, which are necessary elements of all true goodness." It would also tend to develop the not less important qualities of "awe and reverence, which are connected with the best part of man's nature." "A revelation made by§ miracles is likely to produce such results," *i.e.*, to produce this moral

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* Smythe Palmer, in the introduction to Trench's *Notes*.
† *Literature and Dogma*, pp. 56, 57.
‡ *Are Miracles Credible?* p. 111.
§ The words "by," as used here, evidently means "accompanied with."

training and development. For "the occurrence or reported occurrence of miracles compels our attention, and sets us upon inquiring from what source such marvels proceed. When joined to the moral and spiritual force of what is thus revealed it convinces the inquirer that this strange interposition of an external power into the world could only have been for his good, and that a doctrine so supported, and so intrinsically ennobling in itself, must surely have come from God."

Therefore, the Bible miracles are *a priori* probable from the nature of the phenomenon, and also from the conditions under which they are said to have taken place.

(*b*) Let us now apply our three tests (p. 99) to answering the question—Did the Bible miracles actually occur? (1) In connection with the nature of the phenomenon, we note that the character of these miracles is such that, though they be themselves not necessarily didactic, they always are *ancillary* to some teaching concerning *God*, and of a nature to render this teaching effective.* If the need of man and the goodness of God insured the certainty of revelation, it is also certain that the theophany would be given in the way *best* fitted to render it effective, and (as it is pointed out by Aquinas) this way is the way of miracle. *Science* also selects the instruments that are best adapted to the purpose in view. Compared with Bible miracles, the spurious miracles which have from time to time attempted to delude mankind exhibit a difference of character so great as to be best described as contrast, and are all explicable by causes non-supernatural. It is further to be noted that the Bible miracles are not mere accompaniments of the revelation, but are inseparably bound up with it. A very important feature in them is that they *explain*† what is otherwise inexplicable. The Exodus of the Israelites becomes unintelligible if the miracles said to have attended it did not really take place, and no explanation is (in such case) possible of the memorial feast of the Passover. The faith of Christians is bound up with the miracles of the Incarnation, the Resurrection, and the character of Christ. Take away these miracles and you take away Christianity. They explain‡ Christianity and nothing else does. They give the key to its

* "Signs," says Sir Robert Anderson, "are essentially evidential."

† On the principles of Mill's inductive methods of Agreement and Difference. (*Logic.*)

‡ It is not only that the miracles fit into the facts as a key into a lock, but that the lock is fitted by no other key.

doctrines; they account for its wonderful rise and spread and the divine vitality of its continuous history. If Christianity is true, they are true also. It was well remarked by Bishop Douglas* that the more thoroughly Christianity is examined the stronger appear the proofs of its truth. " . . . the closest scrutiny and most impartial examination of the evidences which support those miracles on the credibility of which the truth of the Revelation in the New Testament is built, have served only to satisfy me that Christianity is founded *upon a rock*, and that every attempt to sap its foundations tendeth to discover their strength the more." As Dr. Salmon expresses it, "a non-miraculous Christianity is as much a contradiction in terms as a quadrangular circle; when you have taken away the supernatural what is left behind is not Christianity." "Miracles," says Smythe Palmer, "are of the essence of Christianity. No one who reads the Bible with a candid and impartial mind can be of another opinion." Archbishop Temple† remarks—"It is not possible to get rid of miracles from the history of the Apostles. They testify to our Lord's Resurrection as an accepted fact, and then make it the basis of all their preaching. They testify to our Lord's miracles as a part of the character of His life." And the truth of Christianity is bound up with the perfection of the Divine character. To quote the words of M. Arnold,‡ "Christianity is immortal; it has eternal truth, inexhaustible value, a boundless future," and "certainty and grandeur are really and truly characters of Christianity." " . . . *Sine viâ non itur*, and Christianity can be shown to be mankind's indispensable way."§

Of Christ's Resurrection it has been said that "In one form or other pre-Christian history is a prophecy of it, and post-Christian history an embodiment of it." "It may indeed be said that the Church was founded upon the belief in the Resurrection, and not upon the Resurrection itself . . . But belief expressed in action is for the most part the strongest evidence which we can have of any historic event."‖ The existence of a Christian society is explained by the fact of Christ's Resurrection, and by that only. Westcott also notices that this

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* In *The Criterion*, a work of great ability.

† 7th Bampton Lecture.

‡ *Literature and Dogma*, p. 8.

§ *Ibid.*, p. 7. Similar is the testimony of the Government Report on S. African Affairs :—"Hope for the elevation of the native races must depend mainly on their acceptance of Christian faith and morals."

‖ Westcott : *The Gospel of the Resurrection*, p. 107.

Resurrection meets and satisfies man's aspirations after God and a future life, and responds to the religious intuition.

An objector has propounded the curious argument that "One or other alternative must be adopted:—If Jesus possessed His own body after His resurrection, and could eat and be handled, He could not vanish; if He vanished, He could not have been thus corporeal" (*Supernatural Religion*, iii, 462). The argument is an interesting instance of the logical fallacy *petitio principii*. As Westcott points out, "the very point of the revelation lies in the reconciliation of these two aspects," and it should be borne in mind that a permanent memorial of the event was established from the very first—a memorial so striking as to involve the commemoration of the Death upon the day of the commemoration of the Resurrection.

Not less miraculous than His Resurrection is the Redeemer's Character—a Character unique, and impossible to human invention, the impress of God upon humanity. If the existence of the Christian Church finds its explanation in the Lord's *Resurrection*,* so in His *character* lies the explanation of the Christian character produced by the Spirit of Christ in every disciple. The Resurrection and the Character both pre-suppose the Incarnation—"God manifest in the flesh," and these miracles explain what is otherwise inexplicable. Therefore, science affirms their occurrence. The perturbations of Uranus were explained by the existence of the unknown planet Neptune, and nothing else explained them; therefore science affirmed that existence. The phenomena of light are explained by the existence of a luminiferous ether, and by nothing else; therefore science affirms the existence of this ether. On the same principles, science affirms the existence of the Bible miracles which we have been considering; she tells us that they have actually occurred.

The character of Bible miracles is always in accordance with their origin and purpose, they are evidential, being credentials of the truth of the teaching and the authority of the teacher. Christ's miracles were not tentative. "They bear the impress of His own holiness, and He ever uses them as the means of winning to the cause of goodness and truth those who witnessed them."

Christ's mission is verified in the experience of Christianity,

* Ebrard has pointed out that such an ordinance as the Lord's Supper could not have grown up accidentally and gradually.

† Origen's reply to Celsus.

and miracles are an integral part of that mission. Jesus of Nazareth was "a man approved of God . . . by mighty works and wonders and signs which God did through Him."* It is evident that these three terms convey the character of a Bible miracle as impressing the mind with the presence and power of God (a "mighty work")—as arousing and fixing attention (a "wonder")—as accrediting the teaching and authority of His messenger (a "sign"). Trench has a remark† that miracles are very properly credentials, for "Credulity is as real, if not so great, a sin as unbelief"; and, in the case of Bible miracles, the miracle is an important part of the revelation.

(2) We have seen that a scientific investigation into their *character* leads to the conclusion that the Bible miracles did actually take place. Let us next investigate the *conditions* under which they are alleged to have occurred. What was the character of man? What the character of God? What the relations between God and man? The character of man was that of a being who had not only fallen but was still falling, whose heart had departed from the Living God, so that he "worshipped and served the creature more than the Creator."‡ Man's understanding had become darkened as, blinded by a foolish heart, he sought satisfaction in vicious indulgences. Wise men and philosophers from time to time arose and sighed for the lost knowledge of "The Good," and shook the torch of truth that so their fellows might see the better way. But human nature could in no wise lift up itself. The torch went out, the darkness grew thicker than before, and the result was the failure of the philosophy and the lamentation of the philosopher. Horace (Carm. iii, 6) draws a terrible picture—"Ætas parentum, pejor avis, tulit Nos nequiores, mox daturos Progeniem vitiosiorem."§ Such was man's moral and spiritual condition, such the bluntness of any spiritual perception he still retained that (as is remarked by Lias) it may be doubted whether any revelation from God, if unaccompanied by miracles, would have had power to command his attention. If, then, a revelation were made to him it would be accompanied by miracle, probably in order to insure its reception, in any case to increase its effectiveness. If the revelation was certain, the

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* Acts ii, 22.
† *Notes*, p. 21. *Cf.* The Lord's words in John v, 36; xv, 24.
‡ Romans i, 25.
§ *Cf.* Juvenal, *Satires*.

miracles were certain. Was the revelation certain? There could be no doubt about the need of man. The character of God was that of the Almighty, and was that of the Good—the Good after whom Plato had longed, the Good who was, from the very moment of the Fall, continually working to bring man back to Himself. God's character being such, and the matter of such supreme importance to man, can there be any question that an effective revelation, *i.e.*, a revelation accompanied by *miracle*, was actually given?

The facts that, in the interests of his higher nature, the material universe is continually being modified by human will, and that man's spiritual well-being is vastly more important than uniformity among natural phenomena, may fairly be held to remove any difficulty that may be felt with regard to Divine alteration of any of them. There is no violation of law, but the introduction of a new force under new circumstances, so that in these new circumstances, "the laws of nature" may be in harmony with a higher law. It has been pointed out (by Trench)* that the miracles performed by our Lord, as credentials of His mission, were the very opposite of violations of nature; for they all tended to bring man back to God† and restore that original harmony between man and nature which had been violated by sin, *e.g.*, when the Lord caused the deaf to hear and the dumb to speak, and healed the paralytic, He to that extent undid the violation caused by sin, and brought the physical state of the sufferer into harmony with nature.

Having regard to God's known character, it were impossible to believe that, when circumstances had arisen in which man's highest interests required a manifestation of God's will enforced by miracles, such miracles did not take place.

The ordinary uniformities of nature have been arranged by infinite Love as best for him in ordinary circumstances; the extraordinary exceptional occurrences called miracles were similarly arranged as best for him in those extraordinary circumstances in which they took place. These two classes of phenomena are no more opposed to each other than is the huge Nasmyth steam hammer to the humble tool which serves to illustrate a schoolroom lecture on elementary mechanics. They

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* *Notes.*

† "Atheism . . . deadened the understanding, while it disgusted the heart." Frederick Harrison, in (1902) New Year's Day address to the Positivist Society.

both work together as different notes forming one harmony; for both are equally manifestations of one and the same law—that highest law which governs the universe, the law of Love. And if we take note of the *results*—results as blessed as they are wonderful—which have flowed to man as a consequence of accepting Christianity, and reflect that apart from miracles, Christianity had been impossible, Science leads us to say that if their existence were not known, it would have to be assumed, since for every effect there must be an adequate cause.

That the Bible miracles are genuine is also apparent from consideration of the other facts connected with the alleged circumstances of their occurrence. They were not idle exhibitions of power,—there were, so to speak, no "unnecessary" miracles. They were done publicly,—"this thing was not done in a corner." Frequently they were performed before hostile audiences, *e.g.*, before Pharaoh and the Egyptians, and before Jews "filled with madness." They were opposed by the authorities, and courted inquiry from an incredulous people. They were believed at the times and in the places when and where they were said to have taken place, and are afterwards often alluded to as accepted facts; their adversaries, numerous and powerful and aided by the authorities, were unable to prove even one of them to be false,—they might try to ascribe them to magic, but they did not deny their existence. Sometimes, as in the cases of the Exodus and Christ's Resurrection, they are commemorated by public memorials instituted at the time and continued ever since. Also, they took place under conditions such that "men's senses were well qualified to judge of them." Another circumstance to be noticed is their comparative rarity,—they are grouped around special epochs* or crises in human history, *e.g.*, the miracles of Moses relate to the Exodus, those of Elijah to the idolatrous degeneracy of Ahab and the people, those of the New Testament to the mission of God's incarnate Son. Now these various facts of circumstance are not such as accompany spurious miracles, but they do accompany Bible miracles, therefore these are not spurious but real.

Therefore, the result of investigation into the conditions and circumstances under which they are alleged to have occurred is that science tells us the Bible miracles did actually take place.

(3) In applying to the Bible miracles our third test—the character of the *testimony* to their occurrence—our investigation

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* See Lias, *Are Miracles Credible?*

specially directs itself to two points, namely, were the witnesses deceivers? and were they deceived? Firstly, were the witnesses to the alleged events deceivers? This is negatived by their character. Some of them were learned, others were "unlearned and ignorant men"; but their religion had imbued them all with that strong love of truth which they taught. Babbage has shown that the improbability of the witness of five hundred* persons being false is enormous, even though the truthfulness of each was but moderate.† It is, besides, preposterous to suppose that a band of liars joined together to narrate a tissue of falsehoods most opposed to the feelings and prejudices of both rulers and people, that they should persist in teaching these‡ falsehoods at the cost of their own shame and disgrace and suffering and death, and that none of their many determined and able enemies should succeed in exposing any of their statements. The idea appears too absurd for refutation, and (so far as I am aware) the theory of imposture is not maintained, as a serious proposition by any objector in our time.

Secondly, were the witnesses deceived? Were they the victims of enthusiasm and hallucination? This is negatived by the facts that they themselves were in many cases incredulous and slow to believe, that their conduct was marked by great sobriety, that the mention of the miracle in the course of the narrative comes in quite simply just like any other known fact,—there is no touch of sensationalism, there is not a trace of over-colouring, there is an entire absence of exaggeration. And it should be borne in mind that the testimony appealed to for the truth of the miracle connects itself with more than one of the senses,—not with sight only, but also with hearing and with touch; and very sober and careful details are given in regard to place, time, and circumstance. These facts do not tally with the theory of hallucination. Nor would hallucination have continued unimpaired through many years of persecution and suffering—the fancy would have worn away,—nor would relentless enemies, of whom there was no lack, have failed to expose the folly. The Lord's Resurrection was believed, on the day of Pentecost, by three thousand Jews, within a very short time after the event occurred, and in the very place where it occurred. Peter's hearers "could visit the sepulchre, cross-

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* 1 Cor. xv, 6.

† *i.e.*, if each told the truth in ten statements out of eleven.

‡ Certainly, they would not have mentioned the Lord's prophecy of His Resurrection, had that Resurrection not taken place.

examine the guard; in fact they had unrivalled opportunities of sifting the whole matter on the spot, and no doubt they did so. The result was that they not only believed, but were ready to die for their belief. They became the most devoted of missionaries. These men were Jews, the most bigoted and obstinately conservative people the world has ever known."* Nor would hallucination tally, under the circumstances, with the extraordinary spread of the new religion as recorded by Tacitus and other writers, this new religion not only giving to men the highest morality, but also wonderfully affecting their intellectual and spiritual perceptions.† The theory of hallucination cannot be accepted by science, for it is not adequate to the supposed effect.

Nor can the belief in the Christian miracles be accounted for by what has been termed the Mythopoetic theory. It has been pointed out that myths and accretions require for their success several conditions: they require a considerable lapse of years, a people in a very rudimentary state of intelligence and training, and a very great dearth of historical information concerning the age in which the myth was supposed to originate. But in the case we are considering not one of these was fulfilled. The narrative of Christ's life and death and resurrection has been told and quoted from the beginning just as it is to-day. The times were those of a high civilization and literary culture, in which the Roman province of Judea shared. The age was specially that of history, of Tacitus, Pliny, Josephus, Philo, Livy. The mythic theory is negatived by the facts.

Science declares that every effect presupposes an adequate cause. The spread of Christianity presupposes an adequate cause. The truth of the testimony is an adequate cause, and no other can be found! A geologist, looking at a rock, observes certain markings. He knows that these striæ might be produced by ice, and in the absence of ice is unaware of any competent cause, and he therefore decides that ice is actually the cause. Similarly, in view of the spread of Christianity, science decides that the testimony to the Christian miracles (of which this was an effect) was true, and therefore that these miracles were true.

We here complete our scientific investigation of Bible

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* Drawbridge.

† *E.g.*, the Hebrews and the philosophical Greeks both denoted "wind" and "spirit" by one and the same word; similarly there was but one word for "breath" and "soul." They had not the distinctive words, because they had not the distinctive ideas; Christianity has given them to us.

Miracles. It has embraced* (1) the *nature* of the phenomenon; (2) the *conditions* under which it is alleged to have occurred; (3) the character of the *testimony* to its occurrence. To the inquiry—Were the Bible miracles probable? science answers in the affirmative. To the further inquiry—Did they actually occur? the answer of science is again, and very emphatically, in the affirmative. If we liken them to gold, she has made her assay and says the gold is pure. Or the Bible miracles may be compared to a string of pearls. If science seeks to know whether the pearls are genuine, she may apply chemical and other tests to the examination of their *character;* she may search into the *conditions and circumstances* in which the alleged pearls were found. Were they first found in an oyster, or in some manufacturing laboratory? And she may investigate the *testimony* of experts. Should the result of any one of these examinations affirm the genuineness of the pearls, science will be slow to believe that they are "paste"; if all the results declare their genuineness, science will not hesitate to say that they are true pearls. This, as we have seen, is the case of the Bible miracles. Science, therefore, affirms *their actual occurrence.*

With regard to other "miracles," science is ready to investigate them and apply her tests. She welcomes every new fact, bidding her disciples not to neglect it, not to permit prejudice to block the way of truth. Her exhortation, to-day not less than in the past, is Ἔρχεσθε καὶ Ἴδετε.

APPENDIX.

On Miraculous Occurrences and "Miracles" other than those Recorded in Holy Writ.

From time to time events have taken place in human history which have been called "miracles," but when scientifically investigated have been discovered to be no miracles at all. Of such were the supposed marvels in connection with the Punic War related by Livy, the prodigies described by Virgil,† the "miracles" wrought in the ages most appropriately termed "dark," "miracles" by Apollonius, and those performed at the tomb of the Abbé Paris, etc.,—the etc. including various modern

* See p. 99. To the actual witnesses the class of evidence (3) would be even stronger than it is to us. But on the other hand, the class of evidence (1) is stronger to us than to them.

† *Georgics*, Line 461 in Book i.

impostures. False miracles are frequently counterfeits or absurdities, or ascribable to collusion, and performed in the interest of some powerful class. Commonly they are published in times and places far distant from those when and where they are alleged to have occurred. *They shun investigation.* They never require the *supernatural* for their explanation. If not impudent impostures they are accounted for by natural causes (including psychic and mental forces). They are well discussed by Lias,* and also by Bishop Douglas in *The Criterion.*† They fail to satisfy the tests of science.

Among really miraculous occurrences are some prayer-answers, fulfilments of prophecy going on before our eyes, and special providences. Of a false, or at any rate doubtful, character are second-sight and clairvoyance, as also what are known as spiritualistic phenomena. See, on these subjects, an interesting paper by Dr. Schofield on "Science and the Unseen World."‡ None of them is to be rejected without examination, none is to be condemned without a fair trial. *Science* is ready with her tests; her attitude towards *Miracles*—true, or false—is always that of *investigation.* Ἔρχεσθε καὶ Ἴδετε.

Discussion.

The Rev. A. Irving, D.Sc., B.A., thought that, having had no share in the competition for "the Gunning Prize," he could the more readily propose a vote of thanks to the author of the essay just read, and congratulate the Victoria Institute upon the considerable value, the wide range of thought which it covered, and the catholic fairness of its tone in arriving at general conclusions. As the result of many years of study of such questions as were dealt with—his interest in them having been stimulated many years ago by the personal influence of Archbishop Benson of Canterbury, and continually refreshed and invigorated by his own scientific work at Wellington College—he had arrived at, and for years advocated, views similar to those of the author of the essay. He had, in years gone by, observed with much satisfaction a

* *Are Miracles Credible?*
† Printed in the Strand, in 1754.
‡ Read before the Victoria Institute, January 18th, 1909.

tendency in the young keen minds of some, who had been serious students of science at the Universities, to turn away from the narrow materialism of the last generation towards a more reverent hesitancy in asserting anything like dogmatic certainty or finality in conclusions, which seemed for the time to be warranted with the advance of scientific discovery and thought, and yet seemed to present insuperable difficulties to the acceptance of the great Christian verities, because these rested upon evidence which appealed to a præterscientific range of consciousness. He would remind those present that within the range of the human consciousness there are many things which appeal to what transcends those generalisations and conceptions at which the student of nature and of natural laws arrived from the study of material things; laws of the universe of being, which in fact appeal to the powers of spiritual perception in man, which constitute the region of a reasoned faith.

The speaker went on to say that he could not accept the reasoning of Spinoza, which had been quoted, because a *petitio principii* underlies it in common with the general *dictum* of Herbert Spencer as to "the unknowable," in the assumption that we know enough of the Author of the Universe to be able to postulate what He can or cannot do—the fallacy of measuring the Infinite by the finite. It savoured of the intrusion of ideas of human legislation into the region of the Divine. It may fairly be contended that in nature there is no place for "Divine decrees" (*humano sensu*); that on fuller thought and reflection the notion of a Divine "decree" or *fiat* resolves itself into the working of *Divine thought realising itself in life and form*; and (with Mosley) that the idea of Divine creative thought ceasing to act is unthinkable. There is, therefore, infinitely more room for the introduction into the order of nature (so far as it is known to us) of modifications through the direction (by creative will) of tendencies obscured from scientific observation, than there is for the admitted fact of the modification, within more limited regions, of the course of natural events by the action of the human will. Spinoza and Herbert Spencer, in different ways, seem to fall into the logical snare of adopting a *universal negative*, based in the last resort on the limitations of their own powers of conception of *the possible*; the more reverent and safer attitude of the present scientific spirit, among the younger and more

cultured scientific school, is to be ready, if necessary, to say—"We don't know."

Dr. W. WOODS SMYTH said: I have great pleasure in seconding the vote of thanks to Professor Orchard for his important and interesting paper. He has clearly shown that science and men of science are not opposed to the possibility or even the probability of miracles. In one sense, therefore, the paper is rather misplaced, because while science accepts miracles it is the Church which rejects them. Therefore we should have had a paper on the attitude of the Church towards miracles. I may illustrate my meaning by pointing to the fact that Professor Huxley said that the Incarnation and the Resurrection offered no difficulty to him as a man of science, yet some of our leading divines are telling us of how difficult it is for them to accept these miraculous occurrences. Again, even in the case of Joshua's miracle of the sun standing still, Huxley said it presented no difficulties. The moment we admit the existence of an Infinite Being, it was as easy for Him to alter the movements of the solar system, as for the Professor to alter the hands of his watch. I may mention here that the eminent astronomer, Mr. E. W. Maunder, says that the astronomical, topographical and military data given in regard to Joshua's miracle all point to a truthful record.

However, there is a point which arises here and negatives all attempts to explain miracles. We, as created beings, are not competent to explain the mode of operation of uncreated Infinite Being. It is out of the question to try to explain Joshua's miracle by the Lord slowing the rotation of the earth, etc., because it is unphilosophic to imagine that the universe presents to an Infinite Being merely ponderous bodies governed by the law of gravitation, as it does to us. Neither men nor angels may ever be able to explain how this and other miracles have been accomplished.

In reply to an objector who contended that the miracles of the New Testament were alleged to have taken place in credulous times, he said, the days of our Lord's miracles were the most sceptical the world has yet seen.

J. SCHWARTZ, Esq.—While congratulating the lecturer on his interesting paper, I would point out that there is a large and growing section of modern Christians who realise perhaps more intensely than was ever done before the inspired ethical beauty of Christ's teaching and personality, but regard the miraculous

accretions, with which pious disciples enshrined His memory, as a present source of weakness rather than a support to true religion. The lecturer has laboured, I think, very needlessly over the point that miracles are possible, which I believe modern scientists do not attempt to deny. Science is confined to the co-ordination of phenomena, and the sciences of psychology and history (including that of comparative religions) do not disprove but explain alleged miracles, and make it quite clear that a real miracle would have occurred if alleged miracles had not been interwoven into the Christian tradition. Ethnology has demonstrated that primitive folk everywhere and always remain unconscious of the invariable sequence of phenomena, which has only been thoroughly realised during the last few generations of the scientifically educated. All natural phenomena were thought of as regulated by spirits, influenced by magic, flattery, sacrifice, spells and ceremonies; and the large mass of the uninstructed and many of the so-called educated whose knowledge is largely confined to the study of the prejudices of past generations, hold this fetish form of religion in a modified form at the present time, in civilised countries such as Spain, Portugal, Russia, and the country districts of Italy and France. Patient impartial scientific investigation has rejected the alleged miracles of to-day, and open-minded historians have explained the like misconceptions of past ages. It is a well-established psychological law that miracles are seen by those and those only who expect to see them. Strongly as I differ from the general conclusions of Cardinals Newman and Manning, I, together with many "broad" Christians, consider that their contention that modern, mediæval, and Biblical miracles form an unbroken chain, and stand or fall together, is proved up to the hilt. The Virgin Mary is still believed to be walking about in the country districts of France and Belgium, and recently to have raised from the dead a pilgrim youth hung in error with a highwayman. Christian miracles were accepted by a population in a still lower state of credulity, and the cultured rejected them, as is clearly stated by New Testament writers, the Fathers and their opponents, and they did not receive general acceptance until the Barbarian had destroyed the old civilisation, and the dark ages had set in. The lecturer's definition, "Science is the investigation and study of things and phenomena in nature, with a view to their explanation and

correlation in the great order of the universe," is too broad. Science does not attempt to explain (as fruitlessly attempted by philosophy and metaphysics) but is content to state the co-relation of phenomena. His definition of a miracle as "An exceptional marvel in nature not explicable by natural causes" may be accepted, but the inference "and therefore directly attributable to a supernatural cause," science will not allow, because she hopes with a larger knowledge to bring many phenomena that appear exceptional into co-ordination with the natural order of phenomena. I fail to understand why earthquakes, the burning of stars, and the odd (*sic*) behaviour of radium can be described as "interrupting the continuity of nature," no such suggestion has ever been made to my knowledge by any scientist. His attempts to demonstrate that "the same forces sometimes act in the most opposite way" by stating that "a charge of electricity sometimes attracts, sometimes repels," is a strange one; surely he is aware that the one word is employed for two contrary manifestations differentiated as positive and negative. The statements that "Compared with Bible miracles the spurious miracles which have from time to time attempted to delude mankind, exhibit a difference of character so great as best to be described as contrast," and again, "Nor can the belief in the Christian miracles be accounted for by what is termed the Mythopoetic theory," are at variance with the honoured opinions of many of our most eminent liberal scholars, as exemplified below.

J. S. Mill.—"Stories of miracles only grow up among the ignorant. Modern Roman Catholic miracles often rest upon an amount of testimony greatly surpassing that for the early miracles. Miracles have no claim whatever to the character of historical facts."

Matthew Arnold.—"The human mind is now losing its reliance on miracles, as its experience widens it gets acquainted with the natural history of miracles, and sees how they arise. The comparative history of all miracles admitted Bible miracles are doomed."

Professor Jowett.—"Every one who affirms the truth of miracles does in fact assert the truth of his own miracles, as the one exception to all the rest. But how impossible is this. For he asks you to believe the most improbable of all things, and does at the same time acknowledge a principle of self-illusion in human nature quite

sufficient to have invented them. Men will in time give up miracles as they have given up witchcraft."

Professor Lecky.—"We must quite dismiss from our minds the ordinary Protestant notion that miracles are very rare and exceptional phenomena, the primary object of which was always to accredit the teacher of some divine truth that could not otherwise be established. In the writings of the fathers, especially of the fourth and fifth centuries, they were a kind of celestial charity, supplying the wants of the faithful. Both Christians and Pagans admitted the reality of the miracles of the other, though ascribing them to the agency of demons. Whenever a saint was canonised it was necessary to prove that he had worked a miracle; there were 25,000 in the Bollandist collection, also thousands of miraculous images and pictures. All history shows that in exact proportion to the intellectual progress of nations the accounts of miracles become rarer and rarer, until at last they entirely cease. It is the fundamental error of most writers on miracles to ignore the predisposition of men in certain stages of society towards the miraculous, which makes an amount of evidence that would be quite sufficient to establish an ordinary fact altogether inadequate to establish a supernatural one. To suppose that the Fathers who held these opinions were capable in the second or third century to ascertain with any degree of just confidence whether miracles had taken place in Judæa in the first century is grossly absurd. The predisposition to believe the miraculous constructed out of a few natural facts the complicated system of witchcraft, persuaded all the ablest men for many centuries that it was incontestably true, and conducted tens of thousands of victims to a fearful and unlamented death, the minds of men were completely imbued with an order of ideas that had no connection with experience."

J. A. Froude.—"The Emperor Vespasian restored a blind man to sight, and a man with a disabled hand had recovered the use of it under circumstances which closely resemble those of the Gospel miracles. The historical inquirer can look only through the eyes of the early Christian writers who neither saw as he sees or judged as he judges. The world as they already knew it was already full of signs and wonders. A miracle was as little improbable in itself as any other event. Celsus wrote, 'The Christian teachers have no power over men of education, they call human wisdom folly.'

The conjurers whom Celsus and Lucian knew to be charlatans and impostors were to Origen enchanters who had made a compact with Satan."

Dr. SCHOFIELD.—This lecture seems a fitting sequence to the last. There it was proved that the concept of a Divine Creator was necessary to a student of the phenomenon of the universe. To-day it seems equally clear that the supernatural or miraculous is a necessary effect of the Divine concept. What we call natural laws are in reality Divine laws, and their Author can of course change or modify their action at will.

It seems to me, however, that we make too much of the miracles Christ *did*, and too little of the miracle He *was*. The greatest miracles centred round Himself. His birth, life, resurrection, and ascension were all miraculous.

Then, again, I am not quite sure that Professor Orchard's definition of miracle, no doubt a very good one, will absolutely stand the test of a close examination. What is and what is not a natural cause? According to the previous action a molecule of radium may be watched and will be found absolutely unchanged during a ceaseless observation by generations of scientists for 3,000 years, and a natural law may be deduced therefore that radium is an unchangeable element, and yet within a few years later it may be entirely dissipated and vanish away, showing the natural law though right for 3,000 years is not after all a law at all.

Does Professor Orchard include the confused contradictions in the sequence of events and in the motions of bodies caused by the human will and life power among natural laws, or are they supernatural and spiritual? I read that God made iron swim which had sunk to the botton of the water according to the law of gravitation.

Well, I can do the same; by my life and will power I can raise it up and hold it just level with the water. The difference is my arm is visible and God's is not. Do I work according to a natural law, and God by a supernatural? It seems to me a more satisfactory definition if miracle could be "an occasional and exceptional action of Divine power."

I need hardly say how heartily I join with the other speakers in the praise of this closely reasoned, logical, and convincing paper.

Lieut.-Col. MACKINLAY.—The Victoria Institute is to be con-

gratulated on this excellent paper, and the judges deserve our sincere thanks for their laborious task of reading through the nine essays and deciding on the best one.

In further support of the author's refutation of the old statement that miracles are violations of the laws of nature, pp. 81, 89, and 106, it may be noticed that several miracles are recorded as being themselves subject to law, as we are told that they could only be performed when faith was present: I refer to Matt. xiii, 58, "He did not many mighty works there because of their unbelief": to Mark ix, 23, "If thou canst, all things are possible to him that believeth," and in Acts xiv, 9, 10, the Apostle Paul said that the cripple had faith to be made whole, *before* he said to him, "Stand upright on thy feet." (See also Matt. ix, 29, Mark ii, 5 and 52, Luke xviii, 42.) In all these instances a law is evident that certain miracles could only be performed when faith was present on the part of the recipient.

Our author rightly insists on the value of the testimony of the Bible to the miracles therein recorded. Most men who deny that Bible miracles happened would more or less deny the historic truth of the Scripture record. Hence it would seem that the arguments in the paper before us would have been strengthened if more space had been devoted to the remarkable historic accuracy in Scripture recently demonstrated by archæological research, as for instance, in the Book of the Acts where the exact and varied titles* are most correctly given to different magnates, *e.g.*, to Sergius Paulus, styled *pro-consul* in Acts xiii, 7. In Thessalonica, Acts xvii, 6, *politarchs* are mentioned: a word unknown in other history until an ancient gateway was discovered in the ruins of that city bearing an inscription with that very title. *Chief man* in Malta, Acts xxviii, 7 is also attested by a local inscription. Again in Acts xiv, 6, Paul and Silas, we are told, fled to the cities of Lycaonia, Lystra, and Derbe. Sir W. M. Ramsay† has shown that in the first century these two cities were both included in Lycaonia, but in the second century Lystra was separated and identified with Iconium.

These are only *some* examples of the recently demonstrated

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* *Bible Accuracy*, 1903, pp. 59, 60. Col. C. R. Conder.

† *Trans. Vict. Inst.*, 1907, "Exploration of Asia Minor as bearing on the historical trustworthiness of the New Testament," p. 209.

historical truth of *one* of the books of the New Testament; its historic testimony to the truth of the miraculous Resurrection which it so frequently alludes to should therefore also be received even by those who may have previously doubted the sacred narrative.

On p. 110 our author speaks of the myth theory to account for the origin of various Bible miracles including that of the Resurrection. If there really had been any such connection, why did not the Apostle Paul make mention of it when he preached at Athens, Acts xvii, 16–34, in accordance with his usual plan of being "all things to all men"? As a matter of fact he did quote a heathen poet that "we are all His offspring." But when he spoke of the Resurrection of Christ why did he not explain that it was only a modification of some heathen myth with which they were already familiar? It would have been quite in accord with his usual methods, if he could have done so with truth.

The fact that he did not do so, and that some mocked and others assumed an indifferent attitude directly Paul preached the Resurrection (Acts xvii, 32) is quite in accord with the supposition that that grand event was unheard of and incredible to them. It gives a strong negative to the idea that the Resurrection is a copy of some ancient heathen myth. Paul's hearers, educated Epicurean and Stoic philosophers, must have had a wide knowledge of heathen religion, and yet no idea of any connection between the Resurrection and stories in heathen mythology struck any of them.

I should like to add that I much hope that the Institute will make special arrangements to widely circulate this useful essay, which is eminently suited to the needs of the times.

The AUTHOR expressed his thanks to the Chairman for his kind remarks. He wished also to thank the various speakers and the large audience for the way in which the paper had been received.

One gentleman, however, had permitted himself to make one or two assertions which appeared discordant from fact. Such was the statement that the Christian Miracles were not believed until the dark ages. The Bible miracles were believed by Christians from the very first. Christianity was founded upon, and explained by, the miracles of the Incarnation, the Resurrection, and the character of the Redeemer. The fact of the miracles was not denied by opponents, though they sought to attribute them to magic.

In connection with the definition of a miracle (p. 83) Dr. Schofield asked for a definition of "natural causes." Perhaps a satisfactory answer is that a natural cause is a cause acting according to "natural laws" (or uniformities), "natural" meaning stated, fixed, and settled.*

Responding later to a vote of thanks, the author called for one to the Chairman, which was carried by acclamation.

Further reply by the AUTHOR:—

I wish to thank Mr. Schwartz for some interesting criticism which deserves further comment. Some of his assertions seem inaccurate. He says that "It is a well-established psychological law that miracles are seen by those, and those only, who expect to see them." I am unaware of any such law, and he does not support the assertion by any authority. This so-called "law" does not appear to have been operative in, *e.g.*, the feeding of the multitudes, Christ's walking on the sea and His stilling of the storm, the opening of the doors of the Apostles' prison. Mr. Schwartz argues that because Science has shown that some phenomena which had been attributed to supernatural agency have been traced to natural causes, therefore all such occurrences can be so explained. This is to fall into the fallacy well known in logic as "Undistribution of the Middle Term." To confound together the Bible miracles with the pretended "miracles" of mediæval fame is not a scientific procedure. The Bible miracles (as is shown in the paper) stand the tests of Science, but the mediæval "miracles" do not do so.

With regard to the argument that the early Christian age was superstitious, it may be answered that a superstitious people would be *specially* the class on whose behalf a theophany might be expected to be attended by miracle. We should also bear in mind that the Jews were not a credulous people, that the Apostle Paul—himself no mean example of culture—spent a longtime "disputing daily in the school of one Tyrannus," and that the Gospel was very early and successfully preached at such centres of culture as Athens, Corinth, Ephesus. If it be objected that many cultured people did not believe, the obvious reply is that many uncultured people did not believe. The explanation of unbelief is for both classes the same, namely, man's guilty repugnance to the truth of the Gospel.

* Butler.

Mr. Schwartz's statement that Science will not attribute to a supernatural cause a phenomenon which cannot be assigned to any other cause appears to be inadvertent. Science attributes every effect to some cause.

He is perplexed with an illustration from an electrical charge which goes to show that the same force may, under different conditions, produce opposite phenomena. He must surely be aware that an electrical charge attracts one body and repels another according to the electrical condition of the bodies.

The opinions of certain "liberal scholars" quoted by him can be outweighed by others on the opposite side. They have little to do with Science, though it is interesting to note that Lecky admits that the Christian miracles were conceded by the Pagans. If Mr. Schwartz will read the note at p. 99 of the paper, he will see Mill's considered conclusion as to the "only antecedent improbability which can be ascribed to a miracle."

My thanks are due to Dr. Schofield, who invariably illuminates every discussion in which he takes part. I am indebted to him for several valuable observations. He seems, however, to err in referring *all* miracles to God in view of such passages in Holy Writ as Exodus vii, 12, and viii, 7, Deut. xiii, 1 and 2, Rev. xiii, 14, and xvi, 14.

As to man, he may be looked upon as in some regards a part of nature, but supernatural as to his will. He is a link between the natural and the supernatural, partaking of the character of both.

The definition of a *miracle* (p. 83 of the paper) should read as follows:—*A miracle is an exceptional marvel in nature which, not being explicable by any human or any natural cause, is attributable to some supernatural cause.*

This will, I think, meet Dr. Schofield's difficulty.

502ND ORDINARY GENERAL MEETING.

MONDAY, FEBRUARY 7TH, 1910.

D. HOWARD, ESQ., D.L., F.C.S., F.I.C. (VICE-PRESIDENT), IN THE CHAIR.

The Minutes of the previous Meeting were read and confirmed.

The following paper was then read by the author :—

SPECIES AND THEIR ORIGIN.

By the REV. JOHN GERARD, F.L.S.

TO those who give attention to the discussion concerning the origin of species, which since the time of Mr. Darwin has so greatly exercised the scientific mind, it must frequently have occurred not only that there seems no great prospect of a conclusion being reached which shall secure universal, or even general, acceptance, but that it is by no means clear what the question itself is. Yet it is evident that, unless this be first made perfectly clear, the discussion is not likely to have any very profitable issue. Before we can arrive at any result worth having touching the origin of species, or the manner in which they have come to be what we actually find them, we must begin by determining what we signify by the term, that is to say, what species *are*. But to determine this will certainly not be easy, for although everybody freely uses the word, and has a general idea of its meaning sufficient for practical purposes, very little investigation is required to show that the differences masked by its employment are both wide and vital.

Despite the title of his famous work, with which the question we speak of must always be connected, Darwin himself seems never formally to have stated what, in his view, "species" should

be taken to mean. Undoubtedly, however, he clearly showed that he supposed each species to be descended from a single ancestor, or rather, it should seem, pair of ancestors. To this extent, therefore, he was in agreement with Linnæus and the older naturalists, who, as is well known, defined species as the descendants of a brace of parents originally created in the exact form which their offspring still perpetuate; but with this notable difference, that Darwin's whole point is that the ancestors to whom common descent is thus to be traced, were themselves sprung from progenitors so different from them that they would needs be regarded as constituting *another* species. The question does not now concern us as to *how* the transformation of the older form to the newer may be supposed to have come about, whether by the action of natural selection or otherwise. What we have to examine is simply, What is it that is said to have been transformed; or, in other words, *What* is a species? To this various high authorities give various answers.

Mr. Wallace* quotes one definition from a distinguished botanist, De Candolle, another from a zoologist, Swainson, of whom the former says:—

"A species is a collection of all the individuals which resemble each other more than they resemble anything else, which can by mutual fecundation produce fertile individuals and which reproduce themselves by generation in such a manner that we may from analogy suppose them to have all sprung from one single individual."

Swainson writes to somewhat similar effect:—

"A species, in the usual acceptation of the term, is an animal which, in a state of nature, is distinguished by certain peculiarities of form, size, colour, or other circumstances from another animal. It propagates after its kind individuals perfectly resembling the parent; its peculiarities, therefore, are permanent."

On the other hand, Mr. Mivart tells us†:—

"The word 'species' denotes a peculiar congeries of characters, innate powers and qualities, and a certain nature realised indeed in individuals, but having no separate existence, except ideally, as a thought in some mind."

These definitions are evidently quite different, and the difference is of no slight importance. It is very frequently laid down as undeniable that "species" themselves have no

* *Darwinism.*

† *Genesis of Species*, p. 2.

real existence, but are mere abstractions, found not in nature, but only in the mind which creates them, and here we are often bidden to discern the true key to the question of their origin. Thus Mr. G. H. Lewes writes*:—

"The *thing* species does not exist: the term expresses an *abstraction*, like Virtue and Whiteness: not a definite concrete reality, which can be separated from other things and always found the same. Nature produces individuals; these individuals resemble each other in varying degrees; according to their resemblances we group them together as classes, orders, genera, and species; but these terms only express the *relations of resemblance*, they do not indicate the existence of such *things* as classes, orders, genera, or species. There is a reality indicated by each term—that is to say, a real relation; but there is no objective existence of which we could say, 'This is variable; this is immutable.'"

This Mr. Lewes proceeds to apply to the matter now in hand†:—

"No sooner [he says] do we understand that 'Species' means a relation of resemblance between animals, than the question of the fixity or variability of species resolves itself into this: Can there be any variations in the resemblance of closely allied animals? A question which would never be asked."

On the same subject Professor Bowne declares‡:—

"In any case, a species is nothing but a group of similar individuals. These individuals and the power or powers which produce them are the only realities in the case. The important problem is not what is a species, but what is the individual and what the power that produces individuals. Thus it is clear that the transformation of species means simply the production of individuals along lines of descent in such a way that, if we should take individuals from points mutually distant in such a line, they would be so unlike that we should not think of classing them together."

All this, no doubt, is true enough so far as it goes; but it does not take us very far. Of course, if we define species with Mivart as a congeries of characters, innate powers, qualities, and the rest, it must clearly be acknowledged that the basis of our classification is no more than an abstraction, having no existence

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* *Studies in Animal Life*, p. 169.
† P. 130.
‡ *Hibbert Journal*, Oct., 1909, p. 133.

outside our own mind. But obviously it is not the same when we define it as a collection or group of individuals bound together by certain characteristics. A group, though it is not a substance, as is an individual, has, nevertheless, a real existence of its own, and possesses attributes which do not belong to the several individuals of which it is composed. Such a body is now the British Parliament, such are likewise our Royal Society, the Jockey Club, and the French Academy, each with definite functions and powers, and its own distinctive history. From these and similar instances it is not difficult to see that, by analogy, "the transformation of species" may be understood in a sense differing considerably from what we have heard.

An example which may be worked out in considerable detail is furnished by our army. This, as we all know, falls naturally into certain broad divisions or classes—horse, foot, and artillery. These, again, are further divided into what may be styled genera—as the Cavalry, into Dragoons, Hussars, and Cuirassiers, the Infantry into Grenadiers, Rifles, and Highlanders. Finally, there are regiments which may well represent species, every member of each being modelled on exactly the same pattern as to uniform, accoutrements, and functions, so that from an inspection of one it would be possible to arrive at a correct description of all, none, however, being the exact facsimile of any other. That there is a very real sense in which the continued existence of such bodies can be traced as a concrete reality, and not in any mere abstract or figurative sense, our many regimental histories bear witness, nor can there be any doubt that in very many instances, if not in all, transformations have to be recorded which furnish some analogy with those of which evolutionists tell us. Not a few regiments have served in turn under Marlborough, Wolfe, and Wellington, in the Crimea, the Indian Mutiny, and South Africa. He who knew each of them first at one of these epochs could hardly believe that it was identical with its own previous self, though the unbroken continuity of its life cannot reasonably be questioned. Sometimes we still find in the present actual traces of adaptation to a state of things that has passed away, as our "Grenadiers" record the days when hand-grenades were used in battle, and our "Fusiliers" recall those when soldiers armed with guns had to be distinguished from pikemen and archers. Occasionally we are introduced to historical origins still more remote and fundamental, as in the case of the well-known "Buffs," a regiment which, as claiming descent from one of the

ancient civic train-bands, still enjoys the privilege of marching through the City of London with bayonets fixed, band playing, and colours flying. Notable relics of the past are likewise furnished by inter-regimental feuds, sometimes bearing witness to very long memories. It is said, for instance, that one of these dates from the massacre of Glencoe, in 1692, the corps, representing respectively its victims and its actual perpetrators, being still ready to come to blows, more than two centuries later.

It is unnecessary to indicate in how many points analogy may be discovered between those bodies which are styled regiments, and those termed "species" of plants or animals. The latter, like the former, are distinguished each by its own garb or uniform, and never did the most exacting of martinets insist so rigorously upon the right number of buttons or cut and tint of facings on a soldier's coat as does Nature in every minutest particular whereby her several cohorts may be distinguished, and manifold are the features which seem unmistakably to argue a real continuity of life persisting through changes which might appear altogether to separate newer forms from old.

It is of course proverbial that comparisons are always defective, and that which we have used is no exception to the rule; but one truth at least it serves to illustrate, that a number of individuals being stamped with a common characteristic linking them together as a distinctive group, this may have a definite history including modifications and transformations which might appear altogether to alter its character. The question to be asked is therefore not quite so idle as that which we have heard as to whether there can or cannot be variations in the resemblance of closely allied animals, the relations of those which we term members of a species being clearly subject to a law imposed upon them all.

The real problem, therefore, is to determine, What is the power, influence or law, which makes such original groups what they are, and invests each of their members with those common characters which our mind naturally recognizes, and so proceeds to classify individuals as included in one species, or species in one genus.

This is, in fact, the root of the matter. Far more vital than the question whether species can be transformed is the previous question, How came they to be constituted? To what do they owe their genesis? As we have been told by Mr. Lewes, the relations of resemblance linking together the individuals of a species are real relations—there is a reality indicated by each term. What, then, is the cause of this reality, that to which

we may trace its origin? Until we can satisfy ourselves upon this point, it seems vain to seek any answer to the further question regarding transformation; but if we can arrive at a conclusion satisfactory to reason concerning the basis upon which our classification must ultimately rest, we shall at any rate have a tolerably clear understanding of the problems which lie beyond.

It is clear, to begin with, that in such an enquiry we must needs introduce the idea of Mind. Mr. Mivart, as we have heard, after defining species as a congeries of characters having no separate existence, adds the important qualification, "except ideally as a thought in some mind." Similarly, Professor Bowne declares, "Intelligence is the only source of any objective classification." Nor can this be understood as meaning no more than that were there no intelligence capable of making abstractions, and grouping individuals according to their common characteristics, there could be no possibility of classification, as in like manner there could be no colour were there no eyes in the world capable of sight?

We must, in fact, ascribe to Mind a far higher function, and recognize in it the only power capable of establishing those real relations upon the recognition of which any true principle of classification must be based. And here we may apply what Newman says in general concerning order*:—

"As a cause implies a will, so order implies a purpose. Did we see flint celts in their various receptacles all over Europe, scored always with certain special and characteristic marks, even though those marks had no assignable meaning or final cause whatever, we should take that very repetition, which, indeed, is the principle of order, to be a proof of intelligence. The agency, then, which has kept up and keeps up the general laws of nature, energizing at once in Sirius and on the earth, and on the earth in its primary period as well as in the nineteenth century, must be Mind, and nothing else, and Mind at least as wide and as enduring in its living action, as the immeasurable ages and spaces of the universe on which that agency has left its traces."

Sir John Herschel likewise saw in such a manifestation of order as is afforded by the repetition of similar features, clear evidence of the influence of purpose. As he observes,† a line of spinning jennies of the same pattern, or a regiment of

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* *Grammar of Assent*, p. 70.

† *Preliminary Discourse on the Study of Natural Philosophy*, p. 38.

soldiers clad in the same uniform and going through the same evolutions, necessarily implies a controlling force directing things according to a definite system. So true is this that if along a road we travelled we should find at every twenty yards, or other regular interval, merely a couple of stones laid one upon the other, or three arranged as an equilateral triangle, we should unhesitatingly conclude that an intelligent being had been before us and left this mark, nor would any argument to the contrary—if one could be found, or even imagined—avail to shake our belief.

The admission of such a force being, however, what many evolutionists are most unwilling to admit, they commonly seek for the needful foundation on which to base the objective reality of their classification in community of descent, so that a species consists of individuals which have at some period, comparatively recent, descended from a common ancestor—or pair; and a genus consists of species which have similarly originated at a period more remote, in the course of which the power to which transformation is due, whether natural selection or another, has operated to produce alterations now recognized as specific.

Something of a digression here suggests itself, which appears to be by no means unimportant.

It is not easy to ascertain on unimpeachable authority what the course of evolution must be supposed to have been. In the conclusion of the *Origin*, Mr. Darwin speaks of life having been originally breathed "into several forms, or into one." Mr. Wallace intimates* that not only distinct forms, such as crows and thrushes, may have descended "from each other," but that all birds, including such widely different types as wrens, eagles, ostriches, and ducks, are possibly, or probably, modified descendants of a common ancestor; further still, that even mammals, birds, reptiles, and fishes may have a common origin.

On the other hand, Mr. Darwin emphatically warns us against the notion that we shall ever find, either living or fossil, the direct progenitor of any species, existent or extinct.† All that we have a right to expect is a form intermediate between each species and a common but unknown progenitor not, however, as it would seem *directly*, intermediate between them. But he tells us, moreover,‡ that the same identical species cannot be produced twice over, "even if the very same condition, of life,

* *Darwinism*, p. 6.
† *Origin*, 6th Edition, p. 264.
‡ *Op. cit.*, p. 292.

organic and inorganic, should recur." From this it must follow that every species now existing is made up of descendants of one single ancestral pair, other descendants from the more distant common ancestor having disappeared. But, to take the simplest of Mr. Wallace's examples, the forms intervening between thrushes and crows and their original common ancestor must have been immensely numerous along each line of descent, and of these intervening forms each must have belonged to *some* species, which for the time being had succeeded in establishing or continuing itself, though it had finally to yield its place in favour of other representatives of the same kindred, which had better adapted themselves to the conditions of life. According to this, each evolutionary stage which was marked by the appearance of a group so distinctive as to be styled a new species, must have witnessed the extinction of a multitude of near relatives which had not sufficiently accommodated themselves to actual conditions, an extinction which took the form, not, as was once supposed, of a catastrophe or general massacre, like that of royal princes on the accession of a new sultan, but of a gradual dropping off of those less fitted to survive. But, at any rate, this seems to be clear, from what Mr. Darwin tells us, that in every instance a species has started from progenitors which had developed characters distinguishing them specifically from others descended from the same ancestry, and which, because of such distinguishing characters, became the sole survivors of their race.

Many points are here suggested which seem worthy of more attention than they have usually received, but at present we may concern ourselves with one only, which brings us back to that from which we may seem to have digressed. Can community of descent furnish a satisfactory basis for the classification of species, if it constantly happens, and as it were inevitably, that amongst the descendants of the same progenitors specific differences are produced? As Professor Bowne says:—

"Descent, as such, carries nothing with it in the intellectual system. It is merely the actual method by which the organic system has been realised, but it becomes such a method only because it is so adjusted as to produce the result. The systematic relations of things in a graduated and ordinated scale of existence were insisted upon long before the doctrine of descent was thought of, and this doctrine adds nothing to that earlier view, except a conception of the way in which that intellectual order was realised. But, as just said, descent alone explains nothing unless its inner order presupposes just this

result. Animal homologies, we are told, presuppose blood relationship; but this is not so unless blood relationship implies animal homologies."

Our enquiry therefore comes in the end to this: are the resemblances between individuals, plants and animals, according to which we classify them in the same species, regulated by some dominating cause, or are they merely fortuitous? As Professor Bowne puts it:—

"The only further question that can arise concerning species is whether the power which produces individuals does so at random or according to rule. In the latter case species exist in the only sense in which species can exist; that is, natural groups exist whose members are bound together by their likeness, and the likeness of the members is due to the fact that they have been produced according to a common rule."

It would, in fact, appear that mere points of resemblance between individual objects do not suffice for the establishment of a species, or, which is the same thing, that such points of resemblance, if sufficiently numerous and characteristic to afford a basis for such establishment, necessarily convey the idea of a rule to which such resemblance is due. The resemblances to a camel, a weasel, and a whale, which Hamlet indicated to Polonius in the shapes of clouds, would never suggest the idea of species, simply because they were obviously quite casual, being due to the random operations of the wind. On the other hand, were the sky to be filled with cloud pictures accurately representing droves of camels or schools of whales, we should inevitably conclude that this was undoubtedly owing to *some* sort of rule or cause, even though we could form no notion as to what might be its character. So, when we find in organic nature groups of plants or animals unmistakably stamped with the same image or likeness, we cannot but explain their mutual relationship as being the result of some common influence—just as in the case of coins or books issued from the same mint or printing press. In the case of organic species the influence thus manifested is, we are told, that of common descent; but, whereas that of the coiner or printer is one the nature of which we thoroughly understand, of descent we can only say that we know nothing whatever as to its mode of operation, nor, indeed, anything except the phenomena exhibited by its results—the very thing that has to be accounted for; so that in reality, to explain what we would understand, we are bidden to fall back on our lack of knowledge.

That species have no real existence naturalists who study living nature must, it would seem, find it exceedingly difficult to persuade themselves, so many and so far reaching are the points of resemblance which they must continually discover; and which imperatively suggest the idea of a rule imposing them. If there be such a rule, then assuredly in a very true sense species are a reality, and the question of their fixity or transformation has a very definite meaning. If on the other hand, there be no such rule in existence, and the various characteristics in which classification of species is founded are due to fortuitous circumstances alone, then species owe their origin only to the men who invented them. And doubtless many species, especially amongst the smaller organisms, whether plant or animal, seem to be based on a foundation no more substantial. Professor Asa Gray, for instance, was known to say that he did not believe in the fixity of species, for he had made and unmade too many of them. But this means no more than that some which once he had called species were not in reality species at all; it nowise affects the case of "natural species," if such there be, based upon characteristics common to individuals, and due not to fortuity but to law.

There remains of course the perplexing question of the distinction between species and varieties and the test, or tests, by which species may practically be distinguished one from another—that most usually adopted being the impotence of creatures belonging to different groups to produce hybrids regularly fertile *inter se*. That this *is* a real test Professor Huxley at one time strenuously denied,* though at another† he appeared to take it as the basis of his own conclusion on the subject. In any case it seems clear that groups which are recognised as true species do in certain circumstances interbreed; for example, the black carrion crow (*Corvus corone*) and the grey hooded crow (*Corvus cornix*) undoubtedly do so on the borders of the districts which they respectively inhabit, and there can be no question that the offspring resulting from such unions are intermediate in plumage between the parents, and though it is not very easy in the case of such birds to obtain precise information, it would appear that the hybrid race perpetuates itself. The same is the case with two species of goldfinch—*Carduelis*

* *The Darwinian Hypothesis*, 1859. (*Darwiniana*, p. 3.)
† *The Origin of Species*, 1860. (*Ibid.*, p. 74.)

elegans and *caniceps*. On the other hand, although the common primrose (*Primula vulgaris*) and the cowslip (*P. veris*) are acknowledged to be but varieties of one species, it has proved so difficult as to be well-nigh impossible to obtain crosses between them.*

So, again, there are genera which Mr. Darwin styles "protean or polymorphic," in which the species present an inordinate amount of variation, with the result, as he adds, that hardly two naturalists agree whether to rank them as species or as varieties, examples being, amongst plants, the genera Rubus, Rosa, and Hieracium; amongst animals several kinds of insects and Brachiopod Shells.† Some authorities in consequence multiply the number of species prodigiously, whilst others reduce this to a minimum. It is not an unusual experience to find that as a man grows older he becomes less inclined to favour the larger figures.

The whole question appears to be, Are there or are there not "natural species," species which have for their basis something in nature which impresses upon the individuals of which they are constituted the common characteristics according to which we classify them? Among the higher and more developed classes, both of the vegetable and animal kingdoms, there seem certainly to be groups thus stamped with characters marking them as connected by a bond which man does not make but recognise; and, if such groups there are, it seems impossible to avoid the conclusion that there are in nature really existent species.

If so, we are of necessity driven back on the enquiry, what cause can possibly be supposed capable of producing such uniformity? And it is not easy to understand how any answer to the question can be found which is even plausible, except that the orderly disposition of nature which mind alone can discern, mind alone can have instituted. Very specially, we may add, should this be the lesson which we learn from science, for if there be one conviction more than another which is borne in upon us by every fresh investigation in all her fields it is that all things have been ordered "in measure, and number, and weight." So it is that, in every nook and cranny of her domain, we are able to discover laws which human wit is only now beginning after all these ages dimly and partially to descry, but which have been in operation from

* *Darwiniana*, p. 4.
† *Origin*, p. 35.

the beginning. Such we find to be the case in those wonderful researches as to the constitution of matter which are so marked an achievement of our own day, but which, beyond the fact that they reveal the existence of laws whereof we previously had no inkling, do but enhance the bewildering mystery of the universe in which we dwell. Of this only may we feel assured that we shall never arrive at any region which does not furnish matter for science, in which we do not find order and not chaos —a universe rationally explicable, bearing the stamp of mind whereof we see a reflection in our own.

As Sir John Herschel declared*: "The presence of mind in the universe is what can alone supply such explanation of her constitution and operations as shall harmonise with our own experience."

So it is with inorganic nature; so in an even more marvellous degree with the hosts of organic life. Many a species of both plants and animals wears the family livery, including seemingly trivial and insignificant details, in regions the most diverse and under every variety of condition. There must, it seems obvious, be some controlling power which sets and keeps the pattern, so that from a woodcock, for example, bought in a London poulterer's, we can furnish a description which is sure to agree in every particular with the plumage of birds found in Lapland or in Japan; while in any of the multitude of dandelions which April scatters through the land will be found an exact counterpart, though not a facsimile, of its brethren in Greenland, Italy, or Patagonia. If such agreement is without a cause, does it not seem there must be an end of science? If, on the other hand, a cause there be, must it not resemble, at least analogically, that intelligence which of all powers known to us in the world can alone discern in the visible universe more than can be perceived by corporeal eyes, recognising as its ultimate explanation an infinite cause, for which, to us, the word Mind is the least inadequate and misleading of symbols? †

Discussion.

On the conclusion of the paper, the Chairman thanked the author, in the name of the meeting, for his interesting and all too brief lecture. It must be considered as a tremendous shock to the strict Linnæan to find that there were people who believed in species

* *Familiar Lectures*, "On Atoms."

† Mivart, *Lessons from Nature*, p. 301.

as unstable and even as non-existent. The question—or rather the different questions—was as old as the controversy between the nominalists and the realists; but there was a real practical value in this question of species. If there was an answer to be found they would at the same time have found a conclusive answer to the query whether there was anything but mere accident in it all.

It was generally agreed that the species had a real existence apart from the individual, but much confusion was introduced by the existence of the protean genera.

Was man more ignorant than the dog? Dogs at any rate were all realists. For them there was no confusion introduced by the extraordinary forms at which the breeder had arrived. Great Dane or dachshund, it made no difference. The dog was always recognisable and treated as such.

It was to the speaker one of the most remarkable things to consider the extraordinary results arrived at by an old gentleman walking in his garden. The Abbé Mendel, a gardener and a most patient observer of nature, had been able to demonstrate the rules that governed the reversion to the original type, and only now was the significance of Mendel's discovery being made evident to them by the work of those who had rediscovered him. Reversion to type was for them the real test of species. Asa Gray wrote of making and unmaking species—but did he ever unmake any of these realities?

The speaker himself had only studied one genus—*cinchona*—a protean genus, but giving real species, each reversionary to its type. He could wish to have his whole life before him to study this genus in the light of Mendelism.

But without a mind behind them all the differences of which they spoke could have no real existence: this perpetual flux, if it were true, was a greater evidence of mind than anything else in Science; and men, generally, were coming more and more to favour a broad and general evolution under and controlled by a mind.

Professor HULL congratulated the author on the able manner in which he had handled an abstruse subject. There was a double difficulty to be met; first, to define a "species," and secondly, to account on natural grounds for its development. Through his forty years on the Geological Survey, the question of what was a species was constantly cropping up, and was especially conflicting—because

authorities themselves were often not agreed—regarding special organisms. His experience was, that whoever discovered a fossil specimen, had a claim to give it a name as a species, and it became a type. He, the speaker, recognised that there was a wide range of variation admissible as regards species and even genera, but his difficulty arose when they came to types of organic structure. A type was the appearance of a new fundamental idea, such as the vertebrate type in animals, and the dicotyledonous type in plants commencing in the upper cretaceous stage of the geological series. The explanations of the life history as given by the Darwinian hypothesis was, in the speaker's opinion, inconclusive, and insufficient to account for the phenomena they were dealing with, which can only be explained on the view of Sir John Herschel, quoted by the author of the paper that "the presence of mind in the universe is what can alone supply such explanation of her constitution and operations as shall harmonise with our own experience,"—a Mind all wise, beneficent and all pervading.

Professor H. LANGHORNE ORCHARD.—I am sure we all join in the thanks which have been expressed to the author for his able paper. The paper suffers, however, from the lack of a good definition of "Species." None of the definitions quoted seems adequate. Better than any of them is that given by Buffon, namely, "A constant succession of individuals, similar to and capable of reproducing each other." This distinguishes at once between species and *varieties*. If varieties (within a species) pair together, the result is mongrels, which are perfectly fertile. If species are made to pair together, what are obtained are hybrids—creatures of very limited fertility. It was this physiological fact which (as he himself points out) kept Huxley, who had plenty of good-will toward Darwinism, from accepting that theory.

The so-called "species," mentioned on p. 132, are not species at all. They are varieties—two varieties of the species "crow," two varieties of the species "goldfinch." On the other hand, primrose and cowslip are probably different species. Professor Asa Gray's "species"—which he could make and unmake—were varieties.

Darwin's theory of descent, brought before us on p. 124, convicts him of either inconsistency or confusion of thought.

Darwin supposes that if we trace the descent of all dogs back through thousands of years, we shall at last arrive at a single pair

of dogs, from which all the others have sprung. He supposes that for this ancestral pair and all the multitude of their descendants throughout the ages, the law of descent is that "Like produces Like" and they are all of one and *the same species*. Darwin does not, however, regard this ancestral pair as the final ancestor—he imagines that it had itself an ancestor. And he arbitrarily and inconsistently affirms that the law of descent undergoes a remarkable change, so that descendant and ancestor are of *different* species. To assume, without evidence, that the law of descent changes in this strange manner, is a procedure born not of science but of imagination, and it may safely be said that a supposition so violent would never have been made but for the exigencies of a theory.

I would congratulate the able author of this paper upon the felicity of his comparison—of course only analogical—between a species and a regiment.

We entirely concur with him as to "the controlling power which sets and keeps" the species pattern, recognising that the pattern finds its sole explanation in "an infinite cause for which, to us, the word mind is the least inadequate and misleading of symbols."

JOHN SCHWARTZ, Esq.—I would suggest that the definition of species quoted from Mr. Wallace as limited to those which can by mutual fecundation produce fertile individuals, is now held by practically all the younger generation of biologists; and that the views quoted from Mr. Mivart and Mr. G. H. Lewis are dealing with the matter from a metaphysical or philosophical rather than from a strictly natural science standpoint. As our lecturer states, the vital question is: How can species be constituted? He appears to suggest, on p. 129, that the unwillingness to accept mind as over-ruling all, has been the reason for adopting the evolutionary theory of the origin of species; this, I think, is incorrect. Biologists have frankly adopted the empirical view of natural science, and have practically unanimously accepted the evolutionary theory as established by historical facts; quite independently of any further philosophical or metaphysical views which they may individually hold, as to whether an over-ruling mind has planned it all, or whether it is the result of a fortuitous concourse of forces or atoms; and those definitely holding the latter views are, I think, a minority. Darwin was in no way dogmatic about variation and the precise

methods of natural selection, and I believe that the views that have long been held respecting "the extinction of vast multitudes of nearer relatives," referred to on p. 130, have recently been considerably modified, and that it is now largely held that sports or sudden abrupt large variations are the real causes of permanent variations. Modern Mendelism has made a further analysis, the varying components account for variations in the germ cell, just as electrons have modified our ideas about molecules.

All members of this Institute must, as Christians, thoroughly endorse the conclusions so ably driven home by the lecturer, that the word mind is the least inadequate word that we can apply to the Infinite Cause of the Universe and its operations, and dim as is our comprehension, yet the fortuitous concourse of atoms theory is quite irrational.

Mr. ARTHUR W. SUTTON, F.L.S., expressed the very great pleasure with which he had listened to the lecturer's able and suggestive paper, and alluded to the fact that those whose lives were spent in the more practical branches of horticulture were impressed with two outstanding facts:—On the one hand the wonderful possibilities, by means of selection and cross-fertilisation, of the improvement of the plants of the garden and farm, and on the other hand, the limitations imposed by nature which raised barriers beyond which it was impossible to go.

Mr. Sutton mentioned that, from his experience, he supposed that there was no body of men who, taken as a class, were more profoundly conscious of a supreme or supernatural Power or Being who controlled the course of nature than gardeners. Extraordinary as the results obtained by gardeners undoubtedly were, they were constantly reminded that their success would be impossible were it not for the inherent potentialities with which their plants, trees, etc., were endowed, and although nature allowed her servants to extend the usefulness or increase the beauty of a plant, it was only on lines and in directions peculiar to the individuals under treatment, and that by no possible means could a gardener induce one plant to assume the specific characteristics of another.

Mr. Sutton remarked that it was contended by some that different species could not interbreed and produce fertile offspring, while others contended that certain species did so; this difference of opinion Mr. Sutton attributed to the fact that some included as

species individuals which really ought more properly to be termed varieties, while others limited species to those individuals which were essentially distinct from all others, the whole question hingeing upon what is the true definition of a species.

One speaker had alluded to the theory of "mutations," or sudden modifications in plants or animals, as the starting point for further evolution, or for the origin of new species, but Mr. Sutton contended that there was no instance on record of any such "mutation" having produced a new species, and that the "mutations" of which so much had been heard, were really nothing more than variations which are so common and which occur so constantly when different varieties of any one species are cross-fertilized.

Dr. SCHOFIELD.—I have listened with great interest to the paper just read and it seems to me that the very existence of Science postulates mind, for it is all a quest for laws or orderly and rational sequences which require mind to produce them. The most remarkable thing is the facility with which some scientists can turn the blind eye when they wish. For instance, they wander along an old river bed and pick up a flint evidently chipped purposely to sharpen it, and they called it an arrow-head and see in that flint the unmistakable impress of mind beneath. They are quite clear that it must require mind to make the chips on a flint that have an obvious purpose in view. The funny thing is that when they leave the flint and consider the philosopher who discovered it, the blind eye is turned and they see no necessity for the intervention of mind.

He forsooth is a somewhat fortuitous concourse of atoms, the product of a mysterious and wholly imaginary force called evolution that by "sexual selection" and the "survival of the fittest" has succeeded in forming him. In short it took a great mind to design St. Paul's Cathedral—no one doubts this—but Sir Christopher Wren himself was a chance product of a blind evolution. To make these chips on an arrow-head requires mind, but no mind is needed to make a philosopher. How Wisdom rises above folly in the words, "Every house is builded by some man; but He that built *all things* is God!"

The SECRETARY desired, as one of the least of the followers of Darwin, to be allowed to protest against the manner in which the opinions of evolutionists were so often travestied. He trusted that none of them would ever meet in the flesh the sort of evolutionist

whom their friend, Professor Orchard, was in the habit of exhibiting to them and then successfully demolishing. He believed that no such person existed.

No one could afford to neglect the vast changes which had been introduced into almost every branch of science, since and as a direct result of the propounding of the theory of evolution. The principle of evolution was held to a greater or less degree by almost all men of science. It was true that not all believed now in the Darwinian theory of selection. They differed greatly as to the means, some were selectionist and some mutationists, but on the main principles most agreed, and they were hoping, not without reason, that the study of the "laws" of Mendel would throw new light on the great problem of the means by which evolution was effected.

There were some who conceived of evolution as contrary to Christian belief. Yet it seemed to him that it was the study of this very problem of species or evolutionary lines that led men of science more and more to demand, to postulate, the existence of a first cause, a mind controlling and ruling all the processes of nature.

Surely there was something infinitely grand in the conception of a universe brought slowly into being, from the beginning the germs of progress in it, gradually developing on the lines laid down by the Creator towards a future at which they could scarcely guess; and this was more in accordance with their conception of the Divine power than that ideas of separate creations or a world knowing no change where all things were made for man and man lived beneath the jealous sovereignty of the Jehovah of the Hebrews.

NOTE BY REV. A. IRVING, D.SC., B.A.

I have read the Rev. John Gerard's paper on "Species and their Origin" with considerable interest, and beg to be allowed to make a few remarks upon it. The paper is a careful piece of consecutive reasoning from the selected data, and one has no reason to find fault with the general conclusion, though the author's phraseology is scarcely satisfactory when he speaks of mind as a "force" (p. 129).

There seems to be very little of the inductive method in the paper; and by omitting practically all consideration of the influence of *environment* he has given us only one side of the question under

consideration. Of course the distinction to be drawn between "species" and "varieties" constitutes a very great *crux*, and we must on this matter defer in each case to the specialists. It is that to which Asa Gray referred when he said that he had had to do with the making and unmaking of so many species, that he had not much faith in the hard and fast definitions by which species were distinguished in handbooks of Botany; like the man who "did not believe in ghosts, because he had seen too many of them." (*Natural Science and Religion:* Scribner, New York.) That is an important confession.

Each species is known by characters, which are established in each case by generalisations from those actually found in the individuals which compose the group; and in every instance the generalisation is arrived at, as Mill would say, "by enumeration of instances." There they are, however, transmissible in each species through many generations. Each individual is itself a "summation of powers," including those which characterise the *species* and those which it shares in common with other species of the *genus* to which the species belongs; so that we are thrown back upon the well-known necessity of proceeding in the definition of a species *per genus et differentias* (see Mill, *Logic*, B. i).

The genus *Equus*, for example, contains not only the three modern species—*caballus*, *asinus*, and *zebra*—but others, as *E. stenonis* of the Italian region and *E. sivalensis* of the Indian region; both extinct since the Pliocene, yet with parts of skull, teeth, and limb-bones sufficiently preserved to warrant the assignment of them to the genus *Equus* and at the same time the differentiation of them structurally from the three modern species, with their manifold varieties. The descent of all these from the Miocene *Anchitherium* is pretty well established; but many modifications are marked in the lines of descent, in which the influence of environment has played an important part. Judgments vary as to what constitute generic or specific differences. Thus the form of "Horse" now seen in the British Museum and labelled *Hippidium neogæum* was first described as a species of *Equus*; and the *Equus caballus pregivalskii*, now accepted as the type of the original wild horse of Mongolia, was even thought by a very eminent naturalist to be a hybrid between the Tarpan and the Kiang. That however has been disproved since more individuals have been brought to England, and foals bred

from them. Sterility or fertility in breeding would seem to be after all the true criterion for distinguishing between "species" and "varieties"; but this requires the patient following of the experimental method to check opinions formed from mere observation. Mr. Gerard quotes Huxley "junior" and Huxley "senior," as inconsistent. Obviously the latter must correct the former.

As research advances, the Darwinian creed is apt to receive some rude shocks. Thus Mr. Gerard (pp. 129, 130) quotes Darwin himself as saying that the same identical species cannot be produced twice over, "even if the very same conditions of life, organic and inorganic, should recur." That dogmatic utterance seems to have been rudely traversed of late by the reproduction of the Pleistocene species of small slender-limbed species of horse, which Professor Cossar Ewart, F.R.S., of Edinburgh, but named *Equus agilis*, but which Owen had described from a few fragments from the Oreston cavern as *Asinus fossilis*. Professor Ewart, it would seem, has, in his experimental farm at Penicuik, reproduced, by the cross-breeding of some seven breeds of small horses, the identical *species* of horse which ranged in Pleistocene times from Algiers to the South of England; and he seems satisfied that it represents more than a mere "variety," but rather the "small slender-limbed *species* hunted and sketched or sculptured by our Palæolithic ancestors." (See *Nature*, Jan. 20th, 1910.)

Ewart enumerates as specific characters—"a fine head, slender limbs and small hoofs, a mane which, instead of clinging to the neck, arches to one side, a well set-on tail, and only two out of the eight callosities usually found in horses; *i.e.*, the four ergots and the hind chestnuts are absent." Here again it remains for the naturalists to decide how far these amount to specific, as distinguished from varietal *differentiae*. Whatever uncertainty may beset this question, we may with a fair degree of certainty maintain, I think, that Professor Ewart's results have given a practical demonstration to the important principle of "directivity," as a necessary supplement to the crude Darwinian dogma of "natural selection by the survival merely of the fittest." And in further illustration of this in the plant-world, we hear of a new "species" (? variety) of wheat obtained from cross-fertilisation of species or varieties of *Triticum*, and remarkable for its disease-resisting powers.

Reply by the Rev. J. GERARD, F.L.S.—I find the result of this

interesting discussion to be almost entirely confirmatory of the main contention to the support of which my paper was directed: viz., that while on the one hand we cannot but recognize something objectively real at the back of "species," we have not yet succeeded and probably never shall succeed, in determining the precise character of that reality, and are therefore obliged to base our definitions, not as strict logic would require, upon *genus* and *differentia*, but upon differences which appear on the surface in phenomena which lie within the range of ordinary observation—such, for example, as the oft-quoted sterility of hybrids *inter se*. Here, however, it must be observed there is undoubtedly a danger of arguing in a circle, if we think to explain the fact of sterility by difference of species and then to form this difference by the fact of sterility.

But, as I have said, the net result of the views now expressed appears to be, firstly, that species have a real actual existence in the nature of things, and secondly, that no satisfactory explanation of specific distinctions is possible apart from a Mind ordaining them.

I may be allowed to remark on one or two particular points.

Dr. Irving considers it unsatisfactory in regard of phraseology to speak of mind as a force (p. 140). I would, however, point out that in so speaking I refer to mind *in action*, using the term in its widest sense—*i.e.*, to will, and this, as I hold, is not merely *a* force, but the only causative force of which we have practical experience.

Professor Langhorne Orchard (p. 136) takes exception to the classification which makes two species of *Corvus corone* and *C. cornix*, or of *Carduelis elegans* and *C. caniceps*, which he declares to be only varieties. As to this, it seems enough to say that, in spite of the great authority of the late Professor Newton, the majority of ornithologists consider the difference in each case to be specific, as may be seen in the case exhibited, in illustration of this very point, in the entrance hall of our Natural History Museum. With regard to the distinction between primrose and cowslip (*Primula vulgaris* and *veris*) although Professor Huxley, whom I cited in his essay on the Darwinian Hypothesis, declares it with considerable emphasis to be a well-established fact that these are only varieties and not species, it must be acknowledged that the great majority of botanists are of a contrary opinion.

Two observations in particular made in the course of the discussion appear to me both interesting and suggestive.

The first is that of the Chairman (p. 135) as to the unfailing recognition by dogs of specific identity in their own kind, in spite of all the bewildering varieties which have been produced—a mastiff and a toy terrier equally accepting each other as indubitable dogs. This is certainly a very powerful argument for the reality of species.

Still more important in the observation contributed by Mr. Sutton, that within his own experience no class of men are more fully impressed with the conviction that nature bears witness to the controlling influence of a supreme Power, to which like all else the distinctions of species must be referred—than are practical gardeners. Such an observation I take to be of great importance, as the evidence of those who habitually come into contact with living nature must always, I think, be entitled to much greater weight than that of those who know her chiefly through the observations of others, or as studied in museums and laboratories.

503RD ORDINARY GENERAL MEETING.

MONDAY, FEBRUARY 21ST, 1910.

THE REV. CANON GIRDLESTONE, M.A. (VICE-PRESIDENT), IN THE CHAIR.

The Minutes of the previous Meeting having been read and confirmed, the Chairman referred to the great loss sustained by the Institute since the last Meeting by the deaths of the Rev. G. F. Whidborne and of Colonel C. R. Conder.

Mr. Whidborne was at the time of his death a member of Council, and had been a member of the Institute for over twenty years. His papers and contributions to discussions had always been welcome, and his presence and advice at Council Meetings, more especially during the late period of reorganisation, had been invaluable.

Colonel Conder was one of the earliest supporters of the Institute. His contributions to the Society's *Transactions* had always been much appreciated. His death was a great loss to the Science of Bible Archæology.

The election of the Rev. C. L. Drawbridge, M.A., as a member of the Institute, was announced.

The Chairman then called on the Rev. Professor H. M. Gwatkin, M.A., Dixie Professor of Ecclesiastical History, Cambridge, to read his paper on :—

ARIANISM AND MODERN THOUGHT. By Rev. Professor H. M. GWATKIN, M.A., Dixie Professor of Ecclesiastical History, Cambridge.

BEFORE we can see the relation of Arianism to modern thought, we must look at its significance for its own time.

The Gospel then begins as the Gospel of Jesus Christ, the Son of God; and indeed nothing short of this will justify its claim to be the full and final revelation of God. If Jesus of Nazareth is the eternal Son of God, the revelation must be final; if He is anything short of this, it cannot be final. In the one case, there will be infinite depths of meaning for us to learn; in the other, there will be indefinite possibilities of mistake for us to correct. Our doctrine then is that He is as divine as the Father, and as human as ourselves; and all the

refinements of the Nicene Creed mean nothing else and nothing more than this.

But common opinion in the early Christian centuries was persuaded that God and man are mutually exclusive, so that what is divine cannot be human, and what is human cannot be divine; and the Christians were apt to think as their neighbours thought, without clearly seeing that such a position is fatal not only to an incarnation, but to religion generally, and even to thought itself. So some started from the manhood they had seen, and denied or qualified His deity, while others insisted on the deity they had spiritually known, and denied or qualified His manhood. The history of the doctrine of the Person of Christ is made by the conflict of these two tendencies.

Arianism represents the former, though it concedes so much to the other that some will be tempted to think it a happy *via media*, though in fact it combines the evils of both systems without the advantages of either. Starting then from the Lord's manhood, the Arians were willing to add to it everything short of proper deity. But there they drew the line. He is in some sense divine, said they, and must be worshipped as our Creator and Redeemer; but how can one who is man be in the proper sense divine? We cannot make Him a full revelation of God or more than a creature. He is not even a creature of the highest sort, for His virtue is only the constant struggle of imperfect manhood, not the fixed habit of perfect free-will. And now that His manhood was a mere difficulty, it only remained to say that there was nothing in Him human but a body.

This is the doctrine of the Arians. They establish the Lord's deity by making Him a creature, and end by overthrowing the manhood from which they start. But I need not dwell on the endless confusions of such teaching, for nobody is an Arian in our time. Unitarianism is the most elastic word in theology, and covers a prodigious range of doctrines; yet no modern form of it, so far as I know, is quite like Arianism. But the thoughts from which Arianism arose are thoughts of all ages; and in our own time we can see them plainly, not only in the whole range of Unitarianism, but in much catholic and other agnosticism, and in many schools of philosophy. Modern developments may even have strengthened them in some directions, though upon the whole their tendency seems not only the other way, but more and more the other way.

The modern developments which most directly bear on

Arianism are the scientific and the social. Summing these up for present purposes, we are abandoning the deistic and the despotic conceptions of God which held the field till lately. The old conceptions of a great engineer and of a despot in heaven still linger in the backward forms of belief, and among the backward followers of all beliefs; but we are coming more and more to see that God works directly in common things, and that He is more a Father in heaven who guides His erring children than a king of heaven dispensing arbitrary rewards and punishments.

Now all the Arianizing forms of thought in past ages and in our own entirely depend on these obsolete conceptions. It must be allowed that the modern conception of natural law may be fitted in to the deistic view; for (if taken in a certain way) it destroys the possibility of direct divine action in the world. But then (if taken in the same way) it equally destroys the historical facts which are as vital for Arianism as for orthodoxy. Nor can the Arians bring back divine action into the world by the help of a mediator, for such mediator will have divine work to do, and therefore must be divine. There is no escape from the argument of Athanasius, that if a divine Person is needed to create, a divine Person is equally needed to restore. Yet on Arian principles the mediator cannot be divine. Hence those who hear this way commonly go further, and altogether deny any divine action in the world. They forget that law, like force, accounts for nothing without an intending will behind it. But setting aside these confusions of thought, natural law is nothing more and nothing else than a symbol of our own, which sums up the action of that will, so far as it is at present known to us. Hence anything supernatural must be absolutely natural, and everything natural must be supernatural. The two are co-extensive and form one organic whole, so that the sharp separation of the kingdom of nature from the kingdom of grace required by the deistic systems is a vain imagination.

Even more significant and emphatic are the indications of the social development. We note first that men have formed their conceptions of God and of His kingdom by idealizing earthly rulers and earthly states. Thus the quarrels of tribes and cities are reflected in the anarchy of polytheism, and it was under the shelter of the Roman peace that the unity of God became the belief of the civilised world. Ezekiel's conception of the future is an idealised kingdom of Judah, and there is likeness as well as contrast in Augustine's parallel of the Roman Empire

and the city of God. Now the conceptions of society and government are undergoing in modern times a subtle and far-reaching change, carrying with it an equally subtle and far-reaching change in our conceptions of the divine. To understand it, we must glance back nearly twenty centuries.

The Roman Empire furnished nobler ideals than anything that had gone before it, and those ideals were long sufficient. Indeed, the Empire had a forward look towards better times. Rome alone of ancient empires ruled the nations for their own good and not for selfish gain. Yet in its essence the government was a weak and selfish despotism, and society a structure of selfish class-prides. Like the Empire, but without its nobler features, were most of the kingdoms that followed—that for instance of Louis XIV. Still there was an advance after the Reformation. The philosophic despots reached the stage of everything for the people; and everything by the people was soon to come. Before long the world was startled first by the separation of America, then by the crash of the French Revolution. In England the change was made more peacefully, and through a transition period of softened aristocracy. I need not trouble you with details: suffice it that the modern state in its better forms entirely denies the claim of kings or nobles to govern in their own right or for their own purposes, and calls for the active and intelligent co-operation of all its subjects for the common welfare. Rulers and subjects in their several vocations are alike servants of the common good.

Now this changed conception of society is reflected in a changed conception of the divine, for we must needs believe that God is everything and more than everything that the best of rulers are only endeavouring to be. If such ruler is a guide and father of his country, God cannot be less than the guide and father of mankind. If he chooses his servants for their fitness and not by favouritism, God will do so too. If he is just and right, we know that God is not just and right in some other sense, which in men we should call unjust and unright. If the ideal king never wavers in moods and tempers, the unwavering sternness of the laws of nature becomes a sign of love divine. If the king is merciful, and strives to turn his rebels into loyal subjects, we cannot believe that God will some day burn His rebels in hell. If the king tries to do so much, God will do no less. Above all, if we expect the king to give himself heart and soul without reserve to the service of his people, it becomes easier to believe the Christian story that there is One who gave His life a ransom for us all. Thus the

whole conception of the divine is softened and made humane, and suffused with a tenderness our fathers never dared to realise as we are realising it. The change is immeasurable when we come to this from the hard impassive God of Islam or Arianism—not to add of Rome and Geneva—who sits throned far off in selfish bliss, and has a glory of his own which is not the highest welfare of his creatures.

In yet another direction the social development strikes at the root of all these Arianizing or Unitarian conceptions. The advance of the nineteenth century is shown not only in the changed spirit of governments, but in the wider range of their action, and in the increasing attention they give to social questions. Administration was comparatively simple when it was chiefly occupied with the king's wars, or with the security of life and property. But the modern state regulates factories and provides for the poor; it inspects slums and stamps out diseases; it educates the young and pensions the old, regulates companies from the railways downward, and endeavours to deal with strikes and lock-outs. In all directions it cares for the destitute and the helpless, from the vaccination of infants to the supervision of criminals. No doubt much of this work is badly done, but there is not much dispute that it ought to be done, and that a good deal of it is best done by the state. And this is no passing fancy, but a steady trend of thought, most marked in the most civilised states. There is not much of it, I fancy, in Honduras or Afghanistan. The tide will not recede—we shall not leave the destitute to chance help, or cease to hinder infection. On the contrary, there is every sign that it will advance further. We have all been more or less of socialists ever since the Poor Law of 1835 firmly planted the principle of socialism in the state; and the practical questions which now divide us concern rather means than ends, for we all profess the utmost devotion to the social welfare of the nation. So we are, at any rate, all agreed that social questions are much more complicated and more urgent than they used to be. This means that the social element of human nature is being rapidly developed along new lines. Some think it bids fair to swamp the individual; and though I do not believe this, it certainly plays a larger and a growing part in life.

It is time now to show more precisely what all this has to do with Arianism. If, then, man has in him that spark of the divine which is theologically called the image of God—and he must have it if the universe is rational—then the social element

which forms so large a part of human nature cannot be entirely wanting in the divine. Again, we believe that God is good, for otherwise we could give no account of goodness in ourselves. But goodness is a relation, and therefore implies a second. Were there but one being in the universe, there would be no room for goodness. If such goodness could be supposed incidental, it might possibly be satisfied by a transitory world; but if it is essential as it must be, the second it implies must be eternal. Yet, again, goodness means submission to a rule of goodness which is not conventional. If I am good to some unconscious infant, I confess our common duty to an ideal of goodness which is no creation of my will, however willing I may be to follow it. So if God, who is essentially good, is good to us, He is following a law of goodness which is no mere creation of His will, but the expression of His nature.

As for Arianism and the rest of the half-and-half systems which make the Lord more than man, yet not truly divine, they preach a solitary God surrounded indeed with creatures, but having no true second in the universe. His goodness is, therefore, will, not nature—at least we can never know for certain that it is anything more than the expression of a will subject to change. So of other qualities. Everything becomes arbitrary, and the Son of God Himself can give us no certainty if he is but a creature, and the true nature of the Father is unknown to him as well as to us.

This is all very well for an Eastern sultan with infirmities of temper; but is it a worthy conception of God? And if we can find a worthier, are we not bound to accept it? Now the *ὁμοούσιον* of the Nicene Council, which a logical necessity soon shaped into the full doctrines of the Trinity, simply means that the Son is as divine as the Father. It means nothing more, except that Christian men are not free to explain it away. But it makes a world of difference. If God spared not His own Son, we have a mighty argument; but it does not come to much if He only gave up Joseph's son. Here then and only here we reach firm ground at last. The prophet may tell his vision, but neither man nor angel—no being short of the eternal Son can tell us with full and final certainty the very heart of God our Father.

Again, whatever be the mysteries of the Trinity, there is a simple aspect of it which anyone can understand. It gives us the social element we were looking for; and by making it a relation of eternal Persons, it firmly plants it inside the divine

nature. Here is one reason why I believe that this, rather than some sort of Unitarianism, is the religion of the future. The half-and-half systems may suit the simple administration of past ages ; but we are learning from the infinite complexity of nature and society something of the infinite complexity of the divine expressed alike in the universe and by the doctrine of the Trinity. Shortly to say, Unitarianism in all its forms belongs to an order of thought which has ceased to satisfy either reason or conscience, and both the scientific and the social development make it everyday more visibly untenable. Ideals once transcended are for ever false; and if the deistic and agnostic mists are once more gathering round us, they will surely vanish in the brighter light which the revelation through society throws on things divine.

Discussion.

Canon Girdlestone thanked Professor Gwatkin, in the name of all present, for his thoughtful paper. He added that many of our theological difficulties arise from changes in the sense which we attach to words, *e.g.*, *Person*. He emphasised the distinction between Unitarianism which leads to the "hard impassive God" of Islam, and Biblical monotheism which involves eternal relationship answering to the words Fatherhood and Sonship, within the compass of the Godhead. The new theology was either Gnostic, on which Mansel's lectures on early heresies should be consulted, or Agnostic, which St. Paul touched in a sentence when he said "whom ye ignorantly worship, Him I declare unto you." Professor Drummond, who was brought up at the feet of Dr. Martineau, has done us good service by his study of St. John's Gospel, which he determines both on external and internal grounds to be the work of the disciple whom Jesus loved.

The Dean of Canterbury expressed his gratitude to Professor Gwatkin for his excellent paper.

Mr. Cory thought that there was a saying of St. Augustine which would always be found helpful towards the realisation of this doctrine, "There have always been a lover and a loved."

Professor Gwatkin.—There was still left the difficulty of the Third Person, yet he thought that he could see a way.

The Rev. H. J. R. MARSTON.—To venture to say anything on this subject is to launch out into deep waters. Professor Gwatkin has to-day said almost the last word on a subject that he has made his own. I hope that we may hear the Professor again in the Victoria Institute.

Perhaps, however, it is not self-evident that every phase of human society in its development must reflect an aspect of the Godhead. Each genuine phase has adumbrated some aspect of the Biblical God, not the naturalistic God.

There is then something to say for the Sovereignty of God once unchallenged, now so much impoverished and caricatured. The idea of Sovereignty is more needed than ever. As a life-long Liberal he hoped that there may be some such thing as a Divine Democracy.

Of the Sovereignty of God, Augustine and Calvin have caught glimpses, but St. John had a real vision.

It is my hope that all those who have ideals of Society, whether democratic or other, may gradually find all worthy speculations and ideals realised and transcended.

REMARKS BY LIEUT.-COLONEL ALVES.

Whilst there appear to be certain differences between ancient Arianism and the forms of modern Unitarianism, I think that, broadly speaking, both practically deny the unique Divinity of the Lord Jesus Christ; Gnosticism, on the other hand, denying His real humanity. Each of these opposing heresies would render useless His work on our behalf.

The reader of the paper has hinted that God can have no favourites; but is this correct? Abraham was God's friend; it is true that he was a man of great faith; but God must have foreseen that his descendants through Jacob would manifest what a writer on Scripture has called "a genius for perversity." Yet that nation—as a nation—was marked out for special favour; and, although at present in disgrace, is being preserved in order to be a blessing to the whole world, and also its head nation temporally. This is "Calvinism," so called, applied nationally.

As regards individuals, we cannot get rid of this ("Calvinistic") doctrine without destroying the Bible. To say nothing of others, Moses, Isaiah, Jeremiah, Paul, Peter and John held those doctrines

of grace ("Calvinism") which, I believe, all the Protestant Reformers held without exception.

The revelation is clear, that some are "chosen in Him (Christ) before the foundation of the world" (Eph. i, 4). This is more than an invitation, or free grace which calls, setting the will free to accept or reject; it is Sovereign grace which compels. All are not compelled; those who are, must be "Favourites."

I think that "Calvinism" has suffered in two ways; (1) in restricting salvation to those irresistibly called ("hyper-Calvinism"); (2) in restricting God's plan of salvation to these, and to those others called who accept the invitation. "Arminianism," if not as mischievous in one way as false, "Calvinism" in one direction, is worse in another, inasmuch as it leads men to suppose that they can come to Christ when they themselves choose, and not when God calls them. Both seem to me to narrow the scope of God's plan by the work of Jesus Christ through His Church and His nation; whereas He, through Paul, hints at a vast work extending through the Universe; see 1 Cor. vi, 1–3, and Ephesians i, 1–10. The Bible does not say that the case of those not called in this life is hopeless. 1 Peter iii, 18–22, and iv, 6, hints at a more populous Paradise, but not another or wider door.

I cannot go with one of the speakers in his hints at a Divine Democracy. Differences in degree and position are revealed where Christ bears rule; and the nearest approach to Democracy will be when, after the period known as "the ages of the ages" comes to an end, and everything contrary to God's mind is utterly destroyed out of existence, the Lord Jesus hands over the kingdom to God; even the Father. Even then, it is to me unthinkable that Our Redeemer should stand no higher than even the highest of His Redeemed.

504TH ORDINARY GENERAL MEETING.

MONDAY, MARCH 7TH, 1910.

THE REV. J. TUCKWELL, M.R.A.S., IN THE CHAIR.

The Minutes of the previous Meeting were read and confirmed. The announcement was then made of the impending election to fill eight vacancies on the Council, to take place on May 2nd.

The following paper was then read by the author :—

(*Illustrated by Lantern Slides.*)

AŠŠUR AND NINEVEH.

By THEOPHILUS G. PINCHES, LL.D., M.R.A.S.

Aššur.

OF all the little explanatory verses on the Old Testament there are probably but few which are of greater interest than that referring to the great cities of Assyria. It is that well-known verse 11 of the 10th chapter of Genesis, which, in the Revised Version, tells us that, "out of that land (Shinar or Babylonia) he (Nimrod, who is best identified with the Babylonian god Merodach) went forth into Assyria, and builded Nineveh, and Rehoboth-Ir, and Calah, and Resen between Nineveh and Calah (the same is the great city)." Whether it was Asshur or Nimrod who went forth from Babylonia or not is a matter of but minor importance, as it is the cities which were founded, and not the person who founded them, with which we have to deal.

A very important testimony to the great size of Nineveh is given in the Book of Jonah, where it is spoken of, in verse 2 of the third chapter, as "that great city," and further, in the third verse of the same chapter, as "an exceeding great city, of three days' journey," the distance referred to being commonly regarded as indicating its extent. Naturally, there is some difficulty in

estimating this from such a vague statement, for, admitting that the words are correctly applied, the distance traversed must necessarily depend on the speed of the traveller. Perhaps a preaching-journey, such as that upon which the prophet Jonah was engaged, was slower than an ordinary one, but taking as a rough estimate 10 miles a day, this would make about 30 miles as its greatest extent. Between Nineveh and Calah, however, there is nothing like this distance, so that another explanation will have to be found.

But though I shall refer, later on, to the size of Nineveh, the primary object of this paper is to describe the recent discoveries there and in the old capital, Aššur—a site which, strangely enough, seems not to be referred to in the tenth chapter of Genesis at all. Aššur, however, was a city of considerable extent, and, as the older capital, and the centre of an important branch of Assyrian religious life, a place of considerable importance. Situated between 40 and 50 miles south of Kouyunjik, the ancient Nineveh, Aššur, which is now called Qal'a Shergât, was first excavated by the late Sir Henry Layard, in 1852, when some fragments of the great historical cylinder of Tiglath-pileser I., with a few other objects, were found. Excavations were continued on the site in 1853, when other copies of the cylinder were discovered. One of the largest objects recovered at that time was the black basalt headless statue of Shalmaneser II., the king of the Black Obelisk, who came into contact with the Syrian League and Ahab, and received tribute from Jehu, son of Omri.

The date of the foundation of the city is naturally unknown to us, but it was in existence as early as 2000 years B.C., as Ḫammurabi testifies. He speaks of having "restored to the city, Aššur, its good genius," suggesting that the place had passed through a period of depression—in any case, whatever the misfortune was, Ḫammurabi would seem to claim to have remedied it.

The German excavations at Aššur, the city to which the eyes of English explorers had for long been turned, have added much to our knowledge of Assyrian history. About the time of the Babylonian king Abēšu, or Ebišu, ruled viceroy Ušpia, who seems to have been the founder of the temple of Aššur in the city of that name. This ruler was succeeded by Kikia, after whom came Ilu-šuma and his son Êrišum, both of whom were known, from bricks brought from the site by Sir Henry Layard, to have been viceroys of Aššur (*iššak Aššur*). Êrišum built anew the temple of Aššur, which was called Ê-ḫursag-kurkura

"the house of the mountain of the lands," but in the course of 179 years it fell into ruin, and was rebuilt by Šamši-Adad, viceroy of Aššur. Ikunum, who reigned after Êrišum, rebuilt the temple of the goddess Ereš-ki-gal, the queen of Hades so often referred to in the account of the Descent of the goddess Ištar to that region. At this early date the records are mainly architectural, but it is to be expected that something more of the history of the country may come to light, though as the viceroys of Assyria seem to have been under the suzerainty of Babylonia, their natural warlike nature would be somewhat hidden. It seems to be only when they became kings in their own right that those long and often tedious but exceedingly valuable historical records, giving details of their conquests, and recounting their relations with the countries around—relations generally the result of those conquests—meet our wondering gaze. The Assyrians seem not to have engaged in military exploits for the mere lust of conquest, but because they were ambitious, and wished to hand down their names to posterity as more renowned than any ruler who had preceded them.

According to Mr. Hormuzd Rassam's account, the site of Qal'a Shergāt, as Aššur is now called, is unlike that of the ruin-mounds of other Assyrian cities. Instead of standing out boldly and distinctly from the natural and artificial hills around, it is comparatively flat, the greater portion being simply a gradual slope upwards from south to north. When approaching it from the south or south-east, therefore, nothing can be seen except the ruins of the great temple-tower, Ê-ḫursag-kurkura, the lower boundary being simply a continuation of the natural hills at those points. Viewed from the north and north-west, however, the platform upon which the city is built has the appearance of a structure towering almost perpendicularly to a height of about 100 feet above the level of the plain.

It is at the north-east corner of the city-enclosure that the temple of the god Aššur, founded, apparently, by Ušpia, lies; and immediately adjoining it is the palace of Shalmaneser I. (about 1330 B.C.) and another small temple. The great *ziqqurat* or temple-tower lies a little farther to the W.S.W. Still farther to the same point is the palace of Aššur-naṣir-âpli (885 B.C.), and W.S.W. of that again, lies the most noteworthy ruin of the place, namely, the temple of Anu and Adad—the well-known god of the heavens and his son, Hadad or Rimmon, the god of the atmosphere. The westernmost erection is the terrace of the new palace of Tukulti-En-usāti (Tukulti-Ninip) I. (1300 B.C.), which seems to have been a building of considerable extent.

Among other erections may be mentioned the temple of Nebo, built—or more probably rebuilt—by Sin-šarru-iškun, the Saracos of the Greeks, under whom the fall of Nineveh and the domination of Assyria took place. This foundation contained a treasure-house of the goddess Tašmêtu, the spouse of Nebo. Another important building on the site was a temple to the goddess Ištar, who seems to have borne the name of Ninaittu. Numerous private houses and graves, some of them excellently constructed vaults, with terra cotta coffins, have been found. Of the smaller antiquities some examples have been published, but bas-reliefs similar to those found in such numbers at Nineveh and Khorsabad, are rare or non-existent. Concerning certain royal figures and stele I shall have something to say later on.

From the photographs which have been published it is satisfactory to notice that Mr. Rassam's description of the ruins is correct—the great *ziqqurat* or temple-tower is the only thing appearing prominently above the surface of the ground. Notwithstanding the interest of this structure I am compelled to leave it for the present, as I have not sufficient material for a good description of it. Later on, when a detailed account with restorations, similar to that treating of the temple dedicated to Anu and Adad, which has been so well described by Dr. Andrae, the chief explorer of the site, has appeared, I hope to return to the subject.

Though it is somewhat surprising, we probably know more about the comparatively worse-preserved temple of Anu and Hadad than about the great *ziqqurat* which was, in the days of its supremacy, such a prominent feature of the city. But the temple to these two gods is so interesting that a special monograph concerning it has been written by Dr. Andrae, the Director of the excavations, and it is on this account that the description which I am about to give of it is possible.

The lowest structures of the Anu-Adad temple are of Aššur-rêš-îši, who was the ancient builder, if not the founder, of this double shrine. This ruler, who was the father of the well-known Tiglath-pileser I., records his name on the bricks which his builders used, as follows:—

(1) *Aššur-rêš-îši* (2) *šangu Aššur* (3) *âpil Mutakkil-Nasku* (4) *šangu Aššur* (5) *âpil Aššur-dan* (6) *šangu Aššur-ma, banu bît Addi* (8) *u Anim.*

"Aššur-rêš-îši, priest of Aššur, son of Mutakkil-Nusku, priest of Aššur, son of Aššur-dan, priest of Aššu likewise, builder of the house of Adad and Anu."

This inscription is not produced by means of a brick-stamp, but is written by hand, probably with a rectangular stick of wood, a corner of which, pressed into the clay, forms the wedges—no matter what their shape—with which we are so familiar. The words are all usual ones, and the text is composed with a due regard to the rules of Assyrian grammar, as far as their ideographic system allowed. It is noteworthy that, in this and other inscriptions found on the site, the name of Adad precedes that of his father Anu—whether because he was the more popular god, or for some other reason, is uncertain.

Like all the structures of this class in Babylonia and Assyria, the corners of the buildings are directed, roughly, towards the cardinal points. Its rear looked therefore towards the northern city-wall, which sloped from north-east to south-west, and its front towards the south-west, facing the central portion of the city. The temple proper seems to have consisted of a rectangular terrace with its entrance on the site referred to, flanked by two towers, by which one gained access to a central court-yard, and thence into the rooms where the religious ceremonies were performed, the priests' private rooms, and those wherein the holy vessels and utensils were kept. As it was a double temple, the architects arranged the rooms in each portion symmetrically, and each god had the same number of rooms in the fane dedicated to him—four small rooms arranged round a central chamber which was apparently the sanctuary. The broad recess at the north-western end of each hall suggests that at that end lay the holy place, where the image of the god of the fane stood, and the priests performed their ceremonies. On each side of these rooms, at the angles of the north-western front, were the two massive temple-towers, which Dr. Andrae supposes to have been in four stages, access being gained to them from the terrace, and also, probably, from a corridor which ran between the chambers (dividing the temples from each other), or from the chambers themselves. Though no sanctuaries are shown at the tops of these temple-towers, it is not improbable that there was one in each case, similar to that of the temple of Belus at Babylon. It is to be noted, however, that a sanctuary at the top of every temple-tower was not an absolute necessity, as the ceremonies may have been performed in the open air. Dr. Andrae's restoration of the earlier structure, which I now describe, does not represent the outer walls as being decorated with those deeply-recessed panels which are such a characteristic of structures of this kind, both in Assyria

and in Babylonia. As will be seen later, however, this decoration was employed in the later structure.

It is needless to say that brick structures such as these were constantly needing repairs, and the successors of the builders were accustomed to regard it as their duty to carry them out. Tiglath-pileser I., the son and successor of Aššur-rêš-iši, fulfilled this task with great thoroughness, and records it in detail on his great cylinders, now preserved in the British Museum, and published in the *Cuneiform Inscriptions of Western Asia*, vol. i, pl. 15, l. 60 ff. This king states that the temple tower was built or founded by Šamši-Adad, viceroy of Aššur, about 1821 years B.C. It had been demolished by Aššur-dan, who ruled about 1200 B.C., but this king had not been able to rebuild it. For some reason which does not appear, Tiglath-pileser does not refer to the work of his father Aššur-rêš-iši—perhaps he only began the work towards the end of his reign, and Tiglath-pileser may have had the superintendence of it, for he expressly states that it was at the beginning of his reign that the gods ordered their dwellings to be rebuilt. He then made the bricks, cleared the site, reached the core, and laid the foundation upon the ancient nucleus—brickwork first, and then blocks of stone. He built it, he says, from its foundation to its battlements, and made it larger than before, and he rebuilt also the two great temple-towers, which were adapted to the dignity of the two gods' great divinity. Here it may be noted that translations similar to this were made before the discovery of the site, so that, if there were any doubt as to Assyriologists having found out the way to translate the wedge-written inscriptions, the temple of Anu and Adad would, in itself, suffice to prove beyond a doubt that the renderings were correct. The interior of the two-fold temple, he says, he made bright like the centre of the heavens, decorating its wall like the glory of the rising of the stars. Having founded the holy place, the shrine of their great divinity within it, he caused Anu and Adad, the great gods, to enter there, set them in their supreme seat, and thus gladdened their hearts.

After a description of the *Bît ḫamri*, which seems to have been the treasure-house attached to the temple, or to one of the two shrines (that of Adad) which it contained, Tiglath-pileser calls upon the gods whom he had thus honoured to bless him, and hear his supplication, granting fertility and plenty to his land, and in war and battle bringing him safely back, etc. He states that he had performed the usual ceremonies, anointing the memorial-slabs of Šamši-Adad, his father (ancestor), with oil, sacrificing a victim, and then restoring them to their place.

He asks that the future prince, when those temple-towers grew old and decayed, might treat his own inscriptions in the same way, and calls down a deadly curse, and all the displeasure of his gods, on any who should destroy his inscriptions. Tiglath-pileser's own inscriptions, impressed on the bricks of temple, read as follows:—

Tukulti-âpil-êšarra	Tiglath-pileser,
šangu Aššur mâr Aššur-rêš-îšî	priest of Aššur, son of Aššur-rêš-îšî,
šangu Aššur bît Adad bêli-šu	priest of Aššur, the house of Adad, his lord,
êpuš-ma ikṣir	he has (re)built and paved.

Time passed, and though the temple was in all probability repaired as occasion required by the successors of Tiglath-pileser I., it had reached such a state of decay by the time of Shalmaneser II. (859 B.C.) that that king thought himself justified in rebuilding it. It will be remembered that Shalmaneser II. was the king who came into conflict with the Syrian league, to which Ahab of Israel and Ben-Hadad of Damascus belonged. Inscriptions on what are called *ziqati*, found on the site, record the work which he executed on the temple as follows:—

"Shalmaneser, king of Assyria, son of Aššur-naṣir-âpli, king of Assyria."

[Here follow references to his conquests in Armenia, the West, Babylon, and the sacrifices which he offered in Borsippa, the renowned suburb-city of Babylon, of which he speaks also elsewhere. As the cradle of their religion, Babylonia, and especially the capital and the cities around, must have been a land of veritable romance to the pious Assyrian.]

"In those days the temple of Anu and Adad,
my lords, which earlier Tukulti-âpil-êšarra (Tiglath-pileser),
son of Aššur-rêš-îšî, son of Mutakkil-Nusku (had rebuilt), had fallen into ruin,
to its whole extent I built it anew.
I brought beams of cedar, (and) set them for (its) roof.
Let the future prince renew its ruin,
restore my written name to its place—
Aššur, Anu, Adad, will hear his prayer.
Let him restore my *ziqāti* to its place.
Month Mahur-îlani, day 5th, first year of my reign (or possibly, of my twenty expeditions).

From this we gather, that the restoration of the temple of

Anu and Adad by Shalmaneser II. was no mere work of simple repair, but a rebuilding of the structure, as, indeed, Andrae's plans indicate. The halls and rooms were to all appearance decorated with all the skill of the Assyrian artisans, and cedar, probably from Lebanon or Amanus, were used for the support of the flat roof of the outer structure. Contrary to what we should expect, the temple, when rebuilt, was smaller than the structure erected by Aššur-rêš-îšî, the father of Tiglath-pileser I. The design, it is true, was more symmetrical, but as the new structure was wanting in breadth, it must also have been wanting in boldness. The entrance seems to have been to the left of the centre of the terraced front elevation, and the central courtyard was smaller. It was from this last that access was gained to the rooms used for the ceremonies and for the furniture of the temple. Passing through extensive vestibules, the visitor reached the main halls, which, instead of recesses regarded as holy places (which were probably separated from the main halls by curtains), were provided with side-rooms on the right and left of the halls to which they belonged respectively. The two *siqquṛrāti*, to which access was probably obtained from the terrace above the chambers, were towers in stages similar to those of the earlier structure, but their outer walls were panelled, not plain. A fine view of the river to the north-west must have been obtained from these heights. The absence of formally straight lines in Dr. Andrae's restoration is not altogether unpleasing, and is, in fact, in accordance with the picture on the grant of land obtained for the proprietors of the *Daily Telegraph* by the late George Smith, and now in the British Museum. The carving on the stone in question is very rough, and the details are not, therefore, very marked, but it may be noted, that the shrine on the top is very distinctly shown, suggesting that similar erections may have existed on the similar buildings in the city of Aššur. After this, the restorations of Assyro-Babylonian temple-towers in Perrot and Chipiez's *History of Art in Chaldea* strike one as being rather formal.

Among those who repaired and restored the structure at a late date, Dr. Andrae mentions King Sargon of Assyria, the well-known ruler who captured Samaria. In Shalmaneser II.'s courtyard (which has, by the way, a very good well in the south-west corner), an excellent pavement of tiles almost exclusively of Sargon was discovered. The inscriptions thereon were in the two languages, Assyrian and dialectic Sumerian, and read as follows :—

"For Aššur, the father of the gods, his lord,
Sargon, king of the world, king of Assyria,
magnate of Babylon, king of Sumer and Akkad,
has caused this pavement to be laid, and with bricks of the sacred oven,
the pathway of the court of E-hursag-gal-kurkura
he has made bright like the day."*

This "pathway" finds a parallel in the festival-street at Babylon, and was probably for the processions of the gods when their statues were carried round to visit other shrines and temples, both of the city Aššur and the neighbouring towns.

One of the pictures published shows the entrance to the room designated F, looking from the courtyard. Before it is the pavement of Sargon, and below that, the older pavement. The earthen vessel near the centre is said to be a collecting vase, possibly for offerings.

The desolation which this once flourishing town and temple present may be gathered from the general view from the East, showing the remains of the old North and the late West temple-towers. On the left are the lowest foundation-courses of the courtyard-wall, and in the middle are the remains of walls of some of the rooms. The remains of the late West temple-tower are to be seen behind.

Naturally there is much to say concerning these interesting and extensive ruins, which testify, among many others, to the great and active life of the ancient cities of Assyria, at one time the scourge of the then known world. The walls and their gates, the numerous other temples, especially those of Aššur, Nebo, and Ereš-ki-gal, the Queen of Hades; the palaces; the platforms; which you have seen in the plan; and the "hunting-box" of Sennacherib, which lay outside the walls to the north-west, all present points of interest. Descriptions of these, however, will be best undertaken when satisfactory monographs

* The following are the two versions of this inscription of Sargon, and will give an idea of the differences of the two idioms :—

1. *Assyrian.*

Ana Aššur âbi ilâni bêli-šu Šarru-ukîn šar kiššati šar mât Aššur šakkanak Bâb-ili šar mât Šumeri u Akkadi ušalbin-ma agurre utuni élliti tallakti kisal Ê-ḫur-sag-gal-kurkurra kima ûme unammir.

2. *Sumerian.*

Aššur adda dimmerene lugalanir Šarru-ukin lugal kišara lugal mada Aššur-ge neuru Tindir lugal Kingi-Ura-bi segalurra udun azagga umenidudu neqin kisal Ê-ḫur-sag-gal-kurkurra û-dime ban-lah.

dealing with them are published, like that of Andrae upon the Temple of Anu and Adad, which has furnished material for this portion of the present paper.

Though the objects of art do not by any means equal in number to those from Nineveh, Calah and Khorsabad, there are still a few which are worthy of notice. One is a sixteen-sided column of basalt with a strange-looking capital, supposed to be of the time of Tiglath-pileser I. Another good specimen of Assyrian art consists of fragments of bronze on which chased figures in relief may be seen, reminding one of those magnificent brazen gates which Mr. Rassam was so fortunate as to discover at Balawat. This shows figures in procession, seemingly going to meet the Assyrian king, and introducing a smaller figure, apparently a child. There are several scenes on the Balawat gates which can be compared with this, and in the light of Shalmaneser's historical inscriptions, it is seen that the little personage is a princess who is represented, and that she is being surrendered by a conquered prince or chief to the Assyrian king to become one of his wives. The proportions seem not to be so well kept as in the case of the Balawat Gates, but the work in general is good.

Nineveh.

Aššur is regarded as having been the first capital of Assyria, and Nineveh the second; but Dr. Rogers lays claim to the honour of chief city of the kingdom for two others in addition—Calah and Khorsabad, the order being Aššur, Calah, Nineveh, Khorsabad (built by Sargon on the site of Maganubba), and then Nineveh again. If so, this is a case of kings proposing and God disposing, for notwithstanding all that Sargon did for Dûr-Sarru-ukîn, now Khorsabad, its importance declined after his death, and Sennacherib, his son, showered his favours on Nineveh, which remained the capital of the land until the downfall of the Assyrian monarchy in 606 B.C.

And it is apparently in consequence of what Sennacherib did for the city that its glory revived. Two German scholars, Messrs. Meissner and Rost, have edited and translated very successfully the inscriptions in which that king records his work there, so that we have had for a considerable time rather full details of his architectural, horticultural, and defensive achievements.

Lately, however, fresh attention has been attracted to them, for the British Museum has been fortunate enough to acquire another text—a prism similar to the monument known as the

Taylor Cylinder, inscribed for the same monarch. This text has, on its eight faces, no less than 740 lines of writing dealing with his campaigns and his architectural works. There is the usual honorific introduction, and this is followed by his first campaign, which was against Merodach-bal-adan; his second, directed against the Kassites and the Yašubi-galleans; his third, which passed in the land of Ḫatti, the territory of the Hittites, and was undertaken to chastise Hezekiah and punish the Ekronites; his fourth, which was against the small Chaldean kingdom of Bît-Yakîn; and his fifth, directed against certain states occupying the mountain-fastnesses of Mesopotamia. After these well-known narratives, however, we get details of two little-known military expeditions, in which Sennacherib did not personally take part, but which were led by his generals. The first of the two was against Kirua, ruler of the land of Que (Cilicia), whom he calls "city-chief" of Illubru, and describes as one of his officials. This man not being, as his name implies, an Assyrian, naturally thought to make himself independent of Assyrian rule, and to this end got the city of Ḫilakku (Cilicia) to revolt, and the inhabitants of the cities Ingirâ and Tarsus to rally to his side. These allies occupied and blocked the Cilician pass, hoping to be able to arrest the Assyrian troops in their advance. In this, however, they were unsuccessful, the forces sent against them being armed with all the thoroughness for which the Assyrians were renowned, and even more thoroughly than on former occasions. The Cilicians were first defeated "among the difficult mountains," and the cities of Ingirâ and Tarsus were captured and spoiled. Next came the siege of Illubru, carried on with the help of all kinds of warlike engines, and its fall followed in due course. Kirua, the governor, was captured, and much spoil taken. Having been brought to Nineveh, he met the fate which awaited him, that of flaying—whether alive or dead the record does not say. At the re-occupation of Illubru, which followed, Aššur's emblem was set up, and, facing it, the memorial slab which had been prepared for the purpose.

According to Polyhistor, Sennacherib proceeded against Cilicia in person, a statement which, if he be referring to the same campaign, must be regarded as incorrect. This historian also says that he fought with them a pitched battle, in which, though he suffered great loss, he was successful in defeating them, and erected on the spot a monument of his victory, consisting of a statue of himself, and a record of prowess "in Chaldean characters." Sennacherib does not mention

any statue, but there may well have been a bas-relief above the inscription to which he refers. Confirmation of Polyhistor's statement that Sennacherib rebuilt the city of Tarsus after the likeness of Babylon, and changed its name to Tharsis, may possibly be confirmed by records of a later date—if such ever come to light. Though it is not much, this new chapter in the history of the Apostle Paul's native city is interesting. It had already been taken by the Assyrian king Shalmaneser II., about 850 B.C., when Katî, the then ruler, was deposed, and his brother Kirrî placed on the throne in his stead.

The other campaign referred to was against Tilgarimmu, a city on the borders of Tubal, which Assyriologists have identified with the Biblical Togarmah—a comparison, however, which is not altogether satisfactory; though it may, by chance, turn out to be correct. This place was ruled by a king named Ḫidî, who had "consolidated" (such seems to be the meaning of the verbal form *irkusu*) "his kingdom," apparently meaning that he wished to be considered as independent of Assyria. Again the superior armament, and, it may be supposed, the organization of the Assyrians, prevailed; and after the usual siege, the city was taken and destroyed, and the gods of the people carried into captivity. At the end, Sennacherib mentions the amount of military supplies which he captured and distributed among his forces. This was apparently not an important expedition, but it added to the glory of his reign, and is on that account recorded.

But the longest section of the text is that detailing the work which Sennacherib did at Nineveh, his capital, to which he has devoted no less than 345 lines of writing. He describes the city as the place beloved by the goddess Ištar, wherein exist the shrines of all the gods and goddesses—and in this statement we may see why he thought more of Nineveh than of Dûr-Sarru-ukîn, his father's great foundation—the new city and royal residence did not appeal to him because it was a place of but little religious and historical interest. This view of his favour towards Nineveh is rather confirmed by the words which follow, wherein he goes on to say, that Nineveh is the eternal groundwork, the everlasting foundation, whose design had been fashioned and whose structure shone forth from of old with the writing of the (starry) heavens—practically a claim that it had a divine origin. It was a place craftily wrought, wherein was the seat of the oracle, and all kinds of art-works, every kind of shrine, treasure, and thing of delight (?). It was there that the kings his fathers had ruled the land of Assyria before him, and

directed the followers of the god Enlil, in which last we may, perhaps, understand the Babylonians as being meant. None of these kings, however, had beautified the city as he had done.

For the work which he had in view, therefore, he brought the people of Chaldea, the Arameans, the Mannites or Armenians, Que and Ḫilakku (both mentioned as countries, though in the historical part the latter appears as a city), the land of Pilišti or Philistia, and the land of Tyre. These nationalities, which had not submitted to his yoke, he placed in servitude, and they made bricks for the extension and decoration of the city.

The work which first appealed to him was the building of a palace for himself, and to this end he pulled down the former palace, the terrace and foundation of which had been destroyed by the Tebiltu, a violent stream, which since remote days had sought to reach the structure. In order to safeguard it in future, he turned aside the course of the river, and reclaimed, from another stream, the Khosr, a piece of land 340 cubits in length by 298 in breadth. The palace itself was enlarged, when rebuilt, to a length of 700 great *suklum* and a width of 440, and he caused palaces (that is, separate sections or divisions of the whole structure) to be built, and adorned with gold, silver, and all kinds of valuable woods. To this palace he added a gateway made after the likeness of that of a Hittite palace, and from the excavations which have been made on Hittite sites, it seems probable that this was a special arrangement of winged lions and bulls, such as the Assyrians had themselves been accustomed to employ for decorative purposes. I quote here Sennacherib's words:—

> " . . . a house of double doors (*i.e.*, porch)
> in the likeness of a palace of Ḫattu,
> I caused to be made opposite its gates."

It therefore seems clear that it is the arrangement which is referred to, and not the ornamentation. The lines which follow are characteristic of the East, the land of sweet odours and precious wood:—

> "Beams of cedar and cypress,
> whose scent is sweet, the products of Amanus
> and Sirara, the sacred* mountains,
> I caused to be set up over them."

In the shrines within the royal chambers Sennacherib opened *âpti birri*, which are regarded as meaning "light-holes," or windows, and in their gates (the gates of the shrines apparently)

* Or "the snow-capped."

he set up female winged colossi of white stone and ivory (or perhaps stone of the colour of ivory), which bore *illuru* (? columns) and whose claws were curved. "I set them up in their gates, and caused them to pass as a wonderment," says the king. If one might make a suggestion with regard to these interesting objects, it is that they were small and more of the nature of statuettes than of statues, and were in fact possibly the same as that beautiful winged lioness found by the late G. Smith at Nineveh in 1873–4. He describes it as a winged cow or bull (it is restored in accordance with this description) in fine yellow stone, with a human head surmounted by a cylindrical cap adorned with horns and rosette ornaments, wings rising from the shoulders, and a necklace round the neck. On the top of the wings, which stretch backwards, stands the base of a column in the usual Assyrian style. He describes it as being 3 inches high without the feet (which are wanting), 3 inches long, and having a breadth of 1½ inches. As the face is unbearded it is almost certainly intended for a female, and the absence of any traces of an udder makes it more probable that it is intended for a winged lioness-sphinx rather than a woman-headed cow.

Architectural details concerning the newly-erected palace follow. The recesses of the chambers were lighted "like the day," and the interiors were surrounded with decorative ornaments of silver and copper and with burnt brick and valuable stones, one of them being lapis-lazuli. Some of the great trees used in the construction of the palace had been brought, the king says, from secret places among the mountains of Sirara, their positions having been revealed to him by Aššur and Ištar, lovers of his priesthood. The stone (marble, or perhaps alabaster) used was regarded in the times of his fathers as a fit decoration for the sheath of a sword (implying that it was something rare), and was brought from the land or mountain of Ammanana, and a stone called *tur-mina-banda*, identified by Mr. L. W. King with *breccia*, which was used for the great receptacles of the palace, came from the city Kabridargilâ on the boundary of Til-Barsip (Birejik). The white limestone used for the winged bulls and female colossi, and other similar statues of alabaster came from the district of the city Balaṭu, near Nineveh.

These bulls and lions were made in a single piece of stone, and it is noteworthy that the transportation of similar objects, probably for the palace in question, is represented more than once on the slabs from Sennacherib's palace which were discovered by Layard and are now in the British Museum. It does

not require a very lengthy inspection of these gems of Assyrian art to realise that they are exceedingly instructive illustrations of the way in which the great Assyrian palaces were built. We see there the palace-platform being constructed, and the finished and unfinished human-headed bulls being dragged to the positions in which they were to be set up. The king speaks of the perfection of the form of the female colossi of marble:—

"Like glorious day their bodies were bright,"

and we can easily imagine the imposing effect which they had when they were new and fresh from the sculptor's hands, on the day when the palace was completed.

And here, in the course of his description, Sennacherib touches on another subject, namely, the casting of bronze. When, in early days, he says, the kings his fathers wished to make an image of themselves in bronze to set up in the palaces (or temples) they made all the artizans groan in their construction:—

"Without instruction, not understanding the matter,
for the work of their desire,
they poured out oil, the fleece of a sheep
they sheared within their lands."

This, as Mr. King points out, probably refers to some ceremony in which oil and a fleece were used, in order to bring good luck upon the work. Sennacherib, however, through the clever understanding which the divine prince Nin-igi-azaga (the god Ea, patron of handicrafts) had conferred upon him, combined with his own research and inquiry into the matter, was able to make "great columns of bronze," and colossal lions "open of knee"—probably meaning with the legs separated from each other, and not joined together with a core of metal.

"By the counsel of my understanding,
and the inquiry of my mind,
I formed the bronze-work, and
made its execution artistic.
Of great beams and framework,
the forms of 12 shining (?) lions,
with 12 bull-colossi
sublime, which were perfect as to form,
(and) 22 colossal heifers, upon whom
was lusty beauty, who were mantled with strength,
and vigour abounded,
according to the command of the god
I made moulds of clay, and

poured copper (bronze) therein—
as in the casting of half-shekel pieces
I completed their formation."

What was the improvement which Sennacherib effected? The want of a precise translation renders this doubtful, but we may, perhaps, guess that he had come to the conclusion that much labour, and also a considerable amount of metal, would be saved by casting these objects as a shell round a core of clay which, being constructed with a wooden framework, could afterwards be removed, and the same employed over and over again. In any case, the process here detailed is most interesting, and when more is known of the Assyrian technical terms, may even add something to our knowledge of the history of bronze-casting.

Two of these brass colossi, when finally produced, were overlaid with what is suggested to have been gilding, and were placed, with others of limestone and male and female colossi of alabaster, in the gates of the palaces. Numerous other details concerning the colossal bulls and lions which the king caused to be made follow, and he states that he made columns of bronze, and also of all the different kinds of wood which the Assyrians regarded as precious, for which the colossi seem to have formed supports, and the whole was erected as colonnades (?) in "his lordly dwelling." After this come references, apparently, to the bas-reliefs which the king caused to be carved, the slabs being described as having been produced wonderfully, and if this be the true rendering, the specimens in the British Museum confirm Sennacherib's words concerning them—they are wonderful.

Next comes Sennacherib's account of the irrigation works which he constructed. In order to have water daily in abundance, he caused swinging beams and brazen buckets to be fashioned, and having set up the necessary framework over the water-reservoirs and attached them thereto, they were used for the watering of the fields and plantations. Here we have a description of that well-known Eastern apparatus, the *shadouf*, which Sennacherib would seem to have introduced into Assyria—it is said from Egypt.

" . . . Those palaces I cause to be produced beautifully—
as for the vicinity of the palace, for the wonderment of multitudes of men
I raised its head—'The Palace which has no rival'
I called its name."

And then comes the description of the surroundings of the palace—the great park or plantation "like mount Amanus"

which he laid out, wherein were all herbs and fruit-trees, trees produced on the mountains and in the land of Chaldea (a plain low-lying and flat), and trees bearing wool. This, as my former colleague of the British Museum points out, must be a reference to the growing of cotton, as is shown by the statement, that it was used for the fabricating of clothing.

At this point he quits the references to his palaces, and speaks of his work on the city of Nineveh. From former days, he says, the area of its circuit had been 9,300 cubits, and the princes going before him had not built an inner and an outer wall. Here we have two rather surprising statements, for this estimate of its area is too small to accord with what we have learned from ancient writers, and the absence of defensive walls is not what we should have expected from the Assyrians. If true, however, it would show how remarkably confident they were that the city would not be taken by an enemy—it must have been indeed the city of a nation which trusted in its own power.

This state of things, however, he immediately proceeded to rectify, for he states that he increased the size of the city by 12,515 cubits, and from this portion of the record we gather that the *suklum* and the *ammat* or cubit were the same. The great wall, of which he records the laying of the foundation, he called "The Wall whose glory overthroweth the enemy." He made its brickwork 40 (? cubits) thick, which would probably not greatly exceed the estimate of the late George Smith, who reckoned it at about 50 feet, but added that excavation would probably decide that point—and we may add, that it would also, perhaps, decide the measure of the *suklum* or *ammat*. The height of the walls he raised to 180 *tipki*, which, according to Diodorus, should amount to about 100 feet. These were pierced by fifteen gates:—

> "To the four winds fifteen city-gates,
> before and behind, on both sides,
> for entering and going forth,
> I caused to be opened in it."

Then follow their names, with which, though they are sufficiently interesting, I will not tire you. As specimens of their nature, however, it may be mentioned that the gate of the god Aššur of the city of Aššur was called "May Aššur's viceroy be strong"; whilst "The Overwhelmer of the whole of the enemy," was the name of the gate of Sennacherib of the land of Ḫalzi—an indication, perhaps, of Sennacherib's birthplace. The gate of the Mesopotamian city of Ḫalah was called "The

Bringer of the produce of the wooded heights." The gate of Sin, whose name forms the first element of Sennacherib's own name, was called "Nannar (=Sin) the protector of the crown of my dominion," the moon god being "lord of the crown" in Assyro-Babylonian mythology. What would correspond with the "water gate" was called "Ea, the director of my water-springs"; and the Quay-gate was named "The Bringer-in of the tribute of the peoples." Interesting, also, is the name of the gate *Pakidat kalama*, "The guardian of everything," which was the gate of the tribute-palace or armoury—possibly a kind of museum wherein were placed all that the Assyrian king regarded as curious or precious in the way of tribute, gifts, and trophies. The identification of the fifteen Ninevite gates will add much to the interest attaching to the site of that ancient city.

Following on this, Sennacherib described what he did in the way of constructing the outer wall named *Bad-nig-erim-ḫulḫula* in the old Sumerian language, which he interprets as meaning "that which terrifies the enemy." This wall was constructed with foundations of enormous depth—as far down, in fact, as "the waters of the underground courses," at which point blocks of stone were placed as a foundation, and it was then carried up to the height fixed upon for the coping with further massive blocks. The object of the wall's great depth was to frustrate attempts at undermining in case the city should be besieged—a vain precaution, if the accounts of the taking of Nineveh be true, for it is said that some part of the wall was undermined by one of the rivers flowing near, and fell down; and that it was through the breach thus formed that the allied forces of the Medes, Babylonians, and others, entered. "I made its work skilfully," the king then says, as if satisfied with what he had done.

He then returns to the city itself, the area of which he enlarged, broadening its open spaces, and making it bright "like the day"—an improvement which Oriental cities often need. Above and below the city he then constructed plantations, and placed therein the vegetation of the mountains and the countries around—all the sweet-smelling herbs of the land of Heth (Palestine and Phœnicia), and certain plants called *murri*, among which, more than in their native places, fruitfulness increased. These and other plants he set therein, and planted them for his subjects—probably the higher, rather than the lower, classes of his people. A description of what he did to improve the water-supply for these plantations, and wherewith, at the same time, apparently, he watered all the people's orchards,

and a thousand cornfields above and below the city, forms a fit conclusion to this portion of the narrative.

To retard the current of the river Khosr the king constructed a swamp, in which its waters lost themselves. Reeds and rushes were planted within it, and wild fowl, wild swine, and apparently deer placed therein. All the trees which he planted throve exceedingly, in accordance with the word of the god. The reed-plantations prospered, the birds of heaven and the wild fowl of distant places built their nests, and the wild swine and forest-creatures spread abroad their young. The trees useful for building he used in the construction of his palaces—the trees bearing wool they stripped, and beat out for garments.

To celebrate the completion of the work a great festival was held, worthy of such a king, who, whatever may have been his conduct with regard to other nations, seems to have attended well to the needs of his own people. Assembling the gods and goddesses of Assyria in his palace, numerous victims were sacrificed, and gifts were offered. There was oil from the trees called *sirdû* (which may therefore have been the olive), and there was produce from the plantations more than in the lands whence the trees therein came. On that occasion, too, when the palace was dedicated, he saturated the heads of the people of his land with oil, probably from those trees, and filled their bodies with wine and mead. The inscription ends with the usual exhortation to those "among the king's his sons, whom Aššur should call for the shepherding of land and people," to repair the wall when it should fall into ruin; and having found the inscription inscribed with his name, to anoint it with oil, sacrifice a victim, and restore it to its place. "Aššur and Ištar will hear his prayers."

After this pious wish comes the date:—

"Month Ab, eponymy of Ilu-itti-ia, governor of Damascus."

In all probability many will say that we have here a view of the great and (it must be admitted) cruel conqueror in an entirely new light, namely, as the benefactor of his country. And if what he states be true, the question naturally arises: What modern ruler could say that he had done as much for his capital as Sennacherib claims to have done for Nineveh? And who shall say that he claimed unwarrantedly to be the benefactor of the great city? The sculptures from his palace exist to confirm his record. We see the winged bulls, of colossal size, lying down on the sledges on which they were transferred from the quarries to the site of the palace, sometimes placed uprightly,

and carefully propped up to prevent damage by breakage. The sledges, which the Assyrians called ships or boats, are being dragged and forced forward by means of enormous levers upon rollers by armies of workmen, the captives taken in his warlike expeditions—Armenians, Phœnicians, Tyrians, Cilicians, Chaldeans, and others, driven to strenuous effort by the whips of unsparing taskmasters and the loud voices of the directors of the work. In the background, behind the slaves toiling at the great cables and the levers, we see the soldiers of the guard, and behind these again extensive wooded hills. In other sculptured pictures, however, it must be the pleasure-grounds of the palace which are represented, with a row of trees, alternately tall and short, in the distance. This scene is placed on the banks of a river, whereon we see boats, and men astride on inflated skins. At another point we see the great king himself in his hand-chariot, superintending the work. Here the background consists of reeds and rushes, and we see the deer to which he apparently refers, and also a wild sow with a litter of young. One of Layard's pictures, which is described as a representation of an "Obelisk or stone in a boat," implies that these boat-like sledges were made to float or to be moved on land by means of the rollers referred to above. In this case the "boat" is in the water, and being dragged by long rows of labourers, many of whom are naked, and all seem to be toiling in the water. The ropes attached to the boat-like sledges or rafts are excessively long, and even in the incomplete state of the slabs as Layard saw them, 36 men to each may be counted. The great pioneer of Assyrian exploration gives, in his *Monuments of Nineveh*, second series, an excellent drawing of a winged bull and human figure from one of the gates of the old wall of Nineveh, showing, if any proof were needed, how very excellent the work of Sennacherib's sculptors was. It is said that some of the remains seen by Layard on the spot have been since his time destroyed, and if this be the case, it is a deplorable loss. Fortunately we have Layard's drawings, and know what they were like.

George Smith, in his *Assyrian Discoveries*, gives us a good account of Nineveh. He states that the north wall measures about $1\frac{1}{2}$ miles, the south rather more than half a mile, the east wall about $3\frac{1}{4}$ miles, and the west over $2\frac{1}{2}$ miles. No extension of the city outside the walls seems to have been recognised by the Assyrians, except that called *Rêbit Ninua*, probably meaning "the extension of Nineveh," which seems to have been on the north, stretching towards Khorsabad. It has been identified with great probability, as the Biblical Rehoboth-Ir. In the

Book of Jonah, however, Nineveh is stated to have been an exceeding great city of three days' journey, and that being the case, the explanation that Calah on the south and Khorsabad on the north were included seems to be very probable. The distance between those two extreme points is about 30 miles, which at 10 miles a day, would take the time required. Ovid, in his story of Pyramis and Thisbe, states that the tragedy which he relates took place near the pyramid at the entrance of Nineveh. This was the traditional tomb of Ninus, and may well have been the great temple-tower excavated by Layard at Calah, in which he found a long passage, the original object of which was difficult to determine, and it cannot be said therefore whether it had ever been used as a tomb or not. It is to be noted, moreover, that in Genesis x, 11, 12, Resen, between Nineveh and Calah, is described as being "the great city." As it seems never to be spoken of in the inscriptions (the only Resen mentioned having lain seemingly on the north of Nineveh proper), it could not have been a city of any dimensions, and this parenthetical description may therefore refer to all the sites mentioned. As Jonah's missionary visit to Nineveh took place during the reign of Jeroboam II., 783–743 B.C., Khorsabad must be excluded; but perhaps the extent of the united cities, "Nineveh, and Rehoboth-Ir, and Calah" (with Resen), was sufficiently great for a three days' preaching journey without taking the northern foundation of Sargon in.

Communication from the Rev. Dr. Irving.

As one who joined heartily in the unanimous vote of thanks to Dr. Pinches for his paper, every paragraph of which bristles with interest, I venture to touch upon a few points by way of eliciting fuller information, as I should have done had there been time for discussion when the paper was read.

(1) One would be glad to know to what extent animal or vegetable remains have been found in those buried cities. Such remains (like those found by Dr. Macalister in the ruins of Gezer and in all the three successive cities of that site) are of great interest for students of Anthropology. Professor Ridgeway of Cambridge, for example, has lately shown me hoof-bones ("coffin-bones") of *Equus* or *Asinus* completely calcified by a well-known natural process for which the soil, the building material, and the climate of Palestine furnish all the necessary conditions.

(2) On p. 161 Dr. Pinches speaks of the flat timbered roofs of the buildings ascribed to Shalmaneser II. It would seem that so late as the eighth century B.C. (and perhaps later) *gabled roofs* were unknown among those oriental nations of the Euphrates-Tigris region. This point is interesting as tending to confirm the surmise of Professor Ridgeway that the Celtic nations have to be accredited with the invention of the latter structure, through utilising horizontal branches of trees to support their tent-coverings in the primeval forests.

(3) It is very instructive to learn that the haughty Sennacherib, the mighty conqueror and destroyer of cities and small states, had a better side to his nature as a ruler and as a benefactor of his own people, though the hard and stern side of his character, in his attempt to crush Hezekiah, appears only in Holy Writ. We too often perhaps overlook the more humane side of the later Nebuchadnezzar shown in what he did for the later Babylon by way of founding a royal college and a system of competitive examinations for the more efficient training of higher civil servants, as recorded in Daniel i; a system which Cyrus ("God's Shepherd") seems to have continued and improved upon under the *régime* of the Medes and Persians. All this goes to show progress in the humanisation of those heathen peoples, and that the great monarchies of antiquity were really far from being mere phases of tyranny and bloodshed, as the evidence of the monuments and the unsupplemented records of the Old Testament may lead us to suppose.

(4) Intensely interesting to anthropologists is the information which is now given to us of the advanced working in bronze in the days of Sennacherib, and Dr. Pinches informs me that artefacts in copper and bronze (if not iron) can be traced back in those ancient Babylonian lands, to at least 3000 B.C.* Have we not here a clue to the mixed race that is incidentally mentioned (Tubal Cain in particular) in Gen. iv, 16–23, as having sprung from Cain and a pre-Adamic woman?

The later Hallstadt and La Tène ages (Early and Late Celtic) in Europe seem to have been anticipated in Sumerian lands by at

* This is a greater antiquity moreover than is assigned to the Minoan Period ("Bronze Age") of Crete. See Howes, *Crete the Forerunner of Greece* (1909).

least 2000 years. What the skill of the later Celtic artificers in bronze and iron (and gold) was, is well known. No fools (as many moderns airily suppose) were those ancients, who could apply the malleability of native copper (as in the copper-plated chariot of Sennacherib) or the alloying of tin with copper for casting purposes; nor were those, who, as simple observers of nature, could detect the lasting nature of the slab of diorite, on which Ḥammurabi's portrait and laws were incised, more than a millennium earlier.

(5) Then again the artistic power of the men, who drew and cast those figures on the bronze tablet of Sennacherib's time, strikes one as something surprising; and the more so when one looks at them more closely, and perceives the expression of agility, elegance of figure, nerve, and accuracy of detail in figure after figure of the horses thereon delineated. They bring out the qualities of the "wild horse of the mountains," to which Professor Maspero refers in his account of the "frenzies of Ishtar," and with that vigour of expression which we are learning to see in the early drawings of the horse by our palæolithic ancestors (see Boyd-Dawkins' *Cave Hunting*; and the writings of Professor J. Cossar Ewart).

A. IRVING, D.Sc.

NOTE ON THE ABOVE BY DR. PINCHES.

References to the animal and vegetable remains in Babylonian and Assyrian ruins are rare, and for this reason any that I may have come across in the descriptions I used escaped my notice. Gabled roofs seem to have occurred in Armenia (Botta, Pl. 141; Bonomi, *Nineveh and its Palaces*, 1878, p. 186).

There is no doubt that both the Babylonians and the Assyrians were most intelligent and energetic sections of the human race, and had made really good progress in arts and crafts at an exceedingly early date. Babylonian sculpture was probably hampered by dearth of stone, but the fragments which did fall into their hands were used with excellent effect and considerable success. The Assyrians were originally less advanced than the Babylonians, but the sculptures which have come down to us show that they speedily made up for lost time. About 640 B.C. marks the zenith of Assyrian art.

I am exceedingly obliged to the Rev. A. Irving for his most interesting and appreciative notes upon my paper.—T. G. P.

505TH ORDINARY GENERAL MEETING.

MONDAY, MARCH 21ST, 1910, 4.30 P.M.

HEYWOOD SMITH, ESQ., M.A., M.D., IN THE CHAIR.

The Minutes of the previous Meeting were read and confirmed.

The following elections were announced :—
As Member, T. B. Bishop, Esq.,
As Associate, The Rev. S. H. Wilkinson, F.R.G.S.,
As Missionary Associate, The Rev. E. A. L. Moore.

In the regrettable absence of the author the following paper was then read by his son, P. A. Irving, Esq., B.A. :—

LIGHT, LUMINARIES AND LIFE; IN CONNECTION WITH THE GENESIS ACCOUNT OF CREATION,

By Rev. A. IRVING, D.Sc., B.A.

(*Illustrated by lantern slides.*)

CONTENTS.

I. INTRODUCTION.

THIS paper being intended to be supplementary to my former paper,* on "Evolutionary Law in the Creation Story of Genesis," a few references to that paper are called for by what has passed since in public controversy, more especially that which appeared in the *Guardian* newspaper in the autumn of 1907.† Professor E. Hull was also good enough to bring that paper into prominence in the columns of the *Church Family*

* See *Trans. Vict. Inst.*, vol. xxxviii (1906).
† See the *Guardian*, Oct., Nov., Dec., 1907.

Newspaper in an article in defence of the thesis—"The Genesis Account of the Creation not inconsistent with the Geological Record."*

I am glad to know that my previous paper has been found both interesting and useful to many students (*pace* Professor Driver, of Oxford, and the feeble "Vaticanism" of Professor Sollas in the *Guardian*). In addition to what has appeared in print, I have a collection of private letters, some from entire strangers, expressing their appreciation of the line which I had taken and of the arguments of my paper,† which were partly repeated in controversy.

Among matters which, since my paper was read, have come under my notice, I feel bound to express my warmest appreciation of the paper read before the Church Congress by the Rev. G. T. Manley.‡ It was what might be expected from a man of Mr. Manley's academical and intellectual antecedents, who had so completely riddled the so-called philosophy of Huxley and Spencer several years before.§ Especially valuable are the remarks in his paper on the value and importance of giving closer attention to "apparent discrepancies." As he truly remarks,—"An attitude of inquiry is far different from the undesirable frame of mind, which looks upon the reconciliation of science with the Bible as a Chinese puzzle, and twists and forces them into agreement by some ingenious process . . . Current Science is only the teacher of its own generation, the Bible is the teacher of all the ages."‖ A fitting rebuke that to the rather flippant sneers of the Oxford Professor of Geology about "reconcilers."¶ Professor Sollas (the recent President of the Geological Society) should know that quibbling does not

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* See *C.F. Newspaper*, Oct. 2nd, 1908.

† These include such men as the Dean of Lincoln, the Headmaster of Eton, F. Hugh Capron (author of *The Conflict of Truth*), Rev. Arthur Carr, the Headmaster of Wellington, along with others, entire strangers to me; one long letter to that effect reaching me from a missionary in far distant Matabeleland, whose mind seemed relieved on finding the strong negations of the late Bishop Hicks (scientist as he was) combated in the pages of the *Guardian*. To one writer, Rev. A. J. S. Downer, I am much indebted.

‡ *Guardian*, Oct. 9th, 1907. Mr. Manley, as a Senior Wrangler and Fellow of his College, shows a more capable grasp of the scientific aspect of the "Genesis" question than does the learned and distinguished Hebraist of Oxford, to whom I shall have to refer in the sequel.

§ See *Christian Apologetics*, London (John Murray), 1903.

‖ *Guardian*, *loc. cit.*

¶ *Guardian*, Nov. 6th, 1907.

advance the cause of *truth*; and he ought to recollect, that each new attempt in that direction should be judged on its own merits, and not looked at through the haze which may have been created by earlier attempts made in a less advanced state of our knowledge. On several occasions I have felt it necessary, before this Institute and in the columns of the *Guardian*, to point out the fallacy of assigning to the utterances of even the highest authorities in science a *finality*, which they would be the last to claim for what seems to them the resultant outcome of the latest scientific advance. It was therefore satisfactory to find this contention of mine strongly supported two years ago by a member of the staff of Greenwich Observatory, who writes to me:—

"I was very glad that you laid emphasis at the Meeting on Wednesday* on the fact that there is no *finality* in Science. I think that that fact must always be kept in view as of first importance, when we are discussing the relation between Revelation and Science."†

I have been taken to task in several quarters for suggesting that the ancients, and in particular the writer of the Genesis Narrative, may have been possessed of more knowledge of nature by direct observation than we generally accredit them with. I dealt with that point as it turned up in controversy;‡ and it may suffice to remark here that the more one learns of the indications of such knowledge as possessed by prehistoric men, and of the ancient science of the Chinese,§ the more value one is compelled to attach to such references as are made in the prehistoric chapters (i to xi) of the Book of Genesis,‖ to such knowledge of practical application of nature to the wants of man, as was possessed by the men of at leas tthe Bronze and the Iron Ages, if not even by the Neolithic men. It is from people who touch science from the outside that such criticisms

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* The Annual Meeting of the Victoria Institute.

† Letter to the present writer, dated Aug. 21st, 1908, by Mr. E. W. Maunder.

‡ *Guardian*, Nov. 20th, 1907.

§ See Yu Tung Kwai, on the "Ancient Knowledge of Chemistry," in the *Times*, June 3rd, 1909, and the *Standard* of June 2nd.

‖ *E.g.*, the building of cities and the use of bronze (? copper) and iron by the impure race of Cain's descendants.

Sir Robert S. Ball, F.R.S., the Cambridge astronomer, remarks: "The discovery of Mercury was a brilliant achievement of prehistoric times. The early astronomer who accomplished that feat . . . merits our hearty admiration for his untutored acuteness and penetration" (*Story of the Heavens*, p. 290).

come, and it seems to have taken away the breath of a Cambridge Professor of Divinity, who writes to me:—"I am confident that the doctrine of a 'pre-Adamite man' is not the doctrine of the Bible." If by that is meant that the early chapters of the Bible are primarily concerned with the development of the race of Adam, centering itself at the Call of Abraham upon the chosen people and its history, to whom the special revelation was given, we may I think agree. But while we recognise that as "the doctrine" of the Bible, we may surely at the same time look for agreement between the glimpses given to us of earlier races, in those parenthetical verses (iv, 16–24) and what anthropological science has revealed to us of prehistoric man. It is therefore somewhat startling to find Professor Driver* writing, "Who could there have been to slay Cain? According to the existing Book of Genesis there could have been no one"! Yet the Book tells us that he found a people, among whom he took a wife, at a distance from his paternal home, in the land of the Nâdu, "the wanderers," the nomads, as the Stone Men undoubtedly were. This fact is blinked, and then the inference† is suggested that "Cain" is "a figure which belonged to a much later stage in the history of mankind." The speculations on this subject given in Dr. Driver's learned work are not very conclusive. He points to an "inconsistency, of which the narrator is evidently unconscious"; on which it is fair to ask why he should have been conscious of the "inconsistency," which is read into his narrative by the critics, who refuse to recognise (as he does) the existence of a pre-Adamic race? With this may be compared the preface to the story of Noah and the Flood contained in Genesis vi, 1–8, on which some interesting remarks by Mr. Henry Proctor‡ are very suggestive, although some adverse criticisms of Mr. Proctor's "Hebrew" have reached me from Cambridge.

At the time when my previous paper was read I was further taken to task by two of my critics, neither of whom is very prominent in the world of letters, for speaking of the Genesis account as a "poem,"§ as if they had never heard of "poems in prose." Yet so distinguished a scholar as the Dean of Lincoln did not hesitate to write to me at the time: "The

* *The Book of Genesis* (5th ed., 1906), p. 67.

† *Op. cit.*, p. 72.

‡ See *Trans. of Vict. Inst.*, vol. xl, pp. 74, 75. Discussion of Professor G. F. Wright's paper on "The Influence of the Glacial Epoch upon the Early History of Mankind."

§ See *Trans. Vict. Inst.*, vol. xxxviii.

criticism of your use of the term 'poem' is absurd. Longinus puts the 'Let there be light, etc.' by the side of the first passage of Homer, as types of 'the sublime' in style. You can have prose poems." Again, a very able contributor to the subsequent correspondence in the *Guardian** writes to me—"The objection that it has not poetical form seems to me a quibble, and a rather poor one. Some of the fienst poems in existence are in prose; *e.g.*, De Quincey's 'Levana, or our Lady of Sorrows.'" I was impelled to speak of it as a poem from the balanced proportion and the rhythmic swing of its thoughts, which seem to me to give it the stamp of poetic genius. Perhaps we all need to "think orientally" a little more than we are accustomed to do, in order rightly to appreciate it, or the Bible generally.

What I find in briefest outline in the poem may perhaps be put thus:—

From the first it was God (*Elohim*, a word of obscure derivation according to Dr. Driver)† who *was creating* the heaven and the earth; bringing into being the "waste and void" matter of the universe, with its marvellous properties imparted to it by the Creative Spirit, the primary result being *luminosity* (v. 3), as this "waste and void" matter (this matter in an ultra-gaseous state) became integrated by the energy of chemical affinity; *directing* the powers of inorganic nature (supplemented later on by the introduction of life); so that the inspired writer was able to reach the climax in ii, 3, summing it all up in the double category of the work "which God had *created* and *made*," all culminating in man, a being endowed with spiritual faculties and powers.

This will be found to agree with the last paragraph of my previous paper, which does not clash very much with the *credo*, to which Dr. Driver‡ confessed in the last stage of the controversy, except on the question of the sequence of the phenomena, which are associated with the third and fourth "days." That question is dealt with at length in the present paper. It has long been a puzzle to me, as to why the writer, if he meant a literal "day," should have gone out of his way in each case to define it by "an evening and a morning," instead of phrasing it in accordance with the natural sequence of things.

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* Rev. A. J. S. Downer (*ibid.*, Dec. 18th, 1907).

† *Genesis*, 6th ed., p. 402.

‡ *Guardian*, Dec. 11th, 1907. See also my reply to that (*ibid.*, Dec. 18th, 1907).

One more point may, I hope, be permitted here. The more one compares the Genesis poem with the 90th Psalm, the more one finds of community of thought in the two. The latter has been described as "perhaps the most sublime of human compositions."*

If we want to get behind the narrative of Genesis at the thoughts of God floating in the mind of the author of it, it is to this 90th Psalm that we may, I think, fairly look. An impartial perusal of Bishop Perowne's introduction to this psalm will enable anyone to see how feeble is the case that has been made out by the critics against the traditional heading, "A Prayer of Moses, the man of God"; and we may fairly claim that the same lofty conception of the Divine Immanence with the Divine Transcendence behind it all, which characterises the psalm, may be found in the Genesis poem.

The case against the Mosaic authorship of the psalm may be said to be "not proven"; and a close comparison of the internal evidence found in the community of the ideas, which run through the two documents, ought in common fairness to be taken into account by those who would assign a later—even an Exilic date—to the Genesis document.†

The dogmatic style which characterises the assertion of the "higher critics," must be taken for what it is worth; more especially after the collapse of the contentions of that school in the matter of the historicity of the *Acts of the Apostles*."‡

II. Some General Points further Considered.

(A) *The Geocentric Conception of the Universe.*

In the controversy, to which reference has been made Professor Driver§ had the hardihood to say that the Genesis account of creation is *geocentric*, and therefore "false." How on earth could it be otherwise than geocentric? That however does not make it *false*, unless it can be shown that those observations of the heavenly bodies which were fitted into that conception were false. *Empirical* it certainly is; but empiricism is a matter of degree; and we might equally say of such a dogma as the Lyellian uniformitarian doctrine, which long dominated

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* See Perowne, *The Psalms*, vol. ii, p. 157.

† See letter from Dr. Dukinfield Astley, *Guardian*, Nov. 6th, 1907.

‡ See Sir Wm. Ramsay's Paper, "Exploration of Asia Minor," etc., *Trans. Vict. Inst.*, vol. xxxix.

§ *Guardian*, Nov. 20th, 1907.

geological thought in this country, that it was empirical. The astronomers of the earliest civilizations known to us, and probably even Neolithic men,* had very ingenious ways of recording and classifying their observations of the apparent movements of the celestial bodies; and, so far from being "false" were these, that they went a good way towards laying the basis of the *Kalendar*, by using the geocentric conception, upon which the *Nautical Almanack* in use to-day is constructed.†

Professor Maspero‡ tells us that "the Chaldæans had conducted astronomical observations from remote antiquity," centuries anterior to the earliest date ever assigned to the Book of Genesis, and with such a degree of accuracy as to be able to foretell eclipses; and though their notions of the causes were affected by their "vain imaginations," the observations were not falsified by that. One can follow Mr. E. Walter Maunder, F.R.A.S., of the Greenwich Observatory, much more readily than Professor Driver (even with Professor Bonney's endorsement,)§ when, in his Address to the Victoria Institute,‖ on "The Bible and Astronomy," he tells us that "The Astronomy of [Genesis i] is indeed primitive and simple in character, but it is the astronomy of observation. It concerns the observed brightness of the sun, moon, and stars. But it is not myth; there is not the faintest deification of sun, or moon, or stars, or of spiritism. There is no confusion of ideas; no anthropomorphic treatment of sun or moon. The astronomy of the chapter is sane and simple, and (we may truly say, to the very small extent to which it goes) scientific." So the astronomer. Is it not possible for the mind of the geologist to be too geoconcentrated? It certainly seems that it was, for the quarter of a century or so which held the geological mind in the swaddling bands of uniformitarian empiricism, before it was forced to open its windows to the side-lights of astronomy, chemistry and physics.¶

One thing that impressed itself upon my mind in the

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* *E.g.*, at Avebury and Stonehenge.

† See letter by Mr. H. W. Morley in the *Guardian*, Nov. 27th, 1907.

‡ *Dawn of Civilization* (trans. Maclure). S.P.C.K., p. 775.

§ *C.F. Newspaper*, Oct. 9th, 1908.

‖ *Trans*, vol. xl.

¶ *Cf.* Friday Lecture at the British Association, Bath Meeting (1888) by T. G. Bonney, F.R.S., on "the Foundation Stones of the Earth's Crust," and the Address to Section C on "Evolutionary Geology," by J. W. Sollas, F.R.S., in 1900; also *Chemical and Physical Studies*, etc., by myself (1889).

controversy in the *Guardian* of 1907, to which reference is made in the present paper, was the apparent incapacity of Professor Driver to think in terms of scientific thought. That eminent Hebraist is not serving the cause of *truth*, by including in the earlier chapters of his *Genesis* feeble attempts to give the results of later investigations of great scientific questions cast in the mould of his own mind, and then resorting to the art of dialectic "fence" to maintain them for consumption by his pupils in the Oxford lecture-room. Such a process amounts to dogmatism on matters on which he has no claim whatever (so far as I know) to speak as an expert; and involves the fallacy of assuming finality for the conclusions of scientists themselves. It would be better, I think, if Dr. Driver would substitute for his little homœopathic doses of "science" a good "bibliography" of the subject, which could be simply added to from time to time, and would do far more to open the minds of theological students to the meaning and nature of science.

It is only fair to recollect that in his last letter dealing with this subject,* Dr. Driver corrects himself to some extent, when he speaks of "the *imperfect* science of antiquity." I think, however, that he would find very few Fellows of the Royal Society who would not be prepared to tell him that the science even of the twentieth century is "imperfect." Every Presidential Address to the British Association emphasises the fact.

(B) *The "Firmament"* (Hebrew *Expanse*).

Dr. Christopher Wordsworth (no mean Hebrew scholar) tells us in his *Commentary* that the Hebrew word *rakia* means "literally an *expanse*, not necessarily solid, but simply extended." The *LXX* render it by the Greek word στερέωμα, in which we may perhaps trace the influence of Egyptian mythology. Then the Vulgate translated that by *firmamentum*, which carries more the idea of something rigid, as a prop or support. But I would suggest that we are under no logical necessity of forcing into the Hebrew word *rakia* the conceptions of later ages and cultures involved in the words στερέωμα and *firmamentum*. It was therefore with no little surprise that I found a professor of theology, who is moreover a fair Hebrew scholar, saying in a letter to me a short time ago,† "Why the very idea of a 'firmament,' *the inverted bowl of the sky*, belongs

* *Guardian*, Dec. 11th, 1907.

† Following apparently the writer of the article "Creation," in Hastings' *Dictionary of the Bible*.

to a geocentric conception of the universe, doesn't it?" My reply was that we are not bound to the word "firmament" in its secondary (and poetic) meaning; and that, if you substitute the true word *expanse* the difficulty vanishes, and we get a *scientific fact* stated, the geocentric conception notwithstanding. It would seem almost that the poetic idea, as expressed (*e.g.*) in Addison's well-known couplet—

> "The spacious *firmament* on high,
> And all the blue ethereal sky,"

had so interwoven itself with modern literature that it required more moral courage than the Revisers of 1884 possessed, for them to boldly translate *rakia* by *expanse* in the text.

Let us consider the three definite statements:—

v. 14.—"Let there be lights *in* the firmament of heaven";
v. 15.—"Let them be for lights *in* the firmament of the heaven";
v. 17.—"God set them *in* the firmament of the heaven."

We shall have to deal with these more at length later on. For the present we do well to see what lead they give us as to the idea present in the mind of the writer of this chapter, when he used the word *rakia* in these places, and at an earlier stage of the narrative (v. 6, 7, 8). The most hostile critic will surely refrain from imputing to him such puzzle-headedness as to make him mean one thing by the word in the earlier passage and a totally different thing in the later. He identifies the expanse with "heaven," to which he does not even hint at assigning a limit. And if, by all canons of criticism, we have the common fairness to allow him to use the word in the two passages *consistently*, we are driven to the conclusion that when he spoke of "the waters above the firmament" in the earlier passage, as divided by it from the waters under the firmament (terrestrial waters) he placed the waters above the firmament *beyond* the region of space in which the great luminaries appeared to move. If this be admitted, then we may further assert that to him "the waters above the firmament" meant simply the nebulous and slightly luminous (or illuminated?) masses of the "Milky Way," which in those oriental skies, and to the keen sight of people living so much in the open air, could hardly fail to suggest the idea of fluidity. It is surprising to find this rather knotty point (where "science" must have something to say) evaded by Professor Driver in his *Genesis* (5th ed.). At any rate, I have failed to find it squarely dealt with in that most valuable and learned work.

III. The Solar Earth.

For a long time (see my previous paper to this Society) it was easy to point to a "manifest absurdity" in the Mosaic Cosmogony, since that represents the appearance of *light* at the first stage, while the celestial luminaries are represented as not appearing before the fourth. Such shallow criticism is now seen to be based, not on knowledge but on ignorance, since the fuller comparative study of the Solar System in recent years, and the extension backwards in time of the physical history of this globe, in the light of the great law of Dissipation of Energy and all that it involves, has given us a new mental perspective. The results of investigation on such lines have made it practically certain that our planet, in common with other members of the system, has passed through what Zöllner years ago called the "solar phase" of its history; and the results of the application of telescopic photography to astronomy have revealed things to us in the "spiral nebulæ," which confirm my suggestion of more than twenty years ago as to the *nucleate origin of the planets*.* This hypothesis in a somewhat modified form has been more recently adopted by Messrs. Chamberlin and Salisbury in their great text book of Geology. In other words this dark ball, which now revolves round the sun, was in the remote past self-luminous, as the central orb of the system is to-day. Assuming that the elements appeared in the nebula in a state of elemental dissociation, as they appear to exist in the tails of the comets,† then *combustion* on an inconceivably enormous scale would go on during that solar stage to produce not only steam (H_2O), but also the oxides of the metals, of silicon and of carbon, which together form well over 90 per cent. of the constituent materials of the rocks, which make up the present lithosphere of the planet. If it did not involve the use of language too technical for the present occasion it would not be difficult to indicate roughly from the teaching of the higher chemistry the order in which such oxidation probably proceeded; and I go so far as to assert that we should arrive at results which would render the assumptions which underlie the theory as to the salinity of the hydrosphere propounded

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* See my *Chemical and Physical Studies*, etc. (Longmans, 1899), pp. 22–24, also my previous paper, "Evolutionary Law, etc.," § IV, and *Trans. Vict. Inst.*, vol. xxxvii, pp. 210 ff.; also the "Note" at the end of this section.

† *Cf.* letter to the *Times* by Sir Robert S. Ball, F.R.S. (Feb. 10th, 1910).

in recent years by Professor Joly, altogether untenable. I had that in my mind when, in my previous paper, I spoke of the "diminution of the salinity of ocean waters" during the geological ages, as one of the conditions making for advance in the evolution of organic life.

Let us go a step further in the evolution of this planet. Owing to its comparative smallness the earth has long since passed its solar phase, though it has not yet reached the senile condition of the smaller planet Mars. By loss of heat through radiation into space, and by concentration under the influence of gravitation a stage was reached at which this globe consisted of a molten ball rotating in space, but for a long period of time enveloped in such a dense mantle of vaporous and gaseous matter (not water-vapour only), that the radiation of heat from the incandescent globe must have been effectually retarded, owing to the low conductivity of the vaporous envelope. Very great changes must have occurred during this long-continued "pre-oceanic stage," as I have called it,* of our planet's history, before the first portions of steam condensed into water upon its surface at a temperature much higher than that at which water boils under the pressure of our present atmosphere, which we measure daily by means of the barometer.† It has yet to be shown, I think, that the "Crystalline Schists" may not have their special characters accounted for by their production then through mineral changes in the presence of highly-superheated steam; conditions which would admit of such a kind of "sedimentation" as some petrologists perceive in them. The contention of mine more than twenty years ago that they represent the first-formed "crust" has since been endorsed by such an eminent geologist as Dr. Andrew C. Lawson,‡ the Professor of Geology in the University of California.

Note to III.—The paragraph in which I definitely put forward the idea of the *nucleate origin of the planets* runs as follows:—

"Given a nebulous mass of matter in a state of elemental dissociation and losing heat by radiation into space, a point must be reached, at which condensation of certain elements (those possessed of the highest condensation-temperatures and the least potential

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* See *Chemical and Physical Studies on the Metamorphism of Rocks.* The mathematicians like Kelvin and G. Darwin seem to persistently overlook this, and the geologists seem to fail to understand it, which is not perhaps to be wondered at.

† See A. Irving (*op. cit.*); also letters to *Nature*, vol. lxxii, pp. 8 and 79.

‡ See *Bull. Geol. Soc. of America*, March, 1890.

energy of chemical affinity) must set in. As a direct result of this, concentration into a nucleus must follow from the law of universal attraction. As the nucleus (the embryo-sphere) is thus formed, latent heat is set free, and the temperature of the nucleus is raised, giving off its heat by radiation, to be absorbed for the most part by the surrounding nebulous matter, and ultimately lost by radiation into space. As dissipation of energy progresses, further condensation must follow, the newly-condensed matter gravitating towards the nucleus, every increase of mass in this increasing the force of gravitation."

In the light of this, which was published in 1889, but is now out of print, I think my remarks upon Dr. Warren Upham's paper (*Trans. Vict. Inst.*, xxxvii) were fully justified. (Through the great kindness of Mr. E. W. Maunder, I am able to illustrate this by a few lantern slides from the Greenwich Observatory.)

IV. Early Life on this Planet.

We may proceed next to trace in the light of science, the sequence of development of this planet as a member of the solar system, when the early oceanic waters condensed upon the surface. As steam was more and more condensed, with the gradual lowering of temperature, there must have been gradual dilution of the saturated brine, in which were dissolved the salts (chiefly sodium chloride) previously formed synthetically in "the dry way" during the "pre-oceanic stage," as the teaching of the higher chemistry ("physical chemistry") compels us to believe; and we brush aside the fundamental conception of Joly's theory, upon which he has attempted to calculate the age of the ocean.* Oxygen, nitrogen, and carbon were present (the last-named as carbon-dioxide, CO_2, the result of the combustion of carbon during the solar phase) in the atmosphere and in the waters under the partial pressures of the respective gases; and these constitute along with the hydrogen of the water (H_2O) the most important elements of all those forms of matter with which *life* is known to be associated on this globe. It is the essential function of vegetable life to take up crude mineral matter to build up the *protoplasm*, which forms the "physical basis of life," as this comes under human observation; although it may be equally true, as the late Dr. Burden Sanderson† pointed out, to say that "life (in

* See *The Age of the Earth*, by Professor J. W. Sollas, F.R.S.

† See his Presidential Address, British Association, Nottingham, 1893.

another sense) is the basis of protoplasm." That power of building up the mineral constituents of our planet into living material,* is a function which animals in general do not possess. There seems to be little room therefore for doubt that the earliest living cells belonged to the vegetable kingdom. In the early Cambrian rocks, there is evidence of a practical differentiation of the animal from the vegetable; and we must suppose that the lowest forms of animal life began to feed upon vegetable matter, only as yet elaborated into very simple forms, and for a length of time attaining to no higher development than that of cellular cryptogams (algæ, lichens, etc.). Some light was needed for this, but not very strong light, such as we receive from the direct rays of the sun. In fact, reasoning from what we can actually observe of the conditions most favourable to the reproduction and development of such low living forms, we may safely infer that a permanent diffused light, accompanied by warmth and moisture, such as prevailed upon the earth universally in very early times, would be most favourable to the organic advance at that stage. And there is plenty of evidence to show that such conditions prevailed on this globe through the Cambrian and Silurian periods of its history; and to a less degree during the Devonian and Carboniferous periods, when the great developments of continental regions were outlined along with the permanent ocean basins, after our planet had passed through that stage of planetary development, during which there was practically a universal ocean,† retarding the cooling of the lithosphere, owing to the non-conductivity of water for heat, though allowing of transmission of heat upwards by convection currents. The physical conditions under which the enormous development of vascular cryptogams characteristic of later Palæozoic time took place, were—we may fairly believe—those of warmth and a moist atmosphere surcharged with CO_2,‡ with the further alteration

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* But everywhere in the presence of the elements of water. Lionel Beale, *Trans. Vict. Inst.*, vol. xxxiv.

† In the *Guardian* (Nov. 6th, 1907) Professor Driver made his professorial *confrère* Professor Sollas to say, in his characteristic manner, "Geologists know nothing of an universal ocean." It was easy to answer him, as I did; but he was made to contradict himself, when he endorsed, as "accepted universally by all geologists" (*ibid.*, Nov. 27th, 1907), the "table of succession of life on this globe" (*loc. cit.*), from which no other inference than the "universal ocean" view is deducible as I pointed out then (*ibid.*, Dec. 4th, 1907).

‡ "Surcharged," as compared with the present atmosphere.

of that atmosphere (as the result of further cooling), and the increasing intensity of the light-giving power of the central orb of our system. I have discussed all this elsewhere.* Here it may suffice to quote the conclusion at which Lord Kelvin (the "Prince" of Scientists) arrived after many years spent in investigating this profound problem. Towards the end of his address to the Victoria Institute on "The Age of the Earth" in 1897† Kelvin remarked :—

"Whatever may have been the true history of our atmosphere, it seems certain that, if sunlight was ready, the earth was also ready, within a few hundreds of centuries after *the rocky consolidation of the earth's surface.* But was the sun ready? The well-founded dynamical theory of the sun's heat, worked out and discussed by Helmholtz, Newcomb, and myself says No, if the consolidation of the earth took place so long ago as fifty million years; the solid earth must in that case have waited another twenty or thirty million years for the sun to be anything like as warm as at present. If the consolidation of the earth was finished twenty or twenty-five million years ago, the sun was probably ready though not nearly so warm as at present; yet warm enough to support some kind of vegetable and animal life upon the earth."

Not apparently so familiar with these speculations as he might have been, the satire of Professor Sollas‡ was rather cheap. He does me too much honour to suggest that all this is merely "Mr. Irving's Science," for it is simply a deduction from the science of Lord Kelvin, Helmholtz and Newcomb, three intellectual giants in the world of physical science (*stricto sensu*) representative of the science of Britain, Germany, and America respectively. It raises a suspicion that geological science in this country is tainted in some quarters with the pseudoscientific spirit and methods of the "higher criticism."

The teaching of Lord Kelvin has not been, I think, materially affected by what we have learned since of the recently discovered body *radium*, which has however revealed a mode of *storage and transmission of heat energy* previously

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* *Trans. Vict. Inst.* (vol. xxxvii) and *Guardian*, Oct., Nov., Dec., 1907. By the courtesy of Dr. Horace Brown, F.R.S., I have also had an opportunity of perusing the MS. of the paper he read before the joint sections C and K of the British Association. He agreed with me that the effects upon Angiosperms (as in the Kew experiments), are not conclusive as to the effect upon Cryptogams.

† *Trans. Vict. Inst.*, vol. xxix (1897).

‡ *Guardian*, Nov. 6th, 1907.

unsuspected by most scientists. A little careful thought enables the scientific imagination to see vast possibilities of intimate relationship between various elements, under such conditions of high temperature and planetary pressure, continued through immense periods of time, as are altogether beyond the reach of the most powerful laboratory appliances.*

For reasons indicated above, and from other considerations, we may extend the interval beyond what Lord Kelvin suggests, for the early stages of the evolution of life, as it was manifested in those early forms, which represent the flora and the fauna of our globe down to the Carboniferous Period, when the atmosphere was by no means so clear as we know it in our experience,† and vast forests of vascular cryptogams (ferns, mosses, lycopods, etc.) grew and flourished in the feebly illuminated warm atmosphere with such luxuriance as they have never attained to since. There would seem to be no valid reason for denying that our earth passed through the condition in which the giant planet Jupiter appears to exist at present, and gradually advanced to those terrestrial conditions, which we know to be most favourable to the growth of the higher Cryptogams, so luxuriant and abundant in later Palæozoic time; and we may fairly contend that the period of time roughly estimated by Kelvin since that stage of the earth's history as 25 millions of years, would amply suffice for the further evolution of this globe and of the fossilized forms embedded in the strata during the Secondary, Tertiary, and Quaternary stages of its history. Temporarily and locally such conditions may have partially recurred, here and there, as evidenced by the coal-seams (marked however by a different cryptogamous flora) of the Lower Keuper of Germany and the Alps, the Lias of Europe and Asia, the Dogger, the Wealden, the Cretaceous, and in the Tertiary formations, allowance being made for drift-wood as the leading material of the Brown Coal. Even at the present time it is possible to meet with those dusky and moist conditions favourable to the undergrowth of a sort of "carboniferous" flora, as we know from the observations of Hochstetter (quoted by Zittel‡) in the North Island of New Zealand, and from personal observations of my friend Dr. Gybbon Spilsbury in the forest-region of the Amazon.

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* Compare Supplementary Note A, to my previous paper to this Institute.

† Except under occasional local conditions, as in a London fog.

‡ *Aus der Urzeit*, p. 256.

I have omitted the consideration of *Fungi* here, with their anomalous physiological function in the absence of chlorophyll. It has long seemed to me conceivable that enormous and rapid fungus growths in the dusky dank atmosphere of later Palæozoic times, may account for much of the spore-containing material of the coal-seams, possibly washed down from the early continental regions by water.

V. The Birth of the Moon.

We begin now to see the possibility of both marine and terrestrial vegetation appearing on this planet and reaching a fairly high stage of development before the sun appeared as a *definite luminary orb* to the earth itself. But what of the moon? It is necessary to remind ourselves that the inspired writer does not pretend to tell us anything as to the *modus operandi* of their origin; and he tells us nothing as to the time when they were made. He only recognizes them here as *set for lights in the heaven to give light upon the earth,* and to be for signs and for seasons, for days and for years; and this fits in with our conception of the sequence of things from the inferences which science justifies, as indicated in brief outline only in this paper. Well, the moon at its birth was probably thrown off the earth in a way with which Sir Robert Ball, F.R.S., the Cambridge Astronomer (following up the calculations of Sir George Darwin, F.R.S.) has made us familiar for some years past.* The writer of Genesis knew nothing of that portentous event, though it would be impossible to say what great ideas may not have flitted through his brain. At all events *he deals only with the moon as a luminary to the earth.* To argue therefore, as it was argued by Professor Driver—that according to the Genesis account the moon must have been thrown off the earth after vegetation appeared upon this globe involves a strange misconception. If the moon (according to the latest computations) was thrown off from the molten earth fifty million years ago, and (as we follow Lord Kelvin) the sun had not entered by contraction upon the "solar phase" before some twenty-five million years ago, ample time would seem to be allowed in the interval, for that development, up to a certain stage, of vegetable and animal life (both marine and terrestrial), of which the geological record

* On the authority of Professor Turner of Oxford, Professor Driver tells us that this is considered by astronomers to have taken place about 50,000,000 years ago. (*Guardian*, Oct. 23rd, 1907.)

informs us. During that vast interval the moon (with a mass about one-eightieth of that of the earth) must have soon lost its feeble initial luminosity, and revolved as a dark satellite round the earth, *becoming effective as a luminary only later on, when the solar rays became sufficiently powerful to strongly illuminate it.** This was pointed out by myself in the *Guardian*; but the point was entirely missed by the distinguished Professor of Hebrew at Oxford, who simply met the argument by a reiteration of his previous fallacy.

Having answered objections then, and put the matter more fully in the present paper, I repeat, that, however he may have got the idea, the inspired writer, in introducing the sun and moon (*quâ luminaries*) at a stage when vegetable evolution had made considerable advance, gives expression to an idea, which does not conflict with the latest conclusions of science. As I read the passage, the statement—"He made the stars also"—is parenthetical, and simply reminds us that they were also embraced in the same range of the monotheistic idea of creation. We ought fairly to allow for a certain amount of temporal overlap, if not even parallelism, when we have dismissed from our minds the notion of "the days" as indicating periods of time, and become possessed of the far grander and more ennobling conception of them, as representing so many definite "phases of Creative Will and Thought realised."†

By a closer study in the light of advancing science of such apparent discrepancies as those dealt with in this paper and elsewhere, we are brought nearer to the acceptance of the thesis—"The Genesis account of Creation not inconsistent with the teaching of Geology";‡ and the truth of this is not affected by the fact that the Holy Scriptures were never intended to teach men the Sciences of Nature. May we not say with Mr. Manley§ that, so far as the Creation story is concerned, the grand old Book still stands out surviving the tides of criticism that have rolled over it, like the primæval rocks of the earth itself?

Note to V.—Those tides, in the early stages (when the moon was nearer the earth and the attraction of its mass upon terrestrial water

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* The time required for the cooling of the Moon compared with the time required for the cooling of the Earth would be (*cet. par*) as $1 : 80^3$ or as 1 : 512,000.

† See further my previous paper, "Evolutionary Law, etc.": also the *Guardian*, Oct. 30th, 1907.

‡ Professor Edward Hull, F.R.S., in the *Church Family Newspaper*, Oct. 2nd, 1908.

§ *Guardian*, Oct. 9th, 1907.

greater in the inverse proportion to the squares of the distances) were much greater and more frequent than the tides of the present ocean, as Sir Robert Ball taught us long ago. On this point I wrote more than twenty years ago (see *Chem. and Phys. Studies, etc.*, p. 91):—"On the supposition that the 'crust' had sufficiently cooled to allow of a general condensation of water upon it, the vast accumulations of the materials of the Cambrian slates, grits, and conglomerates can be understood as resulting from the destruction, and deposition of sedimentary detritus from the cooled slaggy crust and its volcanic ejectamenta by the great tidal waves which swept over and levelled down the inequalities of that crust, even though (as some have thought*) there may have been no very general elevation of dry land above the ocean-waters in the Cambrian and Silurian periods." Those conglomerates, etc., have of course partaken in the great earth-movements since, which have resulted in the building of the present continents and mountain systems; and it would be a marvel if the contained blocks did not here and there simulate such signs of "glaciation" (smoothing, polishing, striation and scarring) as have been shown by Professor Albert Heim of Zürich† to occur in slow long-continued earth-movements. When these things are considered, the value of the evidence lately produced by Professor P. E. Coleman,‡ and the recorded evidence of a similar nature in the Permian conglomerates of South Africa, India and Australia, is very largely discounted as evidence of *glaciation*. Such a notion is opposed to an overwhelming mass of cosmic evidence.

VI. Life in General.

In concluding his address to this Institute§ from which I have quoted above, Lord Kelvin said: "Mathematics and dynamics fail us when we contemplate the earth fitted for life but lifeless, and try to imagine the commencement of life upon it. This certainly did not take place by any action of chemistry or electricity, or crystalline grouping of molecules under the influence of force, or by any possible fortuitous concourse of atoms. We must pause, face to face with the mystery and miracle of the creation of living creatures."

This is profoundly true. Later on (in 1903) I heard Kelvin emphasize this with all the force of his great personality in his

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* See references above to the *Guardian* correspondence.

† "Bergstürze," *Geol. Mag.* (March, 1883).

‡ See *Nature* (Nov. 17th, 1909).

§ *Trans. Vict. Inst.*, vol. xxix; compare Lionel Beale, F.R.S., *ibid.*, vol. xxxv.

remarks on a lecture by Professor George Henslow at University College.*

He remarked that "in the coming into existence, or the growth, or the continuance of the combinations presented in the bodies of living things, scientific thought is compelled to accept the idea of Creative Power." Again, "it is not in dead matter that we live and move and have our being, but in the *creating and directive power*, which science compels us to accept as an article of belief. . . . We have an unknown object put before us in science. In thinking of that we are all agnostics. We only know God in His works: but we are absolutely forced by science to believe with perfect confidence in a Directive Power—in an influence other than physical, or dynamical, or electric forces." He refers to a conversation many years before with Liebig, when they were walking together in the country. To the question put to him, whether he believed that the grass and flowers around grew by mere chemical force, the illustrious chemist replied,—"No, no more than I could believe that a book of botany describing them grew by mere chemical force"; and (adds Kelvin) "every action of human free will is a miracle to chemical, physical, and mathematical science." So we fall back upon creation as the process of Divine Will and Thought realising itself in life and form; and upon evolution directed to ends, as the Divine Method, though the Hand which guides it still wears the glove of mystery.

Attempts are made in one direction and another to pierce the veil, but without much success. One of the latest of these speculations has been put before the scientific world by the accomplished physiologist, Professor Starling, of University College, London.† It is an extremely interesting—one may almost say fascinating—address, as we are led on through the various stages in the evolution of the animal world to see how functional development goes *pari passu* with cerebral development. But the *crux* is—as ever—at the first step. Professor Starling attempts, with not much more success than Haeckel before him, to explain this by a bold hypothesis. He attempts to account for the *origin of life*, by the accidental building-up of *endothermic* compounds, "during those chaotic chemical

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* "Present Day Rationalism, with an Examination of Darwinism." (*Christian Apologetics*, London: John Murray, 1903.)

† Presidential Address to Section I of the British Association, Winnipeg Meeting, 1909, by E. H. Starling, M.D., F.R.S.

interchanges which accompanied the cooling-down of the molten surface of the earth, some compound being probably formed with absorption of heat, endowed with the property of polymerisation and of growth at the expense of the surrounding material." A rather big assumption, to which the physicist and the chemist are entitled to cry "Halt!" and to decline to be included under the little pronoun "we," when the learned physiologist says—"We can imagine" that to be "the first step in the evolution of life"; and further suggests that under such conditions "some complex analogous to the present chlorophyll corpuscles" could be formed. We have the right to ask him if he has not overlooked the conditions of exceedingly high pressure and temperature which then existed at and near the surface of the globe in "the pre-oceanic stage" of its history, or forgotten the rather narrow range of temperature within which life as we know it can manifest itself. The building-up of highly complex *mineral molecules* by an *endothermic* process under great heat and pressure, and their subsequent resolution *exothermally* into more stable molecules of less complexity has been long known to science. I discussed it myself years ago*; and it has long seemed to me that here we get near the true account of the genesis and behaviour of such a complex as *radium*; but Professor Starling would hesitate, I fancy, to suggest that radium even with all its wonderful properties, is an organic compound, or endowed in any way with life. Pressure applied hydrostatically makes for crystallisation in the densest and most stable form which the particular body can assume, as I showed more than twenty years ago.† But this implies an internal fixity of atoms, which is opposed to *the free atomic movement*, characteristic of the internal economy of the chlorophyll corpuscle.‡

We can follow Professor Starling more easily when he speaks of "methods adopted by organisms for their self-preservation in the production of some artificial surroundings, which protect from the buffeting of environmental changes." This is however a way of putting the facts, which gives the "go-by" to the Darwinian notion of *chance adaptation*; it recognizes "directivity"; it introduces the idea of working for ends; and it leaves us face to face with what Asa Gray§ calls "the mystery

* *Geological Magazine*, July, 1891.

† *Chem. and Phys. Studies*, etc., Section "Metatropy."

‡ See my letter in *Nature* (June, 1905), on "the Romance of the Nitrogen Atom," and the correspondence *loc. cit.*

§ *Religion and Science*, Scribner, New York.

of a beginning," which is involved in every variation favourable to advance. The early stage of adaptation, to which Starling refer sin the case of the *Cœlenterata*, may well be the beginning of an evolutionary process, which attained its minimum in the *Cephalopoda*, where we witness an extraordinary blunting-off of that process at the close of the Mesozoic Age in the extinction of the *Ammonitidæ* and the *Belemnitidæ*, leaving the cuttle-fish and the nautilus to represent the narrowed-down development of the series in modern seas; the whole of that evolution lying, it would appear, quite outside that which is beginning to appear from the researches of Dr. Gaskell* (to which Dr. Smith Woodward† has drawn attention) to have proceeded in quite another line through the *Arthropoda*.

On the one line, it seems, that *brain* is the fundamental basis of development, on the other *stomach*, with their respective functions predominating in the one case or the other. The Darwinian guess about the Ascidian or the *Tunicata* seems to fall through.

Dr. Starling's treatment of the subject seems to clash very seriously with the scientific romancing of Dr. F. Darwin about "Memory in Plants," a year or two before, in his Address to the Botanical Section. More sane are the remarks of the President of the Queckett Microscopical Club in May last.‡ After referring to Kant's confession of *awe* at the contemplation of "the starry heavens" without us and the "moral law" within us, Professor Minchin recognizes a third source of "wonder in the contemplation of the simplest living things, as revealed by the microscope, in the combination of apparent simplicity with infinitive complexity, and of extreme minuteness with the most extraordinary powers." In an amœba (*e.g.*) we see "a minute creature without definite parts or organs, which nevertheless exercises all the functions of *life*, and exhibits the germ of every faculty which we possess." What, again, he asks, "can be more wonderful to contemplate than that peculiarities in the complex mental endowment and physical structure of a human being can be transmitted from one generation to the next through the medium of a spermatozöon, the tiniest cell in the human body, in which the microscope reveals only a structure of the simplest kind?"

So it remains that where people, whose science consists in the manipulation of scientific phraseology (with more or less

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* *Nature*, May 13th, 1909.
† Address to Section C (Geology), Winnipeg Meeting, 1909.
‡ See *Nature* of that date.

literary skill), strut upon the stage, the real student of science uncovers his head with a sense of awe and mystery, and can share the humility of Lessing, when in his *Streitschriften* he writes: "If God should hold in His right hand all truth, and in His left hand the ever active desire to seek for truth though the condition be of perpetual error, I would humbly ask for the contents of the left hand saying, 'Father, give me this; pure truth is only for Thee.'"

VII. Human Life.

The physical laws which come under "the law of universal causation"* reveal to the believing man of science one phase of the Divine Immanence, and Life in its manifold manifestations reveals to us another phase. In the latter phase we see the more direct revelation of the Divine Transcendence which is behind all phenomena. There is yet a third phase within our ken of the Divine Immanence; and that is to be found and observed, and inferences drawn from it, in all that region of consciousness, which has to do with reasoned thought and reflection, with those powers of the human mind by which scientific investigation is carried on, with the affections and instincts of the soul, and in that still higher plane of consciousness which belongs to the realm of spirit and to the faculty of worship. It is here surely that our perceptive faculties realize most directly the Divine Transcendence. For, as life is not the same in kind as gravitation or chemical affinity or electric force, nor the sum of all these together, there is manifestly something of another kind or order included in it; and in that something we recognize another phase of Creative Will and Thought. Just so in the spiritual nature of man there is a something superadded which is no part or factor of mere physical life; and in that too we can recognize a third and higher phase of Creative Will and Thought. And we can only conceive of the spiritual nature of God and His Fatherhood, through what is highest and best in ourselves, as Christ Himself teaches us.

The late Aubrey Moore, a keen student, in his brilliant essay in *Lux Mundi*, on "the Christian doctrine of God," has well remarked—"We do not read our full selves into the lower world [of being], because we are higher than it; we do not transfer [in thought] to God all that belongs to our own self-

* See J. S. Mill, *Logic*, B. iii, c. 5.

consciousness, because we know that He is infinitely greater than we are. But we should be wrong not to interpret Him in the highest category within our reach, and think of Him as self-conscious life." Add to this Will or Volition, and we get the fundamentals of *personality*. Here perhaps we get nearest to the true inwardness of the phrase, "In the image of God," by which the inspired writer of Genesis designates the highest act known to us of Creative Thought and Will, where there appears the very topstone—the crown and summit of the progressive creation, with its "groaning and travailing in pain" —in painful effort, which is written upon the whole sentient creation, from the first dawn of conscious life on this globe, to the present, as the universal law of Redemption through sacrifice works itself out.*

In what the Bible teaches us of the Ādhām (the *Man*), as distinct from the *Homo*, a race (the presence of which on this globe the Genesis cast of the traditions of prehistoric times assumes before the appearance of Adam and his progeny) we have a differentiation indicated in the general stream of human life on this planet. The race of the Adhām is endowed with those spiritual powers and faculties and capabilities for response to spiritual influences, which mark off the "Man" of Scripture and philosophy, as a being distinct from *Homo sapiens*. Along with these endowments comes in the crowning intellectual gift of *language* or *speech*, the essential instrument of that evolutionary illumination of the human mind, which is written upon the history of recorded thought, from its inception in the earliest Sumerian script, or the unknown vocables of Neolithic man, to the finished structure of the Greek language as an instrument of thought.†

As I said a year or two ago,‡ in reply to criticisms of a previous letter of mine from the pens of Mr. Woods Smyth and Dr. Dukinfield Astley, "Somehow and somewhere a being possessed of higher endowments than those of a mere highly intelligent biped does appear on the stage of the world; and I think it has yet to be shown that the conception of an Adamic race, such as we can form from the Creation story of Genesis, clothed in oriental figure and hyperbole, conflicts substantially with the evidence that can be drawn from true science." The paragraph is too long to quote here *in extenso*.

* St. Paul, Romans viii, 22.

† *Cf.* an interesting article on "Heredity and Tradition" in the *Times* of June 22nd, 1910.

‡ *Guardian*, Dec. 23rd, 1908.

but it is easily accessible. As regards the time-age of Man (in the wider sense) on this planet, much (I have pointed out, *loc. cit*) depends upon our definition of the terms *Man* and *Homo*, and I give reasons for bringing down Dr. Astley's positive assertion that its duration reaches 80,000 to 120,000 years,* to something more like a fourth of such estimate. To me, as a geologist, it seems preposterous to build up a piece of theory—as Dubois has done—upon such flimsy evidence as he has been able to produce. We have no evidence even that the anthropoid fragments which he found belonged to the same individual; and it may be seriously questioned, whether, in the want of a geological survey, the assignment of the deposits in which those remains were found to the later Tertiary is anything more than guesswork. We are not justified in reasoning from the recognized succession of superficial deposits in Europe, where the glacial epoch furnishes us with something like a definite horizon, to an unsurveyed region in the heart of the Tropics. Anyone, moreover, who has like myself recently been engaged in an investigation involving exact correlation of later deposits, in which the later Tertiaries shade off in some regions into the Quaternary, as in Britain the post-glacial Pleistocene shades off into Post-pleistocene and recent alluvial deposits, knows how exceedingly difficult it is to get conclusive evidence as to the exact place in the time succession of a given superficial deposit, where redeposition has often to be allowed for, unless we can get clear evidence derived from contemporaneous fossils, and can make pretty sure that such remains as occur are not derived from older strata. I am not aware that anything like such conclusive evidence has been brought forward by Dubois for his *Pithecanthropus erectus*.

During the past year the scientific world has had its curiosity aroused by the announcement of the discovery of a massive human jaw under some 80 to 90 feet of stratified diluvial sand at Mauer in the Neckar Valley, near Heidelberg—a locality with which I am pretty familiar. There is an excellent model of the jaw in the Geological Department of the Museum of Natural History at Kensington, with a modern human jaw placed above it for comparison. To Dr. C. W. Andrews, F.R.S., who kindly drew my attention to it, I am indebted for a perusal of Schoetensack's Monograph on this supposed late Tertiary "man," which he named *Homo heidelbergensis*. It is a magnificent piece of descriptive work; but unfortunately the

* Following Prof. T. Rupert Jones, F.R.S., and others of the Lyell School.

conclusion of its author, as to the age to which the individual is to be assigned, is mercilessly cut up by Dr. Emil Werth, who has shown that he belonged to about the middle of the Glacial period. He shows that *H. heidelbergensis* does not represent the Diluvial Eolithic age (so-called), still less is he a type of such a creature as Tertiary man; and that "the end of the Tertiary period was as remotely behind him as his ancient Chellean culture is behind us."* It seems that this criticism from Werth appeared too late for the use of Professor Windle, F.R.S., in the new edition of his valuable work, *Remains of the Prehistoric Age in England* (new ed.), p. 307.

Within the last few weeks, another most important "find" has turned up,† this time a fairly complete skeleton of a Palæolithic *homo*, in the Dordogne, which has been identified as of the early Mousterian age, and therefore nearly contemporaneous with the *homo* of the Neckar Valley. The remains have been carefully preserved and removed to Paris for complete examination. Here again no evidence appears to be forthcoming, which would date the appearance of the *homo* further back than 20,000 years.

And as regards the time-age of "man," in the wider sense, upon this planet, if we accept the conclusions of Dr. G. F. Wright, and his American geological *confrères*,‡ drawn from what appears valid evidence, and allow 10,000 years since the retreat of the ice§ and if we further accept the latest conclusions of the French savants, in allowing 20,000 years to carry us back to the beginning of the Mousterian age, with its lowest possible degree of culture, as the artefacts of that age prove, there is not much left behind that, which we can assign with any great degree of certainty to the presence even of the *homo*. And as regards the intermediate periods, the Solutrean and the Madelainean, there may have been a certain amount of temporal overlap, so that mere addition of inferred time-periods may mislead us as to the aggregate.

With such increasing evidence, as it comes to be sifted, we are surely warned more and more against following the speculations of some, who, upon very flimsy evidence, attempt to date

* See *Nature*, Nov. 25th, 1909, p. 105; also *Globus*, Bd. xcvi, No. 1 (Vieweg, Braunschweig).

† See *Nature*, Feb. 24th, 1910 (and the photograph of "la Squelette de la Ferrasie" in *La Nature*, 25 Décembre, 1909, p. 51).

‡ *Trans. Vict. Inst.*, vol. xl.

§ The late Sir Joseph Prestwich, F.R.S., the Oxford Professor of Geology, arrived at a similar conclusion.

back the first appearance of the *homo* on this planet, to hundreds of thousands of years. But whatever the date of his first appearance may be—and perhaps we shall never know—I think we may fairly contend that Man, as he is represented to us in the Adhām of the early chapters of Genesis, appears at a much more recent date, and that he received, as a special endowment from his Creator, those faculties which carry with them *moral responsibility*. This contention was sustained by me in the *Guardian*,* and challenged by Dr. Astley and Mr. Woods Smyth. The latter gentleman (who is known in this Institute) maintained that "evolution is sufficient to account for the whole chain of sequences from the *Protistæ* to *Man* in the highest sense." I had only to let him refute himself; for after elaborating this statement in the first paragraph of his letter (Dec. 23), he occupied the second half of his letter in contending for what constructively amounts to a special Divine interposition at the incoming of man (*sc.* more than *homo*) upon the stage of Creation. He even quoted Samuel Laing (for what his opinion may be worth) as saying that "there is no evidence of any people having arisen by themselves out of a state of savagery." He continues—"This then is the most significant place in human history; this is the time when the same Divine Being, who had been disciplining life for long ages up to man's estate by natural conditions, now, at the demand of, and in harmony with, the position man had reached, came into intelligent converse with His intelligent creature in a new and higher form." So Mr. Woods Smyth, I may fairly think, surrenders his case to my contention all the way through, that something more (and more special) than *evolution* in the Darwinian, or the Spencerian, or the Haeckelian sense of the word, is required to account for all the cognizable facts. (See further *Trans. Vict. Inst.*, vol. xl, pp. 136–139). He seems to fall into line with the dictum of the great Apostle (I Cor. xv, 46), "That is not first which is spiritual, but that which is natural; then that which is spiritual." We cannot in the nature of things expect to find any physical record of this. The important point is that (so far as we can see) the teaching of Science leaves us free to accept the view of the place assigned to the Ādhām (the Man) in the pictorial grouping of facts about Man as the centre, which is put before us with much legendary embellishment in the second Genesis description of the Creation, and of Man's place in it, as

* Dec. 9th and 23rd, 1908.

that of a being possessed (potentially or actually) of *endowments of a higher order* than the rest of that Creation. We have much yet to learn, no doubt, on this supremely interesting question; but I doubt if we shall ever explain, by any evolutionary theory, the possession by Man of "the Inner Light," the God-consciousness seen in its full development in the Second Ādhām.

Discussion.

On the conclusion of the paper the Chairman expressed the thanks of the meeting to Mr. Irving for so ably supplying his father's place, and the great regret that must be felt by all that Dr. Irving could not himself be present to take part in the discussion of his extremely interesting paper. They all hoped that Dr. Irving would soon be restored to health.

Dr. Woods Smyth.—We have listened to an able paper which has been excellently well read by Dr. Irving's son. With the criticism of Canon Driver's views I entirely agree, yet he *mis*-directs the views of the great majority of the clergy and ministers of the churches. Gesenius and Kalisch, rather than Wordsworth, are our chief authorities for translating the word for "firmament" as an *expanse*. Dr. Irving's idea, that the writer of Genesis i, regarded the Milky Way as the waters above the firmament is, I believe, doubly untenable. The writer of the cosmogony did not write from observation, but from Divine inspiration. The waters above the firmament are the clouds which are not vapour but true water. They often lie in seas above the firmament, roll in waves and break in spray upon mountain summits. The "firmament" is also used in a more extended sense than this. The views of Lord Kelvin which Dr. Irving adopts, were refuted at the Cambridge meeting of the British Association—the folding of the crust of the earth render Kelvin's view, that the earth solidified from centre to circumference, an impossibility. Professor Sollas has adopted Kelvin's view, and finds it necessary to regard the earth as having been a frozen globe for about twenty millions of years! Now when the sun would have gained sufficient power to melt this frozen globe, his

fierce sunshine would have rendered the era of warmth, moisture and dim light, of which Dr. Irving speaks, an impossibility. Again the "directivity" in which the doctor believes, is rejected by every accredited authority on the doctrine of evolution. The idea of interference in man's evolution is not Dr. Irving's, but is A. R. Wallace's, who considered that some ultra-natural interference was necessary to complete the creation of man. Among our highest authorities on man's genesis, Wallace here stands alone. I regret exceedingly in this nexus, that Dr. Irving has greatly misrepresented my views, and in a form of words which I hope he regrets. I have clearly taught that Evolution (a Ministry of God), was all-sufficient for man's creation, and to a degree of perfection not possessed by any man living on the earth to-day (*vide Victoria Institute Transactions*, vol. xxxviii, p. 214). But that evolution possessed no means of satisfying man's aspirations for endless life, and that these aspirations were met by the revelation of God recorded in Genesis. I was first enabled to perceive this important truth, and to publish it 37 years ago, while yet a young man.

Rev. JOHN TUCKWELL, M.R.A.S.—Mr. Chairman, may I be allowed to express my great appreciation of the paper to which we have just listened. But with reference to the suggestion made by yourself, sir, that the first verse of Genesis may be regarded as separated by a wide interval of time from the second, I do not think that can be sustained. The first verse is a general statement of the whole creative work of God. The second verse takes up the creative history of the earth from its gaseous or nebulous condition just as one might say "Sir Christopher Wren built St. Paul's Cathedral," and then proceed to give a separate account of the building of the nave. The Hebrew verb *hayah*—"the earth *was* without form and void"—is the substantive verb and cannot correctly be translated "the earth *became*." The LXX accordingly translates it not by γίνομαι, "to become," but by εἰμί, "to be." Besides, if this story is only a superficial story of something which took place in six solar days, then it is not the actual story of the creation of our world at all, and scientific research has never found any trace or shadow of any such creation. Moreover there are certain forms of mammalian life indicated by the Hebrew word translated "cattle" which are found hundreds of feet below the earliest trace of man in the geological strata which cannot possibly

have come into existence within only a few hours of man himself. If on the other hand we take this story as a veritable story of the creation of our world from the time when it was "without form and void"—its nebulous condition—it is one of the most extraordinary proofs of supernatural knowledge communicated to man which the whole Bible contains. It deals with events which transpired ages before man existed, and there is not the slightest evidence among all the Egyptian records or the myriads of Babylonian tablets that any of the most learned nations of antiquity possessed knowledge enough to account for it.

With regard to Dr. Irving's remarks concerning *raqia'* and *firmamentum*, he missed a point which should be noticed. The *expanse* which divides the waters below from the waters above, *i.e.*, the clouds, is called simply "the expanse," but the expanse in which the celestial luminaries are placed is called "the expanse of the heaven," and the form of the Hebrew word for heaven—*shamayim*—suggests the idea of more than one heaven.

If I may venture a word of criticism, I think the writer of the paper has fallen into a little confusion of thought concerning the presence of steam during the formation of the mineral deposits of the surface of our globe.

Then with regard to the human race, I know no reason why we should not suppose that other intelligent beings have existed upon our globe as well as ourselves. In Gen. vi, we have the *Nephilim* or "giants," spoken of, the *Elohim* and the *Adham*; these may perhaps be regarded as three species of the *genus Homo*. The Nephilim are only once mentioned after the Flood, and that is in the lying report of the land of Canaan brought back by the spies. It is very remarkable that in the Babylonian account of the deluge, the gods are said to have taken refuge in the heaven of Anu. As to the Elohim, we do not know who they were, but our Lord refers to the word when, in vindicating Himself from the charge of blasphemy, He says, "If He called them Elohim, unto whom the word of Elohim came, etc."—in post-diluvian times, therefore by our Lord's definition the word was applied to persons "unto whom the word of Elohim came," and that may have been one of the functions of Elohim in antediluvian times. With regard to the expression, "sons of God" (Elohim), the general idea, so far as I have been able to make out, is that of beings deriving their existence immediately

from God. Hence the Christian—the regenerate man is called "a son of God." There are physiological reasons against the old idea that they were angels whom our Lord says, "neither marry nor are given in marriage." I am glad Dr. Irving has brought up this racial question also in the very valuable paper to which we have just listened.

Lieut.-Colonel M. A. ALVES.—Referring to a remark by one of the speakers as regards "the sons of God" and the "Nephilim," the former phrase seems to be confined to direct creations of God, as *e.g.*, Satan (Job i, 6, and ii, 1), Adam (Luke iii, 38) and regener ated descendants of Adam (1 John iii, 1, 2); angels would be among such; and, if they marry, they do not keep their first estate. Jude 6 seems to be a reference to Gen. vi, 4, which, in my judgment, teaches that some fallen angels formed alliances with women, the result being the Nephilim, whose presence on the earth is associated with violence. Og and Goliath appear to have been of this stock; for "the Nephilim were on the earth in those days, and also after that. . . ."

As regards the history of the creation in Gen. i, I think that verse 1 alludes to an ordered state, followed in verse 2 by a fall into ruin, the remainder of the chapter describing a restoration by a series of miracles in rapid succession. I think so for a three-fold reason:—

I. Gen. i, 2, says "the Earth was (or became) Tohu. . . ." Now Isaiah says, "He created it not Tohu. . . .'

II. The crust of the earth gives evidence of a long period in the making.

III. Plant life appears on the third day, and sentient life not until the fifth.

As all the higher plant life needs insects to fertilize it, the period between the third and fifth days must have been short, and we must therefore relegate the long geological period to the 1st verse and not to the third and following.

I consider that Gen. ii, vv. 7 ff. is an expansion of Gen. i, 26–31, and not a different story. Man is God's great work; and, after a general summary of all His work, it is only reasonable to suppose that Man's creation should be dealt with in more detail than the rest of His creation.

Dr. THIRTLE.—Adverting to a remark by Mr. Tuckwell, I call

attention to a historic interpretation of the expression "sons of God," as found in Gen. vi, 2. As is well known, in Codex A of the Septuagint, the rendering is "angels of God," which is in agreement with the meaning accorded to *b'nê-ha-Elohim* (and *b'nê-Elohim*), as found in Job i, 6; ii, 1; xxxviii, 7, and elsewhere, and also to the cognate Aramaic *bar-Elâhin* in Dan. iii, 25. In other words, "sons of God" is a periphrasis for "angels," as is abundantly borne out in subsequent Jewish literature. The statement that there were *Nephilim* in those days (Gen. vi, 4), rendered, after the Septuagint, "giants"—has led to much speculation, and suggested that the passage as a whole speaks of an illicit commerce such as recalls familiar points in heathen mythology, as, indeed, a host of exegetes, ancient and modern, have maintained (see 2 Pet. ii, 4; and Jude vi).

HENRY PROCTOR, Esq., F.R.S.L., M.R.A.S., writes:—I have been deeply interested in Dr. Irving's splendid paper on "Light, Luminaries and Life," and desire to add to my former remarks on Genesis to which he refers therein as interesting and suggestive. I have for a long time held that the Book of Genesis everywhere assumes the existence of Pre-Adamic Man, and that it actually mentions them as the "Nephilim," which the Septuagint renders "γιγαντες," and speaks of their race as "men of renown which were from everlasting."* We may note also that the signification of γιγαντες from its root meanings (γῆ and γενῶ) would be "earth-born-ones," indicating antiquity as much as stature.

In regard to the Noachic flood the Biblical evidence is generally supposed to be on the side of its universality,† but this is only in appearance, for the word translated "earth," no less than nine times in regard to the flood, is "adamah" in Hebrew, not "erets."‡

Now "adamah" implies a locality, and particularly that district where Adam lived, as proved by Cain's words, "thou hast driven me to-day from the face of the adamah . . . and I shall be a fugitive and a wanderer in the 'erets.'"

Again God is said to have set a mark or sign upon Cain, "lest anyone finding him should kill him."§ Of what use would such a mark

* LXX *ἀπ' αἰωνιος, οἱ ανθρωποι οἱ ὀνομαστοι*, Gen. vi, 14.
† Gen. vi, 7, 20.
‡ Gen. viii, 8, 13, 21.
§ Gen. iv, 15; vii, 4, 8, 23; ix, 2.

be if there were no sentient beings who would be restrained by its significance from killing him? It is clear from the narrative that Cain had no brothers at the time, for Seth was yet unborn, and his very name betokens that he was given to Eve in place of Abel; for God, said she, "hath appointed (sheth) me another seed instead of Abel," showing that no other children were born till after the death of Abel.

In the second place Cain is said to have gone out from the presence of Jehovah and to have "dwelt in the land of Nod," eastward of Eden, *i.e.*, eastward of that tract of country called in the Assyrian "Idinu" where Yahveh Elohim had planted the Garden or Paradise. In the land of Nod, Cain takes a wife, who bears him a son who is called Enoch (Khanoch), and he then builds a city,* and calls it after the name of his son "Enoch." Now to build a city implies, first, a number of people to build it, and surely a far larger number to inhabit it.

Again it is quite in accord with Genesis to believe that *only* the Caucasian or so-called White Race sprung from Adam. This is proved by a study of the tenth chapter of Genesis, where, after the flood, the earth is said to be repeopled—*spread abroad*—by the three sons of Noah and their descendants.

For it can be fully demonstrated that all the nations named in this great ethnological chapter are of the Caucasian Race. In regard to two of them, Shem and Japheth, we have always understood that their descendants are white, such as the Jews, for instance, who are certainly descended from Shem, as were also the Assyrians, Lydians, Syrians and others. From Japheth, among many other nations, it is certain that the Greeks are descended, for in the Hebrew Bible the word "Javan" is generally used to designate Greece. Now Javan is the fourth son of Japheth. Kittim and Dodanim also are the ancient names of Rhodes and Cyprus.†

The descendants of Ham are also of the Caucasian Race. "The sons of Ham were Cush, Mitzraim, Phut and Canaan."

Cush represents Ethiopia (Abyssinia), Mitzraim, the ancient Egyptians; Phut, the Libyans; Canaan, the Canaanites, etc., who were all of the White Race. The Caucasian Race is thus divided

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* Gen. iv, 17.

† Gen. x, 2, 4.

into three groups or families corresponding to the three sons of Noah, viz., the Semitic, Hamitic and Aryan.

All the descendants of Shem, Ham and Japheth being of the Caucasian or White Race, they themselves must have been white, as well as Noah their father, and he being only of the tenth generation from Adam; Adam was also white, and he being therefore the progenitor of the Caucasian Race only and the Mongolian and Negro Races not being descended from him, these latter must be the living representatives of Pre-Adamite Man.

Lieut.-Colonel W. H. TURTON.—With reference to Mr. Irving's paper, I think he could have strengthened his argument as to the *firmament* meaning the atmosphere, and not a solid vault, by the following considerations :—*

In the first place the firmament was called "Heaven," and the upper waters, above the "heaven," must mean the sources from which the rain from heaven comes. And these sources are easily seen to be *clouds*, and are continually spoken of as such in the Bible (*e.g.*, Judges v, 4; Ps. lxxvii, 17; cxlvii, 8; Isa. v, 6). And no writer could have thought that a solid firmament intervened between the clouds and the earth; more especially as we read later on that birds are to fly in this firmament, which are also spoken of as birds *of the air* (v, 28). And though at present the amount of water in the clouds seems quite insignificant, it was probably much greater at the time in question.

On the other side, may be quoted the expression about opening the *windows* of heaven when it rains (Gen. vii, 11; 2 Kings vii, 2; Mal. iii, 10). But this cannot be taken literally, any more than that about the *doors* of the sea (Job xxxviii, 8–11); since, as just said, every one can see that the rain comes from the *clouds*, and not from any openings in a solid reservoir.

Secondly, the writer of Genesis omits to say (as he does in other cases) that when God made the firmament, He saw that it was *good*. Now if the firmament means the *atmosphere*, that is the (apparently) empty space separating the clouds from the seas, this would be quite natural: just as an artist, though he might examine each of his pictures to see that it was *good*, would not examine the empty

* I have touched upon these in my *Truth of Christianity* (seventh edition, p. 114).

spaces between them. But it is difficult to account for, if it means any material object, which would seem to require God's approval like everything else.

The only other instance in which God did not examine what He made, to see that it was *good*, is *man*. And this is at once explained when we remember that goodness in a free being must include *moral* goodness or *righteousness*. And man could not have been created righteous, using that word in its strict sense. He might have been created *perfect*, like a machine, or *innocent*, like a child, but to be *righteous* requires his own co-operation, his freely choosing to act right, though he might act wrong. No doubt he was made in a condition perfectly suited for the *exercise* of his free choice; but this seems included in God's final approval of the whole creation that it was all *very good*.

Thirdly, this view is confirmed by the *symmetry* of the narrative, for the six days are divided into two groups of three each, the first set being clearly a sort of preparation for the second. Thus we have light on the first day, and the light-giving bodies, the sun and moon, on the fourth day; and we have land and vegetation on the third day, and animals and men, who live on the land and feed on the vegetation, on the sixth day; and therefore we should expect a similar agreement between the second and the fifth day. Now on the fifth day we have fishes that live in the water, and birds that fly in the air; and if the work of the second day was the formation of the water, and the *air* (*i.e.*, the firmament), then, and only then, is the symmetry perfect.

Reply by the Author.

Mr. Woods Smyth, L.R.C.P., etc., has been liberal in his criticisms. On the points which he has raised, I will endeavour to remark as briefly as possible, but the field covered is a large one.

(1) I must insist upon the *observation of nature* as a source of knowledge, and even of primitive science in a crude way, to the early races of mankind. Evidence of this is referred to in my paper, and it might be greatly extended from the resources of anthropology. My contention is, that the "inspiration of selection" comes in here, as well as in dealing with prehistoric traditions. One of the greatest Biblical critics of Germany (Professor Zittel of

Leipzig) tells us that "this much is certain: the Biblical conception of the universe, which constitutes part of our faith, and in so far as it does so, is for us, not a Babylonian conception, but extremely ancient knowledge, partly the result of experience [including observation of nature] and partly revealed by God to man and preserved among His people."* Philology and archæology alike bear testimony to this.

(2) As to *the Expanse*, the old notion of the atmosphere constituting the expanse ("firmament") and the clouds "the waters above the expanse" will not work at all scientifically, and to import "inspiration" here is simply to "beg the question." Every student of physics knows that the clouds are water, and my critic waxes eloquent over the phenomena of clouds. But one wonders if he has ever travelled for two or three hours together through an alpine cloud, as through a vapour-bath, with the atmosphere, in which the clouds float, above him as well as below him; or stood on an alpine peak or pass, and gazed on clouds far below, as they appear (*e.g.*) to an observer on the summit of Mount Pilatus near Lucerne, when (according to a local Sprüchlein) that giant "wears his collar." I cannot help thinking that the writer of Genesis i was a better observer of nature than my critic appears to be.

(3) *The view of Lord Kelvin*, to which he refers, did not need refutation at the Cambridge Meeting of the B.A.,† at which I was present.

He is mistaken in asserting—Dr. Irving adopts Lord Kelvin's view—"that the earth solidified from the centre to the circumference." On the contrary (following such masters of geological science as Credner, Heim and Suess, of the continental school), I have for more than twenty years advocated the opposite view, as Mr. Woods Smyth may see for himself, if he will be so good as to look into my geological writings.‡

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* Quoted by Dean Wace, D.D., in his lecture on "the Book of Genesis," *Christian Apologetics*, John Murray, 1903.

† See Report for 1904.

‡ Such (*e.g.*) as—(*a*) "Chemical and Physical Studies in the Metamorphism of Rocks." (Longmans, 1889); (*b*) "The Malvern Crystallines" (*Geological Magazine*, October, 1892); (*c*) "On the Consolidation of the Earth" (*Nature*, May 25th, 1905), to which I specially draw his attention.

The notion of a "frozen globe" melted by "fierce sunshine" is one of which, as a geologist, I have never heard until now, and is on physical considerations inadmissible. I have adopted the *calculations* of Lord Kelvin, as a working hypothesis; but we have it on his own authority, that the "matter-of-fact foundation" for his conclusion (that is to say, his primary data) is furnished by "*the heat which we know to be now conducted out of the earth yearly.*"* Such observations and measurements are as independent of the hypothesis of the consolidation of the earth from the centre to the circumference, as the use of the balance in the determinations of atomic weights (and in quantitative analysis generally) is independent of the theory of "electrons." For my purpose "consolidation of the earth" need mean no more than consolidation of the external crust. The conclusion as to the *age of the sun*, in comparison with that of the earth, based on "the well-founded dynamical theory of the sun's heat," seems to me independent of such considerations. However, I am obliged to my critic for giving me an opportunity for putting this point more definitely.

(4) The notion of *directivity* is one which gives my critic much trouble. Even if the consensus of "accredited authorities" were so one-sided as he asserts, the thoughtful student of science would not be bound by their *credo*. To admit such an assumption would be to put an end to scientific enquiry. Mr. Woods Smyth does not attempt to answer the arguments adduced in my two papers: he merely contradicts on the strength of his own summing-up of "authorities." That is rather the way of "Vaticanism" than of either science or philosophy. I deny that "authority" on this question belongs to the biologists exclusively, or even in any special degree to such men as Herbert Spencer (who was not a scientist) or the prophet of Jena.† Men like Lord Kelvin, who speak of "Creative and Directive Power," and look at these matters in a

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* See his lecture on "the Age of the Earth," to the Victoria Institute. (The italics are Kelvin's own.)

† "Has the mantle of Infallibility been torn from the shoulders of the Pope merely to be placed upon those of the Professor?" sagely asks Mr. G. T. Manley in his splendid paper on the "Old Testament in Relation to Science," read at the Church Congress in 1907. (See the *Guardian* October 9th, 1907.)

broader perspective, have surely a right to be heard; and I should reckon Professor George Henslow among "accredited authorities," as well as Professor A. H. Church, F.R.S., from whom he borrows the word "directivity."

The only ultimate logical conclusion, to which evolution without directive power can lead, is blank "determinism" (the result of blind fortuity) which refuses to recognize that "working for ends," for which such "authorities" as Asa Gray have contended, and which even Professor Starling tacitly recognizes, as I have pointed out in my paper. If Mr. Woods Smyth is not prepared to deny that the mind of the chemist *directs* the reactions of the laboratory to synthetic ends,* how can he refuse to recognize similar or analogous working of Creative Mind in the vast laboratory of the universe? But his contention and that of his "authorities" really amounts to a negation of a Divine Providence and the reduction of prayer to an absurdity; and that is, I am sure, far from what he intends.

(5) As to the idea of "*Interference in Man's Evolution*" (which I hold to be special *creation*), I am glad to know that I have the support of Wallace, as I most certainly have of the writer of the early chapters of Genesis and of the Bible *passim*. But I do not borrow from Wallace. I have held and taught it on scientific and philosophical grounds for years past, as I stated a short time ago in the discussion of Professor Orchard's paper on "Philosophy and Evolution."† Seventeen years ago, as I wrote, "the projection of life into the world of matter from 'the unseen universe' is the only theory that meets at once the requirements of religion and science," so I wrote also, "the catholic idea of the projection of the spiritual life is after all but the logical counterpart of the projection of the natural life into the world of matter, which (with its energy and properties) has existed, and may exist again, without being

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* I am glad to find that Professor Church had anticipated me in the use of this illustration in my previous paper, "Evolutionary Law, etc." (§ II).

† *Trans. Vict. Inst.*, vol. xl, pp. 136 ff. Some very sane and cogent remarks for our present purpose were contributed to that discussion by Professor George Wright of America, to which most of us would probably subscribe.

associated with life at all."* In a paper on "Faith and Science,"† and again in a sermon, "The New Creation,"‡ I said, "Anything like a gradual development of the spiritual life out of the physical life seems to be as untrue as the doctrine of the development of life from non-living matter, with its energy and properties. . . . Each life has its place in guiding and controlling, to higher ends, properties and forces of a lower order than itself. As science can tell us nothing directly of the intrinsic nature of physical life, so can it have nothing to say for or against the spiritual life: for this we must turn to the revelation of Jesus Christ"; and (I may add here) to the "inner light" of that "God-consciousness," which man has, because man *is* a soul, a creature *sui generis*.§

The term "Man" (in the highest sense) then must include this, the central factor of his individuality (his self-hood); and carries with it the refutation of Mr. Woods Smyth's *dictum*, "Evolution is sufficient to account for the whole chain|| of sequences from the Protistæ to Man in the highest sense." Evolution has to do with matters belonging to the lower grades of consciousness.

I thank Mr. Tuckwell for his appreciative remarks. As to the *rakia* (expanse), his remarks, I think, tend to confuse what I find actually stated in Gen. i. The author of that chapter even seems to go out of his way to preclude that, by anticipation; for in v. 8, he expressly defines the "expanse" of vv. 6, 7, when he says—"God called the expanse heaven," so as to make it quite clear that in the succeeding verses, from which I have quoted, he is speaking of the same thing three times over. I can find in the text no countenance to the idea of more than one expanse.

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* "Things New and Old"; a sermon published in the *Clergyman's Magazine* (January, 1893) and referred to in my previous paper.

† *Ibid.*, June, 1893.

‡ Written and preached on the occasion of the Meeting of the British Association at Nottingham in 1893, and published in *The Churchman* (August 1894).

§ *Cf.* the very able paper by Professor Caldecott, D.D., Litt.D., read at the Victoria Institute on May 23rd, 1910, and the discussion thereon; also *The Inner Light*, by the Rev. Arnold Whiteley, M.A. (Camb.), D.D. (London), with Introduction by Dr. Caldecott.

|| The misprint of "claim" for chain must have been too obvious to mislead anyone.

Mr. Tuckwell has, however, committed himself to a definite piece of "criticism," in which he questions my physics. He might have been, I think, a little more cautious. He says there is a little confusion of thought concerning the presence of steam, in what I have for the last twenty years or more spoken of as the "pre-oceanic stage" of planetary development. There is some "confusion of thought," but the confusion is Mr. Tuckwell's. He has confounded two physical facts, which are entirely distinct, when he makes the critical temperature of steam to mean the temperature of dissociation. The *critical temperature* of steam is that temperature above which no pressure can coerce it into a liquid; and that, as he says, is about 773° Fahr., or a little above 400° C., about the melting-point of zinc. But the steam remains a true dry gas of the molecular composition H_2O, as every student of physics knows. The *temperature of the dissociation* of steam is far higher. Under ordinary atmospheric pressure, the dissociation of steam is known experimentally to begin at about the temperature of white-hot platinum; but the temperature of complete dissociation is far above the melting-point of platinum, which is about 2,000° C. (= 3,632° Fahr.) This is known from the fact that platinum melts readily in the flame of the oxy-hydrogen blowpipe, in which hydrogen and oxygen are entering into combination at a temperature which of necessity is below the temperature of complete dissociation of H_2O. I have often demonstrated this in former years in lectures to my pupils. Perhaps the best account of "dissociation," which occurs to me, is that given in the Introduction to Professor Wislicenus's *Lehrbuch der Anorganischen Chemie*. He might also possibly find of some interest my two papers on "Dissociation," read before the British Association in 1886 and 1888, and published *in extenso* in the *Chemical News*. The electrolytic decomposition of H_2O into oxy-hydrogen gas is of course a different matter.

"Sons of God." Without attempting any definition of "inspiration," though insisting upon revelation coming to mankind through an "inspired race," leading up to the greater Pentecostal Illumination of the Church,* we may reason inductively from the use of this expression in the Bible; and it is only fair to claim that the fuller

* Professor Masterman's little work, *I believe in the Holy Ghost*, is useful in this connection (Wells Gardner & Co., 1906).

light of revelation given to us by Christ and His Apostles in the New Testament may be invoked to throw light upon the Old Testament use of it, assuming (as we are justified in assuming) that Revelation was *progressive*, and that the same presiding Spirit illuminated the organs of both Old and New Testament revelation. Now the writer of the Epistle to the Hebrews* speaks of God as the "Father of Spirits" in such a way as to appeal directly to the consciousness of the spiritual man, and he interprets all the discipline of life as the chastisement of *sons*. Paternity necessarily implies *sonship*; and in the Introduction to St. John's Gospel we are expressly told that those who (from the earliest dawn of the religious consciousness in man) received by a responsive faith the illumination of the divine Logos, in whom was "that life, which is the light of men," had given to them the "power" (A.V.) the "right" (R.V.) (ἐξουσια) to become the "sons of God" (John i, 12). This I take to be the key to the whole teaching of the New Testament, as the thought is developed in St. Paul's own masterly way in the eighth chapter of his Epistle to the Romans, which Dean Vaughan used to speak of as "the heart of the New Testament." At the same time, standing as it does, this phrase seems to me to link up the deepest teaching of the Old Testament (as that was understood in the time of Our Lord) with the fuller teaching of the New. It is moreover a favourite expression of St. John's, and Christ the Lord clinches it, when He teaches us to say "Our Father." The prophet Hosea (i, 10) uses the very expression when he predicts the *status* of the spiritual man in the Church of the then future, as St. John (I, iii, 1) applies it; and St. Luke expressly speaks of Adam as "*the* son of God." For such reasons I am inclined to take the use of the term in Genesis to mean those to whom the God-consciousness was imparted, as to "living souls,"

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* In a sermon published sixteen years ago I ventured to say that—"Regarded from a philosophical point of view, that Epistle is the one supreme effort of Christian philosophy of the first century in applying the inductive method of reasoning out from the records of the Old Testament the higher meaning, the heavenly interpretation, of the more material and earthly facts which were to be found in the law and history of Israel and in the Mosaic religion" (see *Clergyman's Magazine* for February, 1894).

which could hear the voice of God saying to them, "The fear of the Lord, that is wisdom; and to depart from evil is understanding" (Job xxviii, 28); or (as St. Paul puts it) "as many as are led by the spirit of God, they are the sons of God" (Romans viii, 14).

On anthropological grounds I go so far (*pace* the older exegesis) as to apply all this even to the use of the expression "Sons of God" in Job i, 6 and xxxviii, 7; the former implying ancient and primitive corporate worship outside the pale of the Abrahamic Covenant—the latter the early and primitive conceptions of God as revealed in Nature. (*Cf.* also the heathen poet Aratus, Acts xvii, 28, quoted by St. Paul to the sharp-witted Athenians.)

It was surely a sound maxim of St. Augustine that "the Old Testament prepares for the New, and the New explains the Old"; and I see no valid reason for making an exception in this case. That "light of men," of which St. John speaks, has never been entirely extinguished in the best human spirits, though much obscured by sin, which consists essentially in the misuse (through perversion of the Will) of those powers and faculties and instincts with which God has endowed humanity. I have worked at this line of thought in a sermon of mine, which was published in 1893, as indeed also in many sermons.

To refuse to look at the early chapters of Genesis in the light of the Incarnation and of the New Testament, is surely to go out of our way to create Scriptural difficulties. Mr. Tuckwell does well to refer us to the teaching of the Living Word Himself in John x, 34–36; although, if he will refer to Bishop Perowne's learned commentary on the Psalms (resp. Ps. lxxxii), he will see that the meaning of that passage is somewhat obscure. For myself I should interpret it in the sense of the remarks which I have ventured here to make. Mr. Tuckwell is evidently more at home in Bible studies than in physical science.

Mr. HENRY PROCTOR has sent a most valuable note from a real student. I am glad to have the opportunity of explaining away what is said in my paper (p. 180) as to certain criticisms of his former remarks which had reached me. On passing on the criticism to Mr. Proctor I received such a full explanation of the points raised as seems to me fully to meet the criticisms referred to, and I thank him for the information. In a subject, which Mr. Proctor (as a Hebraist) seems to have made his own, I feel that it

would be presumptuous on my part to offer any criticism of what is contained in his present communication; but we must all thank him for the light which that seems to throw upon the Genesis cast of prehistoric traditions contained in chapters i–xi. I may be permitted to add that his idea, as to the "Nephilim" being impure offspring of a previous race of *Homo*, of whose remote origin tradition had lost all traces, seems to receive support from what I have drawn attention to in the Presidential Address of Dr. Smith-Woodward, F.R.S., to the Geological Section of the British Association last year at Winnipeg.* The *Homo* (whether Neolithic or otherwise) would seem to have developed the same tendency as some other races of mammals, "to store up mere dead mineral matter as bone" before they became extinct. It would be interesting to have Mr. Proctor's idea, as to any possible correlation of the primitive Nâdu of the Euphrates-Tigris region with the Neolithic men (of unknown date as to origin), who were overmastered and superseded by the "Bronze" men, as they, in their turn, were by the Achæans, with their use of iron, in Crete. (See *Crete the Forerunner of Greece*, by C. H. and H. B. Hawes, Harpers, 1909.) The Genesis tradition (iv, 22) seems to point to such superior power of the forgers of cutting "instruments of bronze and iron" among the Cainites.

It is scientifically impossible to follow the gallant Colonel Alves in his speculation. That Dr. Thirtle should attempt to make the Genesis narrative carry the burden of such things as he refers to in heathen mythology, is bad enough from the theological point of view; but the idea of angels forming alliances with women is such a physiological absurdity† that it must be relegated to the limbo of a pre-scientific age. It traverses moreover the teaching of the Master of masters, when He tells us in effect that the sexual function is something entirely outside the range of angelic existences (Matthew xxii, 30). Science here seems to me to make a clean sweep with its besom of a great deal of rubbish, which a fanciful exegesis has read into the sacred text, and the recognition of a pre-Adamic race moreover renders unnecessary. I

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* See the discussion of the paper on "Darwinism and Malthus" by the Rev. James White, M.A., read before the Victoria Institute on April 4th last.

† Despite even *Hastings' Dictionary* (article "Nephilim").

do not see that the substitution of Aryan for Babylonian myths does much to clarify our idea of the "inspiration of selection" of prehistoric traditions.*

That idea of Gen. iv, alluding to an "ordered state," is an old one, with which I have been long familiar. Something like it is put forward in his *Commentary* by the great divine and scholar, Bishop Christopher Wordsworth of Lincoln. But Wordsworth was not, and never pretended to be, a student of science; though he maintained an open attitude of mind towards the teaching of science, as I have reason to know.

Lockyer's hypothesis of the meteoric origin of planets might seem to favour the notion of a state of things brought about by the collision of two bodies moving in space;† but if Colonel Alves will think the matter out, he will see insuperable difficulties in the way of its application; since it would have to account for each and every planet of the solar system by a special event, instead of regarding (as the "nebular hypothesis" does) the whole series as the result of the regular and simple operation of physical laws in their evolution, as I have attempted to show in my two papers.

His remarks about insects and "the higher plant-life" are beside the mark. If he will study what I have put forward in my former paper and the "analytical parallelism" there suggested, he will, I think, come to see that, though a few insects did exist in the Carboniferous period, their agency was not required for the fertilization of the cryptogamous flora, which was then predominant; nor even was it wanted for the early forms of Coniferæ, which do not depend upon insect fertilization.

Professor Driver's *Genesis* will give him some useful information, as to the reasons for separating the two accounts of the Creation. I have long maintained that they are written from two different points of view: the one may be regarded as a sequential account of a continuous evolutionary process, while the other is a pictorial grouping of leading and striking facts of creation about Man, as the head and centre of it all. "Image of God" in the one may, I

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* *Cf.* Dean Wace, D.D., on "The Book of Genesis" in *Christian Apologetics* (John Murray, 1903).

† *Cf.* Sir Robert Ball's lecture to the Victoria Institute in 1901.

think, be taken as the counterpart of "living soul" in the other. I find it difficult to attach any clear meaning to the phrase, "the long geological period." On this point he will, I hope, pardon me for again referring to my previous paper, to which the present one is professedly supplementary. It is important not to overlook the fact, that the second of the two accounts of creation is but the first "Act" of the drama, which runs on from chapter ii, 4, to chapter iv, 24.* There is internal evidence of this. In all our studies of these old Scriptures we must learn to "think orientally,"† if we are to get away from the bondage of what the late Sir Gabriel Stokes, F.R.S. (a former President of the Victoria Institute), used to call "a slavish literalism." (See further on this point correspondence in the *Guardian* in the autumn of 1907, on "Genesis and Science.")

Colonel Turton refers to his book, *The Truth of Christianity*, which I procured and read with much pleasure on its appearance. Though the science of it is weak in places, the book as a whole is a valuable addition to the literature of Christian Apologetics. Unfortunately he, like some others, has not been at the pains to make a real study of my paper before criticizing it; and so he has misunderstood that part with which he deals in his *quasi*-criticism, consisting of little more than quotations from his own book. If the Colonel would do me the favour of making a careful logical analysis of Section II (B) of my paper, he will see that the notion of the atmosphere constituting the "expanse" is one which is entirely ruled out by the argument adopted. That argument is based upon what the inspired writer actually says, and not in any way upon what others have read into it. The word "expanse" means an indefinite portion of extended space, and cannot possibly mean a material substance, such as the atmosphere of this planet undoubtedly is. If the gallant Colonel doubts that, it must be because he has forgotten the laboratory-teaching of his Woolwich days, which must have familiarized him with the air-pump and its applications. My conception of the "expanse" is that of interplanetary space, on the assumption of the *nucleate inception* of the planets, as separate centres of condensation in the nebula; and it

* See further Driver, *Op. cit.*, page 35 ff.
† Mackinlay in his book, *The Magi, etc.*

was for the express object of demonstrating this, that the Greenwich photographs of the "spiral nebulæ" were thrown upon the screen. I regret that my enforced absence from the meeting on March 21st prevented me from emphasizing this at the time. The difficulty raised as to the winged creatures (v. 20) flying "above the earth in the open firmament of heaven" is more apparent than real; as we see at once if we follow the literal Hebrew (and we can hold the author responsible for naught else), which says "on the face of the expanse of the heaven" (margin), as they of course appear to do to a spectator on the surface of the earth.

As to the points 2 and 3 of Colonel Turton's criticism, I am unable to follow him, nor do I see that they have any very cogent bearing upon the point under discussion.

506TH ORDINARY GENERAL MEETING.

MONDAY, APRIL 4TH, 1910.

LIEUT.-COL. G. MACKINLAY IN THE CHAIR.

The Minutes of the preceding Meeting were read and confirmed.

The following election was announced :—

Associate : Colonel H. G. MacGregor, C.B.

The following paper was then read by the Author :—

DARWINISM AND MALTHUS.

By the Rev. JAMES WHITE, M.A.

AMONG the many centenaries that marked the year 1909, none have equalled either in interest or importance that of Darwin. His discovery of the laws of evolution and survival of the fittest, explaining the origin of species and the development of life's various forms, has been the most important and wide reaching since Newton established the law of gravitation. And although we cannot be sure that the principles discovered and elaborated by Darwin and by Wallace, are as far-reaching throughout the material universe, as the law that matter attracts matter directly as the mass, and inversely as the square of the distance, yet the idea of evolution, development, and the struggle in life, have affected more fields of thought, and have more varied applications, than that great law which governs only the relations of inanimate matter. Our ideas on morals, religion, social relations, in almost everything that concerns human life, have been influenced, and frequently very largely modified by the principles for whose discovery and exposition we are indebted to Darwin and to Wallace; and their application to animal life have not only been illuminating but transforming.

No apology is needed for coupling the two names. These two great men have acknowledged their obligations to each other with that noble chivalry which has so often distinguished men of science. The pursuit of knowledge, the love of truth for its own sake, have done more than make us acquainted with the material world. In them also are learned some of the highest moral qualities, pre-eminently justice and generosity. Other names have been mentioned as having in some degree anticipated the discoveries of Darwin and Wallace, but they have done so only to a very limited extent. No one has been more often mentioned and referred to in this connection, in the numerous lectures, magazine articles, and essays, that have been called forth by the centenary of Darwin than Lamarck; and yet his contribution has been very insignificant. The only credit that can be claimed for Lamarck, is that he believed in the possibility of the transformation and progress of species: but he did nothing to explain how this was accomplished. The principal cause he suggested for such transformation and development was a "formative nisus," but of this no trace has been found in nature, nor has it in any way helped forward the theory of evolution. This explanation was derived not from observation but from imagination. It is true that the habit of the bottle-nosed whale, of laying his nose upon a rock when sunning himself, has been quoted as indicating an aspiration for terrestrial existence. This suggestion has at least the merit, rare in scientific work, of being amusing.

One name which has been very seldom mentioned, and would seem to be almost of purpose ignored, is that which stands at the head of this article, namely, that of Malthus. His "Essay on Population" was really the living seed from which all that is implied in the word Darwinism has sprung. Falling on the fertile minds of Darwin and of Wallace, there it germinated and produced a rich and noble harvest. It was Malthus's "Essay on Population" that gave them both the clue to unravel the difficulties of the Origin of Species. The now familiar ideas of the struggle for existence, survival of the fittest, natural selection, evolution and development, and all that they imply are engermed in the thought of the Pressure of Population on the means of Subsistence, of which Malthus's essay is an expansion though in a very different direction. To anyone acquainted with that book, and the writings of Darwin and Wallace, the connection is very obvious. It has been very fully acknowledged by these distinguished philosophers themselves. In his *Origin of Species*, Darwin states in the

introduction "the struggle for existence, is the doctrine of Malthus applied to the whole animal and vegetable kingdom" (4th ed., p. 4). In the life of Charles Darwin, published in 1887, we have the following:—

"I soon perceived that selection was the keynote of man's success in making useful races of animals and plants. But how selection could be applied to organisms living in a state of Nature remained for some time a mystery to me.

"In October, 1838, that is, fifteen months after I had begun my systematic enquiry, I happened to read for amusement *Malthus on Population*, and being well prepared to appreciate the struggle for existence which everywhere goes on from long continued observations of the habits of animals and plants, it at once struck me that under these circumstances favourable variations would tend to be preserved and unfavourable ones destroyed. The result of this would be the formation of a new species. Here then at last I had got a theory by which to work."

From this it is obvious that the theory of Darwin with all its varied and far extending applications was the fruit in Darwin's mind of Malthus's principle. All that wide extending harvest, which is briefly summed up in the word Darwinism; a harvest yet far from fully reaped, has sprung from the living seed of this principle. Malthus observed the pressure of population on the means of subsistence. Darwin took up this observation and applied it in ways which its author never contemplated, and probably could never have applied it. Other causes no doubt contributed to the production of Darwin's *Origin of Species*: other influences brought their aid to fertilize that mind of almost unrivalled powers of observation and induction which has been the chief agent in this great development of thought, and for this is due to Darwin far beyond all others the gratitude of mankind. But the living seed is Malthus's observation of the pressure of population on the means of subsistence.

Dr. Alfred Russell Wallace in his very interesting and valuable autobiography, has most fully acknowledged his indebtedness to Malthus. Writing of his 21st year he records on p. 222, vol. i, as follows:—

"But perhaps the most important book I read was Malthus's *Principles of Population*, which I greatly admired for its masterly summary of the facts and logical induction of its conclusions. It was the first work I had yet read treating of any of the problems of

philosophical biology; and its main principles remained with me as a permanent possession and twenty years later gave me the long sought clue to the effective agent in the evolution of organic species."

Referring to the same period on p. 240, after mentioning his making the acquaintance of Mr. Bates, the eminent traveller and naturalist, Dr. Wallace writes:—

"the other equally important circumstance was my reading Malthus, without which work I should probably not have hit upon the theory of natural selection, and obtained full credit for its independent discovery."

Later on, beginning at p. 361, Dr. Wallace in a passage too long for quotation, gives a most interesting account of the full development of his theory, relating the whole process of the flowering of the living seed that had been for years germinating in his mind. The entire passage is well worthy of perusal; for it exhibits the birth of a great thought in a great mind, the birth of a living truth destined to enrich humanity. It begins thus, "one day something brought to my recollection Malthus's *Principles of Population*." It ends with these words, "I wrote it (the theory of natural selection) out carefully in order to send it to Darwin."

It is strange that with this ample acknowledgment of their obligations to Malthus, obligations which are evident to anyone acquainted with the works of these great philosophers, it is strange that the name of the first should be almost ignored, although he was the originator of all that followed. The other two have fully confessed him as their fountain of thought and suggestion. And it is not only by the general public but also by really learned and scientific men in the numerous letters, addresses, articles, and speeches which have illustrated the Darwin centenary that the name and work of Malthus have been almost entirely ignored.

It is a good thing to take a part however humble in the cause of justice; to make an effort however feeble to give honour where honour is due. And such an effort would, it is to be believed, have the sympathy and approval of such men as Darwin and Wallace.

There are other reasons too which make the consideration of the debt rightfully due to Malthus of interest and importance apart from the sentiments of abstract and poetic justice.

A prejudice has been long felt against Malthus which may partly account for the manner in which he has been ignored, namely, the impression that he is in some way responsible for those practices which may be referred to as connected with race suicide; or that at least some sanction for them can be derived from his writings and principles. This is a very great mistake, and a very unjust slander on a man whose moral character was as pure and high as his intellect was penetrating and exalted. Malthus but slightly refers to these subjects, and then only for his strongest reprobation. For the evils of over-population Malthus knows only one remedy, viz., virtuous abstinence; and while quite aware of the evils of over-population, he is also aware that there are other evils which are greater still. The following is the principal reference to the subject; it is taken from vol. iii, p. 391 of the fifth edition of his Essay on the *Principles of Population*, published in 1817.

"I have never adverted to the check suggested by Condorcet without the most marked disapprobation. Indeed I would always particularly reprobate any artificial and unnatural modes of checking population, both on account of their immorality and their tendency to remove a necessary stimulus to industry . . . The restraints which I have recommended are quite of a different character. They are not only pointed out by reason and sanctioned by religion, but tend in the most marked manner to stimulate industry."

The restraint on which Malthus relies is the sense of parental responsibility. It is the only one which he advocates, and he thinks it should be taught, fostered, encouraged and strengthened in every way. It is the duty of parents to put those children they have brought into the world in such a position by training, care of health, education, etc., that they may have a reasonable prospect of being able to maintain themselves in it. In fact, the law of nature which Malthus seems to have discovered is more serious than at first appears. It is this, that the right to live is not inherent. It has to be acquired or imparted. This is startling, we naturally shrink from its statement. But if it is a law of nature it is no use attempting to resist it. When applied to biology it has been the most fruitful truth that has ever entered into that science; and this is a strong presumption that it is a law of nature. Our duty to the Laws of Nature is to obey them, however stern and severe they may be. It is our higher duty to apply them in accordance with the spiritual laws of justice and mercy, to administer them with

justice and to mitigate them with mercy; but to disobey them means prolonged and extended suffering, a lengthened lesson in the dear school of experience until we have learned rightly to obey.

It is remarkable that the principles of Malthus were discovered not in the study of biology, with which he apparently had no acquaintance, but in the subject of political economy. It was reflection on the causes that hinder the progress of the human race to happiness that led him to consider the principle of population as affecting this subject. To apply it to the animal or still less to the vegetable creation seems never to have occurred to his mind. Natural history seems to have been quite outside his range of thought and interest. Now if his principles have been so fruitful when applied to subjects which are altogether outside the field of their discovery, how much more fruitful may we expect them to be if applied in that field in which they were discovered.

This consideration becomes the more important, when it is observed that the whole trend of legislation, and of the thought which lies behind legislation, and both is its cause and gives it force, has been for a long period in a contrary direction. Increase of the sense of parental responsibility was the check on which Malthus relied for the evils of over-population; modern legislation has done much and seems likely to do more to diminish the feeling of responsibility of parents for their offspring. Free education has been given; free meals are being demanded, gratuitous feeding is to some extent given, and demands for further relief from parental responsibility seem likely to follow. All this is in direct opposition to what there is strong presumption at least to believe to be a law of nature.

The phrases "survival of the fittest," and "elimination of the unfit" were not invented by Malthus; but they follow directly from his principles of population. Modern legislation, and indeed modern sentiment, without which legislation is powerless, have sought, and are still seeking to preserve the unfit and to encourage their multiplication. But the laws of nature will prove themselves too strong even for the strongest radical government, or the most plausible socialistic theory. The laws of nature will assert themselves in the end, even it may be by the destruction of our entire civilization. It is useless to complain of their harshness and severity. Nature is full of that which is harsh and severe. But we may do much, if we recognize them as facts, we may do very much to mitigate the

harshness and severity of their application. By ignoring or disobeying the laws of nature, we only multiply and prolong suffering. Our truest mercy and our highest wisdom is to obey them.

Communication on Rev. James White's Paper.

By Professor Edward Hull, LL.D., V.P.

Read on the conclusion of the paper.

In thanking the author for his interesting paper I wish, in the first place, to express dissent from the idea that there is any possible analogy between Newton's Law of General Gravitation, and the inferential hypothesis of Darwin and Wallace, to account for the succession of species of plants and animals. Valuable as this hypothesis may be, and useful as a workable basis for naturalists to build upon, it still remains simply an hypothesis open to discussion, founded on observations more or less liable to error, and certainly, limited in application; whereas Newton's Law is of universal application, mathematically true, and verified by astronomers in their calculations regarding the mechanism of the universe. The analogy, therefore, does not exist; the hypothesis of evolution and the law of gravitation stand on different planes, and doubtless the author is aware of this.

But in dealing with the "Darwinian theory" of evolution it should not be forgotten that there are difficulties in its acceptance which have to be overcome before it can be accepted by naturalists. As yet no case of transmutation of species has been observed; and the curious fact remains, that most, if not all, plants and animals which have been modified by domestication or culture exhibit a tendency to revert to the original type when in a state of nature, and Dr. Darwin's own instance of the pigeons has always appeared to me to be opposed to his views; lastly, hybrids are not fertile.

Those of us who, like myself, have not read Malthus's works, but are only acquainted with this profound writer as the author of what are called "Malthusian doctrines," will be grateful to the author for rescuing his memory from association with views which

most of us would consider objectionable, as well as for having suggested to Darwin and Wallace their conceptions regarding organic evolution. With Mr. White's views regarding parental responsibility I am in entire accord, and they require to be enforced at the present time, when legislation, modern habits amongst the poor, and mawkish sentimentality are tending to undermine the high moral duty of parental responsibility. When the State steps in, and removes the education, the upkeep, and the supervision of the child from the parent to itself, the effect on both is disastrous; it withdraws from the parent one of his greatest incentives to industrious labour, and from the child, the feeling of affection which has been implanted by nature, and is an incentive to a virtuous life. Scripture is absolutely opposed to this aspect of State Socialism, which commands the child to honour his father and mother, and the parent to provide for those of his own house, including his offspring.

Discussion.

Dr. W. Woods Smyth said:—Our hearty thanks are due to Mr. J. White for his excellent paper. I entirely differ from Professor Hull and Dr. Irving upon their strictures on the Doctrine of Evolution. It is not contended that one species has ever been transmuted into another. We are a Christian Institute and as we believe and reverence the Bible we must acknowledge, as the Scriptures say, that the creative evolution of the several forms of life was *finished* ages ago. This leaves no room for new species to arise to-day. But when we glance into the past geologic ages we perceive symbolic types in the fields of life. In one instance there is a creature combining the formations of the deer, the hog, and the camel. Now in the finished forms these have become differentiated into the three familiar creatures known to us to-day.

The Bible is on the side of evolution, Haeckel acknowledges this to its credit, and even Dr. Irving has contributed a paper to the Institute pointing out evolutionary ideas in the creation story. I have shown that the scriptural expression, "Let the earth bring forth

the living creature," the verb being in the *causative* voice; *Hiphil* presents to us more vividly the principles of evolution in the influence of environment than are to be found in whole pages of Darwin and Spencer.

Again, all our learned Societies support the doctrine of evolution and no scientific evolutionist of eminence believes in the idea of a "directivity." It would be entirely opposed to the great scriptural principle (as I have shown in my writings) which makes life responsible for its own conduct, and even in degree, for its own organization. It would be repulsive to our mind to suppose that God created creatures specially red in tooth and claw to riot in raven. But I have shown that this vastly magnifies the moral responsibility of man which has been accumulating through long ages up to man's estate at the summit of all life.

Lastly, I have contributed to the Victoria Institute the important truth which it has been my privilege to urge upon the Church for thirty-seven years, namely, that the destruction of the unfit was the *sacrifice* of life for the evolution of living organisms. "Sacrifice" is the word used by Herbert Spencer in this connection; so that man was created by a great ministry of animal sacrifice. Little wonder that the type of his redemption is shown in the animal sacrifice of the ceremonial law, and had its complete consummation in the great sacrifice of the ineffable Life of our Lord Jesus Christ.*

Professor H. LANGHORNE ORCHARD said:—While thanking the Rev. author for his interesting paper, I am compelled to associate myself with the dissent so generally expressed from some of his conclusions. In the second sentence of the paper we read of Darwin's "discovery of the laws of evolution and survival of the fittest, explaining the origin of species and the development of life's various forms," etc. I fail to see that an imagination is a "discovery," or how that which has no existence can have "laws," or how such can "explain" anything, or how it is advisable to use the term "development" as synonymous with "evolution."

I must protest against any attempt to compare Darwin's untrue

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* "The Bible and the Doctrine of Evolution. The Government of God, 1882. Evolution explained and compared with the Bible, 1883. Divine Dual Government, 1899–1902–1905. The Bible in the Full Light of Modern Science, 1907." *Victoria Institute Transactions*, vol. xxxviii, 215.

speculation with the grand discovery by which Newton bound together all parts of the material universe. To call by the name of "science" an unverified conjecture—a conjecture negatived by experience—is to dishonour science. To speak of an imagination as a "fact" is not conducive to our progress in the knowledge of facts.

On p. 224 Darwin tells us that favourable variations (in animals and plants) are preserved, and unfavourable are destroyed. What does he mean by "favourable" and "unfavourable" in a species with regard to the other species into which he supposes it is being transmuted. The result, he says, "would be the formation of a new species." What sort of a reasoner is he who thus piles up assumptions?

Improve the breed of horses long enough, and at last you will get something which is not a horse but another sort of creature—shall we say, a gibbon? What led Darwin to write such nonsense? Was it that he possessed an elastic faculty for believing whatever he *wished* to believe? This seems to have led him to first bamboozle himself and then to try to bamboozle his readers.* Dr. Irving has alluded to Darwin's misapplication of Malthus's theory. Henslow† also points out that the "individual differences," relied on by Darwin, can never transmute a species, for they lack *hereditary constancy*.

Darwinism has no doubt exercised a considerable influence over many minds, but this has been owing not to ability or truth in the speculation, but to the fascination of the subject with which it deals. The author of the paper has, I think, proved his point that the speculation is greatly indebted to the principles of Malthus; and we shall concur with him as to the immense importance of recognizing parental responsibility, and of working with, and not against, the laws of nature.

The SECRETARY said that he was sorry to have to protest once again at the spirit of many of the remarks made. He was sorry to see that instead of discussing the main point raised by the paper all

* Huxley says that Darwin's style of writing is like "a sort of intellectual pemmican—a mass of facts crushed and pounded into shape, rather than held together by the ordinary medium of an obvious logical bond."

† Henslow thinks that Darwin was misled through not observing plants and animals in a state of *nature*.

the previous speakers had turned aside at the mention of Darwin's theory of natural selection, and had raised once more that strange spectre of evolution which it was so easy to drive away.

The speaker's first protest was against that to him unrecognizable caricature of the doctrines of Charles Darwin which had been once more brought forward. In regard to this he contented himself by expressing the hope that at some future time they might have the pleasure of listening to and discussing a paper on evolution by some one who was really in touch with the most modern development of that theory, and who would be able to put before them the whole case, and not merely the survivals of the views of that great Christian but indifferent scientist Samuel Wilberforce.

The point of the paper which seemed to him to have been altogether neglected was the Malthusian doctrine of which so many misrepresentations were current. If, as Mr. White had said, this doctrine had produced such great results when applied to the field of Natural Science, what might not result if it were applied to the field of political economy, and that science of which Malthus was a true student though its name was scarcely heard in his time—Sociology.

Every effort was being made by authority to secure better conditions for the human race; yet as the learned author had pointed out, the net result was the decrease of parental responsibility where it was most needed.

The attempt to eliminate the unfit by raising the present generation and doing away with the conditions which led to another generation growing up with stunted bodies and minds was having one remarkable effect.

The increased burden was being thrown, and rightly thrown, on those who were most able to bear it. But at the same time while the responsibility of the wealthy and middle classes was being enormously increased, little was done to increase the sense of responsibility amongst the lowest and really unfit.

The diminishing birth rate of England was a real danger, because there was little or no diminution amongst the least economically fit, the unskilled labourers and the casual labourers, while among the economically fit the decrease was very great indeed.

They were all faced by a tremendous economic problem, and by tremendous responsibilities which they had to take up.

For his part he thanked the reader of the paper for his illuminating suggestion, and only wished that the discussion had not taken the turn it had, but had been on the lines so clearly indicated in the paper.

The Rev. A. IRVING, D.Sc., B.A., writes :—

The author of the interesting paper on "Darwinism and Malthus" seems scarcely to realize the crudeness of the Darwinian theory as an attempt to account for the fact of evolution. As a theory it has been most fruitful in the advance of thought and the enlargement of our ideas of creation. It has gone a long way to raise Natural History (both of plants and animals) from a science merely of observation and classification to an inductive science; but serious modifications of Darwin's theory have to be recognized in what we may call the "Neo-Darwinism."

Professor George Henslow, in his lecture on "Darwinism and Present Day Rationalism,"* remarks (p. 9)—"Darwinism was a theory to account for the process of evolution, as it is expressed in the title of his book—*The Origin of Species by means of Natural Selection.*" It is "based on two postulates—(i) the original creation of a few or one primitive being; and (ii) the existence of variations without which selection can do nothing" (p. 7). "Darwin's first and fundamental mistake was to introduce the element of structure or form into the theory of Malthus. It has never been shown that slight changes of structure or form, or what are called 'individual differences,' have anything to do with the death or survival of individuals. Darwin's second mistake was to regard individual differences as a source of varieties in nature." The Law of Adaptation is "the true and only interpretation of evolution, and replaces the old argument of design"† (p. 20). This implies (what Darwin assumed) that there is a power residing in the nucleus [of a cell] which can respond to external influences" (p. 18).

Here we can surely recognize *directivity* as an extension of the

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* See *Christian Apologetics;* London (John Murray), 1903.

† To the Botanist; and the latest pronouncement of the physiologist (Prof. Starling) is—"Adaptation must be the deciding factor in the origin of species, and in the succession of the different forms of life upon this earth."

same creative power, which gave existence to the protoplasm, with its capacity for cell-building as the basis of all living forms. Though "evolution" may not constitute a *philosophy*, since it fails as a sufficient basis for the simplification of knowledge, the word conveniently expresses a great law, which is something more than the "development" of the individual, as of a bird or mammal, from its *ovum*. It expresses what is included under Lord Kelvin's happy phrase, "Creative and Directive Power."

When we speak of "Evolution" as a term connoting a general law, we of course use it to express the "subsumption" or gathering up of many minor evolutions; just as we use the phrase "the law of universal causation" to connote the subsumption of minor observed laws or uniform sequences of phenomena. The fact seems to be that we must recognize in nature many minor evolutions of form and structure, which it is not always easy to correlate exactly with one another. But it is fair to contend that in every case there is the principle of *directivity* behind.* I fail to see how we can get away from that, if we accept the fundamental axiom of *the unchangeableness of the Creator*. The one is as necessarily postulated in that axiom as the other; and we may claim that this principle of directivity working for ends by way of adaptation is the only explanation for those *variations* which make for advance. These must be the *esse* of such variations (as Darwin admits) before there can be mutual reaction between them and environment leading "from lower and simpler to higher and fuller harmonies"; and thus we come to see in "Evolution" a divine method of working for ends in accordance with those laws, which belong to elemental matter and force. As Asa Gray puts it† "In each variation lies hidden the mystery of a beginning." From such a point of view we are justified in speaking of the whole process of Creation as a "continuous flow," but not as a simple stream nor as an uniformly continuous flow, as seems to be contended by Professor Starling among the latest contributors to the discussion, in his Presidential Address to

* In the discussion Mr. Woods Smyth asserted that "directivity is unscientific." This is to "beg the question." "Science" as limited to the plane of "observation and experiment" has nothing to say on this matter. It is a question of *philosophy*, and is arrived at by inductive reasoning. —A. I.

† See *Natural Science and Religion*; Scribner, New York.

the Physiological Section of the British Association at Winnipeg last year. Far more helpful, because written in the light of a broader perspective of facts, is the Address at the same meeting of the President of the Geological Section.* Dr. Smith-Woodward discusses at some length (with a marvellous wealth of facts, which palæontological research has brought to light in recent years both in the Old World and in the New) the dual tendency (i) of changes towards *advancement* and *fixity* as determinate in one direction; and (ii) of changes towards *extinction* (which are so commonly repeated), as denoting some *inherent property* in living things, which is as definite as that of crystallization in inorganic substances. All this surely implies "directivity." It is compatible with the doctrine of evolution with its limitations, but it carries us far away from the doctrine of "blind chance or blank fortuity."

Dr. Woodward recognizes a "persistent progress of life to a higher plane, which we observe during the succession of geological periods." But this had its checks, as with arrested development of the cerebral function the more animal functions, with favourable environmental conditions, expended their energy in the production of a "superfluity of dead matter." As examples of this we may point to the megatherium, the mammoth, the glyptodon, the dinornis, storing up useless encumbrances of osseous mineral matter. We see the same principle illustrated in the Orders *Ammonitidae* and *Belemnitidae* among Invertebrates; both ending off bluntly at the close of the Mesozoic age, while the former shows a repetition of this tendency to produce a superfluity of dead (mineral) matter. Here one minor evolution seems to have run its course parallel with the straight, chambered shells of the *Nautilidæ* through later Palæozoic time, to come to an abrupt regional termination with the disappearance of the magnificent Ammonites of the Alpine Trias, which may be seen in the Vienna Museum. In other regions a similar process of evolution seems to have begun at the incoming of the Jurassic series, to culminate in extinction at the end of the Mesozoic period. Space does not permit further quotations from Dr. Smith-Woodward's remarkably illuminating paper, or his enumeration of "strange cases of the rapid disappearance of whole

* Address to Section C (Geology) by A. Smith-Woodward, LL.D. F.R.S., Keeper of the Geological Department, British Museum (Nat. His.), South Kensington.

orders of animals, which had practically a world-wide distribution at the time when the end came."

It seems to me, that if we apply these considerations to the present discussion, they add redoubled force to the ideas, which in the concluding paragraphs of his paper the author has put forward, as deductions from the principle enunciated by Malthus. "The right to live," as conditioned by conformity with the laws which make for the well-being of the community, is seen to be even more strongly enforced by nature, when we see the law of directivity working for the removal from the stage of organic life on this planet of whole orders of creatures, which seemed to block the way for the advance of the whole organic complex. The idea is even older than Malthus; for it is recognized in the simple dictum of the Apostle: "If any will not work, neither shall he eat." It supplements the "parental responsibility" of Malthus by the responsibility of the *State*; and we have the double sanction of Nature and Holy Scripture for interference by the State with the liberty of the individual (i) to organize forced labour for those able-bodied people who will not work and have no other right to live; and (ii) to prevent the imbecile and feeble-minded from propagating their species. We shall all agree that such remedial measures should be tempered with mercy.

Mr. JOHN SCHWARTZ, Jnr., wrote:—

I wish to protest emphatically against the caricature of Charles Darwin depicted in this discussion, representing him as a huckstering bully who ruthlessly forced his baseless theories; whereas it is common knowledge that he was one of the gentlest and most modest of men, who held back his theories during many years of hard work, until he could fully support them by thousands of experiments and observations.

The primary object of our Institute is defined "to investigate fully and impartially and reconcile any apparent discrepancies between Christianity and Science." To-day's discussion is a fair illustration of the bias and antipathy to modern thought expressed by several members who generally monopolize the time allowed for discussion. Broadly speaking, the excellent papers read by non-members have been much more in sympathy with the main object

of our Institute than those read by members, who have often shown both narrow prejudice and an entire lack of appreciation of modern views. Professor Hull's statement that the theory of evolution was not backed up by facts as numerous and striking as were those of gravitation is quite true, but I would point out that the slowness of evolution, the impossibility to reproduce the conditions of past ages, the difficulty of experimenting, etc., precludes such satisfactory evidence.

Gravitation, like all scientific theories, is merely a working hypothesis to help us to co-ordinate numerous experiences, and evolution has also been accepted as the only adequate working hypothesis by practically all biologists, and this appears to me all that our excellent lecturer suggested.

Dr. Irving stated that he knew members of the Royal Society who did not accept evolution; surely F.R.S. does not imply encyclopædic knowledge, and beyond their special object of study, their opinion is of no more than that of the average educated man.

The Rev. J. TUCKWELL writes:—

The title of this paper gives no correct conception of its purpose. The relations of Darwin and Wallace to Malthus are only of academic interest. A better title would be "How to prevent the increase of population." No one will doubt that as things are at present there are evils arising from over-population. But the evils arise not from an excess in the numbers of the human race, but from other and preventable causes. The Divine injunction to man at his creation was "Be fruitful and multiply and fill the earth." This has not yet been done, and it may be that the ultimate purpose of God concerning humanity cannot be disclosed until it has. If I understand the Malthusian principle aright it would check the process and delay the purpose. There are better ways of meeting the existing evils, one of which is by making more room. There is room in this country for two or three times the population without our jostling one another, but millions of acres of the land are in the hands of half a dozen landlords and hundreds of thousands of acres are kept for hares, rabbits and deer instead of being used by the people. Moreover, there are vast tracts of the earth not yet inhabited by

man. Yet the writer of the paper has not a word to say about all this. He tells us on the other hand that "it is the duty of parents to put those children they have brought into the world in such a position by training, care of health, education, etc., that they may have a reasonable prospect of being able to maintain themselves in it." This is very plausible and right enough if rightly judged. But under this specious pretence there lurks too often selfishness, love of pleasure and an unnatural determination to shirk the responsibilities of paternity.

Among the well-to-do classes also parents too often require that their daughters, at all events, shall begin life with an affluence which they themselves have only attained after many years' industry. This is pernicious and demoralizing. There is nothing more ennobling than the success which is the fruit of honest toil.

But one of the most reprehensible sentences in the paper is the following: "the law of nature which Malthus seems to have discovered is more serious than at first appears. It is this, that *the right to live is not inherent.*" The author does not make it quite clear whether he himself would apply this to mankind. If he does, I do not wonder that he should add "This is startling." It certainly is startling in any case to find that any Christian should utter or repeat such a sentiment. The writer says that "when applied to biology it has been the most fruitful truth that has ever entered into that science." Well, no doubt our Creator has given man authority over nature. The right of plants and animals to live is subject to the will of man. But the right of man to live is subject to the will of God, and the Divine decree has never yet been abrogated, "Whoso sheddeth man's blood by man shall his blood be shed." If the right to live is not inherent in human life are we to have Mr. Bernard Shaw's lethal chamber set up for the destruction of the unfit? And by what tribunal is the unfitness to be determined? The author certainly has laid himself open to the suspicion that he strongly leans towards an approval of this diabolical doctrine, for he goes on to express his disapproval of "free education," "free meals" and "gratuitous feeding," and threatens the "strongest radical government" with the revenge of nature for thus seeking to "preserve the unfit." What would he have his ideal non-radical government do with the weak and sickly and underfed childhood of the nation? Leave them to suffer and die under the plea of the "elimination of

the unfit"? The Victoria Institute is not the place for the expression of the spirit of party politics, but this would be sheer brutality against which the Christian spirit among us would energetically protest. Insanity, feeble-mindedness and other causes of unfitness are largely due to drunkenness, immorality and the excessive stress of life. Suppress drunkenness, make immorality a crime in both sexes, overthrow the tyranny of inordinate wealth, give the people room to live, and bring in the ethics of the Gospel of Christ into our national life, and you will soon get rid of the wicked and nonsensical talk about the "survival of the fittest," and the "elimination of the unfit," so far as mankind is concerned.

Author's Reply.

While thanking those who have done this paper the honour of criticizing it a few deprecatory observations may be made.

The reference to Newton is merely an *obiter dictum*. No comparison is made between the two discoveries so unlike in many respects, but it is pointed out that Darwin's theories affected a greater variety of subjects.

The paper assumes Darwinism only so far as it is generally accepted. That Darwin and Wallace pointed out some most and important and unnoticed factors in the production of types of life is unquestionable: but these are not all the factors, nor do they explain everything.

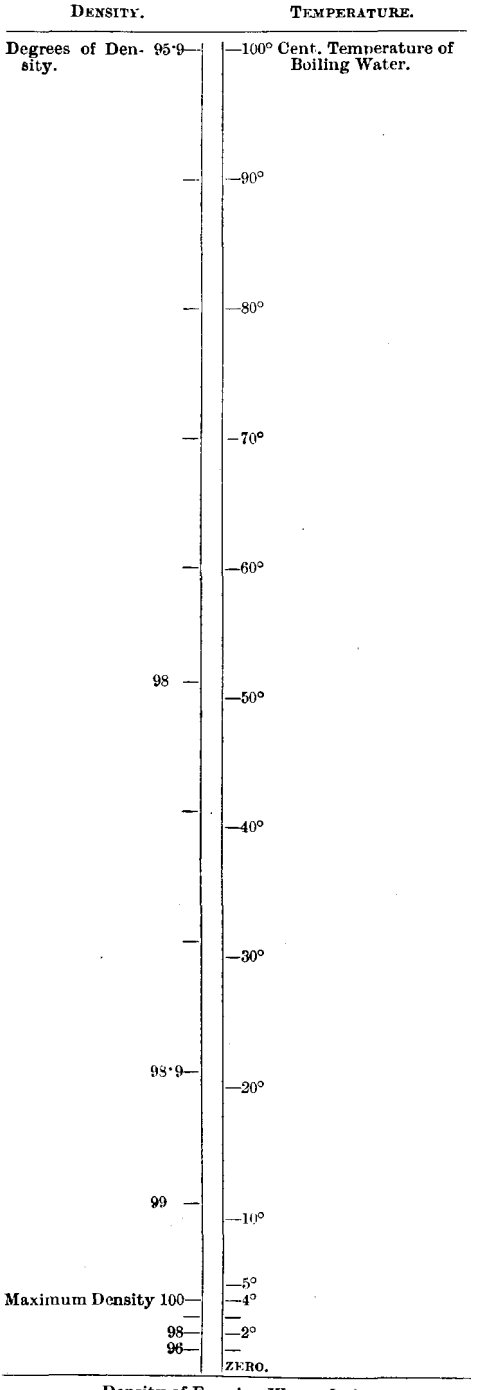
Dr. Alfred Russell Wallace, in his book entitled *Darwinism*, shows that there are gaps which Darwinism cannot bridge over; and there are other factors at work which have yet to be discovered and explained. For example, there are subtle influences of climate, locality, and environment that affect both physical and mental characteristics in ways of which at present no explanation can be given. To take a case. In the last three centuries a new type has arisen in the human race—the North American or Yankee type. This differs considerably in feature, which are marked, and in bodily and mental characteristics, from its English or European ancestors. And where the type does so differ it conforms to or takes after the aboriginal inhabitants of the soil, and that without the slightest admixture of blood. Here then there have been at work influences whose effects may be observed, but whose mode of action has not been explained.

This interest in Malthus and the obligations to him of Darwin and Wallace are more than academic. It is of the nature of a moral duty to do justice to a man who has been so ignored and misrepresented. Of all the essays and papers that the centenary of Darwin has drawn out the only one I have seen which refers to Malthus is that of Professor E. B. Poulton, F.R.S., of Oxford; and it is much to be regretted that in the Report of the Committee of Convocation on the diminishing birth-rate, it is implied that he is responsible for theories and practices which he abhorred and which he denounced.

But further the teachings of Malthus are of the highest practical importance. When they entered, into the science of biology they produced greater fruits of thought than any or all other principles or discoveries have done. How much more fruitful might they be if applied to the subjects with which they are more directly connected, such as political economy and sociology.

It is rather a strange suggestion that the title of the paper should be "How to prevent the increase of population." Except the reference to parental responsibility there is no mention or allusion to any means of checking population either in the paper or in the writings of Malthus himself. The question Malthus discusses is not whether any given country or the world itself could sustain a larger population, but this, that as population tends to increase in a geometrical progression and the supply of food in an arithmetical progression the former must overtake the latter, and a certain amount of misery and degradation must result. Malthus appears to have established the law that the right to live is not inherent, but is either imparted or acquired. The general and popular opinion is that the right to live is inherent, that is, if a man cannot or will not keep himself he has a right to make other people keep him. This is a right that could not be universally, or by a majority, or even by a large minority, exercised simultaneously.

DIAGRAM TO SHOW RELATIVE TEMPERATURES AND DENSITY OF WATER.



After the discussion on Mr. White's paper, the following paper was read by the Secretary in the regrettable absence of the author :—

THE ABNORMAL CONDITIONS OF WATER; AS EVIDENCE OF DESIGN IN NATURE. By Professor EDWARD HULL, LL.D., F.R.S. (*Vice-President*).

WE are every day brought face to face with phenomena of which we are unable to understand the origin and cause, and can only reason on their effects. An instructive and closely reasoned paper was read before the Society recently on the origin of species,* but I fear it left us very much in the same position as did Darwin's celebrated essay, dealing with the same subject; in this case, however, the difficulty was to define what was meant by "a species," while Darwin, if I recollect right, assumes the existence of species.

The phenomena of nature may be conveniently arranged under two heads; those which are normal, and those which are abnormal, or appear to be so. The former are accepted by us without question, and we have theories to account for them which appear satisfactory when tested by experience. Thus when the apple falls from the tree to the ground, we say it is merely the effect of the law of gravitation by which all movable bodies fall in the direction of the centre of the earth; this is supposed to have suggested to Newton the question which gave rise to the discovery of the great universal law: that all bodies attract each other in proportion to their mass, and inversely as the square of the distance. This seems very simple to us now that it has been demonstrated by the great mathema-

* By Rev. John Gerard on February 7th, 1910.

tician; but those who have dipped, however slightly, into the *Principia*, will find that the demonstration was *not* a very simple matter.

But it is the abnormal conditions of phenomena that more especially attract attention, and call for explanation, and I propose in the following paper to deal with two conditions of *water* which *appear* to be quite abnormal. These effects are of transcendent importance, and influence the harmonious working of the physical agencies around us; and yet have scarcely been recognized as being very different from what are regarded as the ordinary or normal results which we are acquainted with when we see that water flows down an inclined plane; or that when boiling it gives off steam. There are, indeed, many remarkable effects produced by water which I should like to have dealt with did time permit, such as its presence in the quartz of granite, and its solvent action on minerals when at high temperature and pressure, whereby these substances have been introduced into mineral veins. But I pass on to the subject more immediately before us, namely, the abnormal conditions under which waters occur; and by "abnormal" I mean differing from those which we should be led to expect by comparison with other natural objects; these conditions resolve themselves under two heads:—

(1) The temperature of water at its maximum density of 39·2° Fahr. (4° Cent.), and
(2) Its incompressibility by which it probably differs from all other substances.

The consequences of these abnormal conditions in the economy of nature are inestimable, and we shall consider them in the above order.

(1) *Maximum Density.*—When water is at a temperature of 212° F. under normal pressure it passes into steam and has a minimum density. Cooling down from this point it contracts or becomes denser as it grows cooler, until it reaches a temperature of 39·2° Fahr. (4° Cent.) where the contraction is arrested; and from this point down to 32° F. (that of freezing) it expands, producing ice, which being lighter than water, floats on its surface. Here it is, therefore, that the abnormal conditions arise, for the condensation might have been supposed to have continued throughout the intermediate seven degrees (from 39·2° to 32° F.) resulting in the formation of ice heavier than water, and consequently sinking down to the bottom of the basin or reservoir. Such, however, we know not to be the case, as eleven

volumes of ice melt into only two volumes of water* at 32° F. The water has, therefore, expanded (or become less dense) between these two definite points of temperature. This is a very remarkable and important fact; and we shall best understand its importance by considering what would have been the physical results had what we may call "the normal law of contraction of volume" been continuous down to 32° F.

(*a*) We may consider the results as regards rivers and lakes and other large areas where the annual mean temperature of the air is below 32° F., such as the lands north of the Arctic Circle—latitude 66·33° N.—especially those at some elevation above the border of the ocean. North of the Arctic Circle the rainfall, instead of flowing off the land into the ocean as rivers, would have been permanent ice-streams; while the lakes would have been converted into solid masses of ice; because the ice once formed would have remained as such, accumulating on the bed of the valley without opportunity of melting. As this process must have been in operation throughout long ages of time it is impossible to imagine what would have been the condition of these regions had ice as it formed at the surface subsided to the bottom.

(*b*) Now extending our purview to the adjoining oceanic regions, is it not clear that the effects would have been similar in kind, though vastly greater in result? The ice as it froze on the surface, being by hypothesis heavier than the underlying water, would have subsided, and this process having proceeded throughout long ages of time must have inevitably resulted in converting what is now oceanic water into solid ice. Can we conceive anything more lamentable than a solid Arctic Ocean? Only where the influence of the Gulf Stream extends, warming the surface waters, and mollifying the climate so that the surface does not freeze throughout the year, would the present conditions have been permanent.

(2) We now come to consider the second abnormal, or exceptionable, condition under which water exists, namely, INCOMPRESSIBILITY and its effects in the arrangement of the *Cosmos*. Water is incompressible; and perhaps it is the only object in nature that is so. Various experiments have been tried in order to compress this liquid without success, and just because it is a liquid. On the other hand, solids are compressible; the contrast being due to the difference in arrangement

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* Daniel, *Principles of Physics*, 3rd edit. (1895).

of the molecules in each case. In solids the molecules are not in contact, and consequently pressure only forces them closer to each other, "but in liquids, the molecules are within the spheres of each other's action; and each molecule is free to adjust its mean position under the influence of surrounding molecules." This, at least, is Alfred Daniel's interpretation of the phenomena.*

But whatever be the true explanation of the difference between fluids and solids as regards incompressibility and the reverse—the experiments shown in Bramah's hydraulic press, and by Francis Bacon seem to confirm both the above statements. In the former case a ball of iron was filled with water at 3·9° Cent. and closed. It was then subjected to great pressure; but the water forced itself through the pores of the iron, and appeared on the surface as vapour. In the latter case, a shell of lead was filled with water and compressed; the water oozed through the lead in drops and beads on the surface of the shell, showing that the iron and lead are porous; while the water resisted compression, up to the bursting point of the shell and ball.†

But however the question of incompressibility might be investigated by the aid of experiments in the laboratory it is surely set at rest by observations in the region of physical phenomena itself. It may be impossible to imagine that water like other substances in nature cannot yield to any conceivable force—but for all practical purposes, the fact remains that it is incompressible; as it remains fluid at the lowest depths of the ocean yet touched by the soundings. Depths of 2,000 fathoms and upwards have been sounded in waters of the North Atlantic at a temperature of 2° to 3° C. (37° to 39° Fahr.)‡ and living forms have been brought up from the bottom. What the pressure on the lowest strata of the water may be I cannot venture to say; it must be some thousands of tons per square foot, but it is insufficient to consolidate the water even at a temperature approaching freezing point. Now just imagine for a moment compressible water. What would be the state of the ocean under such conditions even were the degree of compressibility of the slightest? Evidently, that after the weight

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* *Principles of Physics*, p. 254, 3rd edit.

† *Principles*, p. 220; we are not told the amount of pressure, or the thickness of the ball and shell, but we may assume they were both sufficient to satisfy the experimentalists up to bursting point.

‡ Wyville Thomson, *Depths of the Sea*, p. 322, Plate VI.

of a few hundred fathoms of water added to the degree of condensation reached at a rather low temperature, the water would become solid; that is to say, a mass of ice throughout a depth of several thousand feet from the floor. Throughout this zone life would be absent; the currents of the ocean would be restricted to the surface, and the whole physical arrangements now working harmoniously, would be impossible. All this has been rendered impossible owing to the incompressibility of water, in which it differs from all other bodies, and is therefore abnormal.

As a digression for a moment, I may observe that it is owing to this condition or attribute of incompressibility that the flanges of a propeller are so effective in forcing a ship of the largest size at a high speed through the water. When we examine one of the beautiful models of our ocean liners, we are struck by the diminutive size of the propeller at the stern with the huge mass which by its rotation and the slight angle at which the flanges are set to the axis, it is capable of forcing the ship through the ocean at a high speed. We have to recollect, however, that the water when thus acted upon is practically a solid. There is not time for it to give way, and being incompressible it cannot yield to the lateral pressure exercised by the flange, any more than if the waters were solid or nearly so. We shall now return to our subject.

It is to be observed, moreover, that these two attributes of the maximum density and incompressibility work harmoniously together in the physical system of the globe. It is owing to this that the ocean at its profoundest depths is never frozen, though it approaches within a few degrees of the freezing point. The currents of warm water, such as that of the Gulf Stream, which is constantly pouring water at a high temperature into high latitudes, are necessarily replaced by cold polar waters moving slowly in both directions over the bottom of the ocean towards the equatorial regions. If the waters were compressible, or if the conditions regarding density were otherwise from those above described, this circulation of the warm and cold waters would be rendered difficult, if not impeded because the frozen polar waters would not be able to rise to the surface.

As regards lakes; for similar reasons the waters even in deep lakes are never frozen at the bottom; the ice as it forms at the surface owing to the cold of the air, constantly ascends; thus tending to keep the underlying waters in a state of fluidity. The soundings over the Lake of Geneva show that the lowest waters are at a temperature above freezing point. From a

depth of 240 feet down to nearly 1,000 there is an unvarying temperature of 34·9° F. (6·6° C.) throughout the year. In the Lake of Constance a temperature of 40·1° F. (4·5° C.) prevails in the deeper parts, and in that of Neuchâtel of 41° F. (5° C.) prevails. The slight excesses in some cases are probably due to the heat of the bottom rocky floor.

I hope I have succeeded in showing that the two conditions under which water exists are apparently abnormal—yet I do not wish to assert that they are on a plane outside the range of the Creator's general work, or plan, in Nature. To my mind the whole mechanism of the world is the outcome of supreme wisdom and mind tending to the harmonious working of the whole, and the instances I have adduced are only parts of the general plan. These are amongst the most evident as indicating DESIGN, and we are therefore more able to investigate their mode of operation.

DISCUSSION.

At the conclusion of the paper the Rev. A. IRVING, D.Sc., B.A., said: Professor Hull's paper on "Abnormal Properties of Water, as Evidence of Design in Nature," deals with a very interesting subject, and one which Canon J. M. Wilson of Worcester, who in his day was a Cambridge Senior Wrangler, handled in a masterly way in a lecture given many years ago to the Literary and Philosophical Society of Nottingham.

(1) The fact that water has its maximum density at 4° C. is one which admits of quite simple demonstration, and I have frequently given the demonstration (by a modification of Hope's method) to classes in years gone by. But not only does water expand on cooling from 4° C. to 0° C., it also further expands in the act of congelation, a fact with which most householders have unpleasant familiarity in severe frosty weather. The force of this expansion is enormous. Some thirty years ago we obtained actual demonstration of this at Wellington College, when a bomb-shell, 9 inches in diameter, with walls of solid cast-iron $1\frac{1}{2}$ inches thick, was burst into three large fragments by simply exposing the shell (after being filled with water at 4° C. and closed with the gun-metal plug) to

the severe frost of a January night. The importance of this in the economy of nature is pointed out by Professor Hull; but I wonder that, as a geologist, he did not lay some stress upon the important work which it does in the degradation of mountains and of sea-cliffs as well as in pulverising the soil during frost, with beneficial results known to every agriculturist.

(2) But another deduction follows from this law, and from the converse fact, that pressure acting hydrostatically upon ice causes it to melt or liquefy. This was splendidly demonstrated years ago by Helmholtz and others.* Now, as pressure upon ice tends to its liquefaction, so pressure upon water at 0° C. prevents its congelation. This is the true explanation of the fact that water can exist in the liquid state at ocean-depths at very low temperature; and we cannot therefore follow Professor Hull, when (in the second part of his paper) he attributes this fact to the incompressibility of water. Pure water is compressible to only about one twenty-thousandth of its bulk; but most water, as it occurs in nature, holds atmospheric or other gases in solution (a fact which is easily demonstrated), and is rather more compressible accordingly. Still, for practical purposes water may be said to be incompressible, and the important results of this have been dealt with by Professor Hull.

(3) In connection with this subject there is however one point which has not been touched upon in the paper, although it must be of philosophical interest to many members of the Victoria Institute. We can follow Professor Hull in pointing to the abnormal behaviour of water in expanding from 4° C. to 0° C., with all its important consequences, as one of the strongest evidences of Creative Design which Physical Science discloses to us, because it is *unique* among liquids. But we must not confound this fact with the other fact, that in the act of congelation it undergoes further expansion, since in this matter it is not unique. Bismuth and cast-iron undergo similar expansion; and in the case of the former, the fact is turned to account in using an alloy of bismuth and lead for casting type-metal, the expansion of one metal compensating for the contraction

* Liquefaction under pressure and regulation is a most important factor in the flow-movement of glaciers. See my paper on "The Mechanics of Glaciers," in the *Quarterly Journal of the Geological Society* (February, 1883).

of the other. Failing to draw this distinction so good a physician as the late Professor Tyndall went out of his way to deal (in some of his writings) feeble blows at the teleologist. It was an instance of dealing blows into the air, *vires in ventos effundere* (Virg.)

Professor HULL'S reply.—That water "further expands in the act of congelation," as Dr. Irving points out, is of interest; though I question whether the experiment at Wellington College proves more than that at zero of Cent. the expansion had reached its maximum; and water *being incompressible ex necessitate* burst the bomb.

As regards Dr. Irving's "wonder" that as a geologist I did not enter upon the agency of water in eroding mountains, etc., my reply is that these were outside the range of my subject. My object was to point out the abnormal characteristics of water, and their evidence of Design in Nature. Until I received Dr. Irving's criticism I was not aware that this subject had been treated by a Senior Wrangler of Cambridge, or any other writers; the advantage of this is, that both essays, that of Canon J. M. Wilson and my own, are original.

507TH ORDINARY GENERAL MEETING.

MONDAY, APRIL 18TH, 1910.

PROFESSOR E. HULL, F.R.S. (VICE-PRESIDENT), IN THE CHAIR.

The Minutes of the 505th Ordinary General Meeting were read and confirmed.

The following lecture was then delivered by the author :—

PLATO'S THEORY OF PUBLIC EDUCATION IN RELATION TO THE CHRISTIAN DOCTRINE OF HUMAN NATURE. By the Rev. H. J. R. MARSTON, M.A.

THE acknowledged greatness of Plato as a writer and a thinker, and his perennial influence upon thought, especially in connection with education, justify me in approaching what is, perhaps, the most interesting and thorny of problems, through the great Greek thinker. Moreover, there are in his opinions, especially as expressed in the Republic and the Laws, certain phases on which he insists, which have visible affinities with opinions of leading educationalists in the present day.

This is specially true of the emphasis which Plato lays upon the State. For weal or for woe during the last generation and a half in England, in France, in Germany and in America it has passed into an axiom, or at least, an assumption, that the State has to have the first and the last word in education.

This subject has divided mankind always, and there are incidental advantages in passing from the heat and din of current controversy to the calm and the cool of the academic grove, and in trying to gather first principles from one whose voice has long been mute, although his spirit still rules ours from his immortal urn.

I will trouble my audience, for the sake of clearness, and of what will come after, by indicating how this subject arises in the *Politeia*. That wonderful dialogue begins by describing a gathering, friendly and domestic, of Athenians. They are discussing the nature of justice. And Socrates, who is amongst them, suggests that they should study justice on a large scale—in large letters, to use a favourite Platonic image: that they should not seek for it in the individual man, but as expressed and embodied in the State. They agree. They then proceed to discuss what the State is, how it originates, how it works itself out. They arrive at the conclusion that the principal thing in a State is the ruling class.

The question then naturally arises—How is this ruling class to be educated? They then proceed to discuss the nature of the education of the guardians. Thus there are three great subjects which alternate and interweave themselves throughout the whole of the *Politeia*. The first is the nature and office of the State. The second is the essence and the issues of justice. The third is the scope and the method of education. Thus it is that education, though only the third of the subjects engaging the mind of Plato, becomes a permanent and striking matter in the course of his meditations.

In the next place let me review what is in general terms the ground and scale of Platonic education. It begins with morals. It then proceeds to music. Music, however, we must understand not in the limited and technical sense, but *mousike*, that is to say, the whole art of the muses. It involves elocution and general culture, λέξις, a mode of diction and demeanour proper to the guardians. From music he passes on to gymnastic, which is to have the same effect upon the body as Μουσικη has upon the soul. Gymnastic is to be followed, so it appears, by arithmetic; arithmetic does not mean that painful, mechanical form of study from which I have a hereditary and an instinctive aversion. (Laughter.) But it means the whole of the great science of number and of measurement, for which I have a profound but distant admiration.

Following arithmetic comes dialectic, which covers a great deal of what we should call moral and mental philosophy. Finally, the close and climax of the Platonic graduation of knowledge, of the scheme of education, is philosophy itself. Philosophy meant to Plato the power acquired by the highest intellects of contemplating pure truth, a power which, unhappily, he has at last to confess, is only attainable by the rarest and most gifted of the intellects of mankind.

I shall have to criticize at some length and with some asperity a great deal that is contained in Plato's theory of education. I must begin by saying that the whole scheme at once attracts and arrests us by certain admirable and striking features. (Hear, hear.) In the first place there is displayed throughout the whole of the *Politeia* immense, I might almost call it a preter-natural, ardour for knowledge. In the second place it exhibits a highly admirable belief in the value and importance of educating the faculties of both mind and body; and in the third place it exhibits a breadth of view and speculative freedom and grandeur which it may be said is very far remote indeed from, and apparently but slenderly understood by many of the most clamorous, and by many of the most obtrusive, advocates of education in the present day. (Hear, hear.)

This is the scheme of education which one gathers from the *Politeia*. I would not have you suppose that it is categorically set forth as in the Code proceeding from Whitehall. It is mainly apparent in these parts: in the third book, in part of the fifth book, in part of the sixth book, and in the tenth book, where it divides with justice the honour of bringing the dialogue to a magnificent climax.

This system of education which Plato here unfolds rests upon one single thought, the exclusive supremacy of the State in education. Education by the State and for the State is the distinguishing conception of Plato's theory. Nothing may be allowed to interfere with that conception. That is the root, and it is the centre, and it is the close, of all Plato's cogitations.

It therefore now becomes my duty to describe Plato's ideal state. I will begin by describing it succinctly. Plato's ideal state is an aristocracy. That aristocracy rests upon a divinely-made distinction of classes. That distinction of classes is rigorously defended by a division of labour. It is an axiom with Plato—one man, one job. This is again and again insisted upon. A cobbler must cobble shoes *in æternum*. A shepherd must do nothing but tend sheep. A soldier must always be soldiering, and a guardian must always, from morn till night, and again from night till morn, be occupied in protecting the State.

This view of the State necessarily involves that the State should govern education. Accordingly, the whole question of education for Plato is ruled by one consideration. Is this, or that, a good thing for the State or not? Does this, or that, tend to make a good citizen, or a better citizen than something

else? If so, it shall be *pro tanto* incorporated in the scheme of education. If not, it shall be peremptorily ruled out. That must be carefully remembered as we are discussing Plato's theory of education and what follows from it.

There is another important, a painful element which it is impossible to pass over in describing Plato's ideal State. It became necessary for Plato in constructing his ideal State to enquire, how shall this State be preserved? It can only be preserved, said Plato, by the perfection of its guardians. What is it which the guardians of a State are most likely to be corrupted by? It is, said he, "by discord." All states ultimately come to ruin through discord. Our State, therefore, at least in its guardian class, must be wholly immune from discord. But what are the things which cause discord? "Private property, personal ownership, 'Mine and thine.'" These terms, therefore, must be banished from our guardians. They must never know the sound or the meaning of "Mine and thine." They must, in short, be absolutely communistic. With remorseless logic, he carries this out into every detail of life; he sweeps away family obligations. To this he sacrifices the purity, and the naturalness, of woman. Under this head he sanctions sins from which modern legislatures would recoil; this is the sole test of what things are fit and not fit to be enjoyed and practised by the guardians of the State. It is melancholy, that we have to contemplate in the man whom Dr. Jowett has called "the father of idealism" and the greatest metaphysical writer of the world, such a lapse from the high standard of morality which has been introduced by the Gospel.

But two things are to be borne in mind. First, that Plato is only here arguing upon ideal conditions; and secondly, that he was not acquainted with the sacred morality of the Old Testament, still less with the more lofty and sacred morality of the New. Those things must be said in mitigation of any sentence which we pronounce upon Plato's doctrine of communism.

But, those things being said, do not prevent me from saying this, viz., that the *Politeia* of Plato furnishes the most illustrious proof in the world, that the theory of a proprietary state is logically inseparable from a communistic view which endangers private property, personal liberty, sexual purity, and intellectual originality.

Such, then, is Plato's State; and I now pass to enquire, what is the influence of such a State upon education, even from

Plato's point of view? I answer, that it has two distinctly disadvantageous consequences.

First, although it would secure to the guardians a thorough education, it would make that education restricted in a marked degree. The guardians may know and practise only such things as by knowing and practising would make them better citizens.

Now that is good from the point of view of Napoleon. It is odious from the point of view of Dr. Arnold. On the other hand, while this Platonic State would give to the guardians a thorough, though restricted, education, it appears to leave the lower classes wholly uneducated, or it passes them over.

In illustration of this statement I read the following extract from the *Politeia*, "All you who live in the city are brothers,* but God in fashioning you mingled ingredients of gold in the composition of those who were capable of ruling the State. On that account they are to be the most highly honoured. Those who are capable of becoming auxiliaries to the guardians He composed with silver; while husbandmen and the working class in general He mingled with elements of iron and of bronze."

Popular education could never flourish, could perhaps scarcely exist, under such a theory of Society as that.

Passing now from the effect of Platonic education upon the upper class and the mass of the community, I turn to consider wherein a Christian system of education differs from that expounded by Plato.

In order to meet that consideration I must trouble the Society to allow me to examine the Christian doctrine of human nature. I find that the word φυσις, or nature, occurs in the Greek Testament at least fourteen times. It occurs in the writings of St. James, St. Peter, and St. Paul.

St. James uses it twice;† St. Peter uses it once;‡ St. Paul uses it eleven times.§ St. Paul uses it in the earliest of his Epistles—that to the Galatians; and in the Ephesians, one of his latest Epistles. It is distributed through the New Testament in Gentile and Jewish scripture. This word and the notion which it expresses runs through the teaching of the Apostolic Age.

St. Peter uses it in connection with God. St. James uses it

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* Book iii. † iii, 7. ‡ ii, 1, 4.
§ Galatians ii, 15; iv, 8. 1 Corinthians xi, 14. Romans i, 26; ii, 14; xi, 21, 24. Ephesians ii, 3.

in connection with man—(though it is unhappily mistranslated as "Mankind" in the third chapter of his Epistle). St. Paul uses it to describe nature neither in connection with God nor with man, but as it is in itself if you examine the uses by St. Paul you will find them valuable and instructive.

The Apostle appears to regard φυσις as a *Monitor*,* where he speaks of the Gentiles doing by nature the things which are contained in the law; as a *Teacher*,† where he says that nature teaches the propriety of a woman wearing long hair, as a *Witness*‡ against idolatry; as a Registrar§ of decrees of God distinguishing Jew from Gentile; as a Recorder of God's displeasure with our sinful condition.‖

A new conception of human nature, and with it of human education, gradually possessed the minds of the best Christian teachers. It flowed inevitably from such a view of nature, that nature seen in man should be regarded as dignified and splendid,—a something whereby man comes into living fellowship with God both as his Creator and his Redeemer. When once human nature, albeit fallen, was realized as something redeemable, if not redeemed, thenceforth the contracted notion of State humanity, and consequently of State Education, began to wane.

On comparing Plato's view of human nature with that prevailing in the New Testament, we perceive that the two views have features in common. Both are cast in gloomy colours. There are passages in Plato more trenchantly interpretative than the severest indictment framed by St. Paul.¶ The philosopher and the apostle are alike remote from the sickening self-complacency of Rousseau and his imitators. There are in Plato no rosy-tinted illusions about the inherent goodness of human nature, as it actually is.

But the Christian doctrine of human nature is, when compared with Plato's, felt to be tenderer, more liberal, more profound. To Plato, indeed, human nature** meant little more than Greek human nature. The Apostolic writers treat of man as man. "There is no difference." "What God hath cleansed that call not thou common." Such is the language of the New Testament about human nature.

This language flowed from the knowledge that man, however

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* Romans. † 1 Corinthians. ‡ Galatians.
§ Galatians and Romans. ‖ Ephesians.
¶ *Politeia*, Book vii, Jowett's translation, p. 214; Book ix, Jowett's translation, p. 280.
** See Luthardt, *Moral Truths of Christianity*, pp. 238, 239.

deeply fallen in fact, was originally good,* was capable of renewal, might become a partner in the Divine nature.

And from this doctrine was derived an ideal of education fruitful and indestructible, because co-œval with man's best self. This ideal displaced that elder one of State humanity and State education.

Now it is upon this conception of human nature that Christian education took its stand. Upon this conception it has ever remained.

What seems to me to be in danger is a reverting from the Christian view of education resting upon the Christian doctrine of human nature to a lower view of education resting upon Plato's ideal of human nature.

I now come to discuss for a few moments a definition of education,† and then to ask a question. I venture to define education thus:—It is a process of developing the faculties both of mind and body by a method of collective tuition adapted to the individual scholar and subordinated to the highest end of human nature.

I have no doubt that the sting of the definition lies in its tail, as in the case of the scorpions of the Apocalypse. What is the highest end of human nature? It is here that the conflict between the two ideals takes its rise. "The highest end of human nature," said Plato, "is to be a guardian of the state. The mass of mankind can never fulfil that end, for they can never be guardians of the State.

Christianity replies, "The highest end of human nature is to glorify God." In order to glorify God a man must become what God designed him to be. He cannot be twisted and tortured into any relations whatever, which are going to supersede his essential freedom. Two things follow from my definition of education. First there must be in every well ordered scheme of education resting upon Christian principles a liberty to specialize. We cannot be dragooned into something to please either the Conservative or Liberal Party. Education must be free. Schools must have their sovereignty. We must respect the individuality of the scholars. We must reverence the highest that is in human nature. This raises the great question, which I hope the Society will take up and discuss

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* Compare Bishop Butler's preface to the *Sermons on Human Nature and Tertullian*, translated by Gwatkin, *Selections from Early Christian Writers*, p. 113.

† *Moral Truths of Christianity*, p. 234.

with its usual animation—what is the function of the State in education? I cannot stop to elaborate, but I will close with two suggestions. The view of education founded upon human nature as disclosed in the New Testament requires first, that the State must be the delegate of the parent, and secondly, that the State must consent to be the partner of the Church. (Applause.)

Additional Note.—The English word "natural" which is read in 1 Cor. ii and xv, is an unfortunate and misleading translation. It represents the Greek word "psuchikos"="psychic," or "sensuous." It is wholly different from the Greek word "phusikos," translated "natural" in Romans, and 2 Peter.

No text has done more harm to English Christianity than this—"the natural man receiveth not the things of the Spirit of God." The words sound as if nature were essentially irreligious. A careful study of the language of the New Testament leads to a very different conclusion.

Discussion.

The Chairman.—Ladies and gentlemen, you have listened to a most eloquent and clear lecture on the part of the gifted speaker the Rev. Mr. Marston, which I am sure has been a great pleasure and gratification to us all to listen to. I am happy to say that there are in the room gentlemen capable of taking up this subject and dealing with it as it deserves, and I now only have to say that the question is open for discussion. Perhaps any lady or gentleman —because ladies are not excluded—who wishes to speak on this subject would kindly send up their names in case the unhappy Chairman does not recognize them at once.

The Rev. J. J. Coxhead.—Much as I appreciate—in fact no one in the room can more fully appreciate—the interesting address to which we have listened, I do not feel quite certain whether the leading idea of the Republic has been altogether grasped and elucidated by the speaker. The object, as I conceive it, of the Republic is to find out what justice really is—a term which would be expressed in the New Testament by the word "Righteousness." In order to discover what justice really is Plato desires to see it written as the speaker reminded us, in large letters, that is to say, in the State. As a matter of fact, the State does consist of various

classes, and to each of these classes a certain education is by common consent given, and ought to be given. And it is a grave question whether in departing from that principle we have not, to a certain extent, made a great mistake; because in endeavouring to give as much culture as possible to those whom we regard as the lower classes, we aim at giving them precisely the same education that we give to those of the upper classes; and as the result of that system it is a grave question whether we do turn out the kind of citizens and the kind of persons who are most useful to the State and most happy in themselves. (Hear, hear.)

Now Plato, as I have said, in the desire to discover what justice or righteousness is, wishes to see it illustrated on a large scale, and in that large scale he seeks to include an education even as regards the lower classes, because he would consider that they had their education in doing their work well. Even in the class of cobblers, of whom he speaks in rather contemptuous terms, he makes distinctions. There are good cobblers and bad cobblers; and he assumes that in their cobbling they will receive that education which will render them happy in themselves, and useful to the community to which they belong. Is he doing altogether wrong in that? Is it better that we should have good cobblers who can cobble well, than that we should have bad cobblers who understand Plato? (Laughter.) I think we shall all agree that we would rather have the good cobblers who did not understand Plato (Hear, hear) and have never heard of him.

But I think that if we catch the spirit of the Republic as it ought to be kept, Plato's object is to show that there is in human nature a certain division of faculty and a certain division of powers each of which must be subordinated to the highest of all the powers, namely, reason

The question is whether in the exercise of reason we ought to have husband or wife or child, or whether there should be any of those distinctions in the inner nature which will induce us to act contrary to what we conceive to be the principles of pure reason.

Now the Ancients always believed that the father acting as judge, acted righteously, and acted as he should act, when he would bring himself, though no doubt after a great conflict with the other part of his nature, to give the sentence which justice requires. And if we look into the New Testament we find that there are

indications of something of the same kind to be found even there; because there, there is neither Gentile nor Jew; there is neither male nor female, but all are one; and Supreme Reason, the highest reason of our nature, should teach us to trample under foot even the natural desires of man for the sake of the Kingdom of the Lord.

Colonel ALVES.—Mr. Chairman, unfortunately I was not able to be here at the beginning of the lecture, so I do not know if Mr. Marston gave a definition of the word "Education." Well, education is not book-learning. Book-learning may be necessary, or at any rate, very useful for education, but I have heard of great warriors and great statesmen and kings who ruled ably and wisely, who could not read or write, and who made their mark. We have an illustration of that in pricking the roll where the king or queen takes a bodkin and puts a prick against the name of one or two who have been read out, and who are those elected for sheriff. It dates from the time when great kings and other people could not read or write. But they were not uneducated men; they could set the battle in array, and they could make wise laws and show themselves men. Book-learning is useful because it helps a man to do without his fellows; but I have found myself that what I have learned through contact with my fellows is of more use to me than what I read from printed matter in books. (Hear, hear.)

Mr. Coxhead alluded to cobblers, and I remember a little boot-maker more than a score of years ago who could hardly read or write. He was a sharp, intelligent man. He could make a pair of boots from start to finish, and he could make the last on which those boots were made, but he could hardly read or write, and his complaint against the men who worked under him was this: that they took no interest except in doing some little bit of a pair of boots. They had no pride in doing their work; all they wanted was to receive their pay. I have no doubt they could read and write. We know journeymen bootmakers and journeymen tailors are great politicians. One of their number is paid by them to read the newspaper for an hour, and they discuss politics over their work; but I am not aware that they are highly educated men or great statesmen.

Now we have to go to the Bible. Do we not find in the book of Daniel mention of the element of gold, silver, or copper?

The CHAIRMAN.—It does not apply to those degrees.

Colonel ALVES.—It applies to Governments and forms of government, and the people carrying on the Government, showing that there are differences of quality; and in the New Testament we read of a man having five talents, a man having two talents, and a man having one talent. There are great differences, and there is no doubt if you take your walks abroad into various neighbourhoods, you will see in the heads of the men and the heads of the children vast differences between class and class; that some have higher qualities, and are capable of being educated to a higher pitch than others. And after all, education only means leading out, developing the faculties that a man already has, and not trying to make him into something that he cannot be. We are born, I am told, each one with a certain number of brain cells, and that number cannot be added to all the days of your life, though you live to the age of Methuselah.

So I think we find that there are those differences of classes, and as most men have to live competitively, those of the highest power rise up either to be kings or noblemen, or gentlemen of a humbler rank, or lower middle-class, each class a social stratum. Yet even in one class there are vast differences, because an artisan is far higher than the bricklayer's labourer; his intelligence is greater, he is a better man. He has either developed his faculties or his forefathers have developed their faculties; and the result has been that they have had better offspring, so we cannot put mankind on an equality. The old Feudal System had this in it at any rate; men rose to knighthood from the very humblest ranks of life, but if a man rose into the higher class he had to leave the lower class behind him. If a man has to go from the iron to the bronze class, he leaves the iron behind him; if he goes from the bronze to the silver he leaves the bronze behind him, and so on. There is no mixing up classes. I will not say that Feudalism was right, but it had the elements of rightness in it, and it is because the upper classes do not treat the lower classes with consideration that there has been the assumption that the upper classes are not fit to be rulers because they are not just, and that therefore the lower classes will be fit to rule. But they will not be any more just than the others, and we know the final result of bringing up the lowest class into power will be that eventually they will receive Antichrist. That is the teaching of the Bible, so we cannot put men on an

equality. The object of all our education and book-learning is to develop the best and highest faculties of a man for the work for which he is best fitted, and nine-tenths of the population must work chiefly with their hands.

Rev. J. J. COXHEAD.—May I say a word more?

The CHAIRMAN.—Certainly.

Rev. J. J. COXHEAD.—I do not think Plato for one moment ever contemplated as a fact the composition, the construction of any State exactly on the lines of a Republic, and I think that Mr. Marston clearly said that: that his idea is ideal and not actually practical.

Dr. TRENCH.—A very interesting question arises in connection with all we have heard. I do not know whether it comes within the compass of the subject matter of the lecture we have, with great interest, listened to, to consider in a more practical aspect, and from the Christian standpoint, what ought to be the aim of the State as an instructor in education.

The CHAIRMAN.—Oh yes, sir, quite.

Dr. TRENCH.—We stand on a common ground here in believing that the State should give education to the members of the community. What form should such education take? The Christian Faith, we know, recognizes the variety of social position which as a community we represent. All do not stand on one dead level: the mental and physical endowments of each individual obviously vary. It seems an outrage on the liberty of the subject that, in the name of the brotherhood of man, communities of men should ever attempt to interfere with the liberty of the individual. (Hear, hear.)

As education needs to be provided for the general community at the public expense, it seems fitting that the aim should be to give knowledge of an essentially simple and useful kind—the groundwork for the future development of each boy and girl.

It seems right that knowledge of the three R.'s should therefore form the main substance of such an education. In addition, that the girls should be practically instructed in simple laws of hygiene, in cooking and in sewing; that provision should be made for gymnastic open air exercise for boys and girls. Further, as I think, special attention should be given to inculcating on all the duty of patriotism, and the nobility of showing respect for

authority, whether in the family or the State. Military drill for every boy in the land would be an excellent means for imparting the sense of discipline.

All tuition should be distinctly grounded on the broad basis of the principles of the Christian Faith which, as a people, we hold in common, for on this basis alone is it possible to build securely and with well-founded hope. All experience teaches that, and the wisdom of our wisest men tells us it is so.

With such groundwork for the development of the moral and the mental faculties, it seems to me that the State would essentially fulfil its duty as regards Primary Education.

We look further for provision for Secondary Education, as is already embodied in legislation and practice, whereby a broad and more liberal education is provided for the relatively few who in the Primary Schools have shown marked ability or zeal in their studies, together with opportunity for gaining scholarships or other rewards, and provision for such is rightly borne at the public expense. I think the State should make provision for the establishment of Continuation Schools for instruction in the evenings, making it obligatory that, at these schools, every boy, on leaving the Primary Schools, should learn a trade, that thus mind and body, through study of a handicraft, should be together exercised. (Hear, hear.) Such special education would prove of immense benefit in more directions than in the manifest economic one.

Mr. OKE.—Mr. Chairman, we have had a very interesting summary of Plato's views on Education contained in those ten Books of the Republic of Plato which are such masterpieces in their way. It is very interesting to those who can read them in the original. I struggled through them a great many years ago, I am sorry to say now, and therefore I do not remember entirely what was contained in them, but if my memory serves me, the Guardians were to be hereditary, were they not? If a man was born a Guardian his son was a Guardian?

Rev. H. J. R. MARSTON.—Not if his son proved unworthy. If his son proved unworthy he was to be degraded to the class of cobblers over which Mr. Coxhead has made so merry.

Mr. OKE.—It did not follow that gold was mixed up with the composition?

Rev. H. J. R. MARSTON.—It was not hereditary gold.

Mr. OKE.—It was not hereditary gold—that is all-important, and I think that is a point to be brought out: that gold that is contained in people is only discovered through giving a modicum of Education to all. That is the position to-day; our State ensures that a certain amount of Education shall be given, as far as the Law is carried out, to all; and by not placing the standard too low, by not confining it simply to the three R's, it is possible that you may bring out talents in those who have been living almost in the gutter and find them at the Universities years hence. I can name at Oxford and Cambridge men whose origin was so humble that perhaps through the fault of their education they despised their relatives. It was only recently that I was in the other end, in the slummy part of London, looking to see where one of our Senior Wranglers came from; and when we think of such capabilities only needing the chance of development, what may not education do for us in the future?

I do not think we need limit ourselves to the three R's. Give the people something for which they may strive (Hear, hear), and remember that in the New Testament we are told that all are to strive to do their best in their different spheres. If then by Scholarships, and if by helps in various ways anyone is able to rise in the so-called social scale, surely it is best for us. But education must be directed in such a way that to the highest intellectual attainments there is added the element of religion. Only here the difficulty, as it seems to me, is to ensure that a right definition of the Church is given.

If you speak of the partnership between the Church and the State one would like to take it in that widest sense of a Church that is almost above the Creeds, of a Church that is based on the Bible, and if you do that, you may be sure that your education, although it may be somewhat ambitious in the end, will be for the benefit of all those who form part of the community.

Rev. J. TUCKWELL.—I should like at this stage, especially after the very excellent remarks we have just heard, to add a word or two if I may. I think we have had before us this evening two rather different subjects. We have had the ideal, and we have been discussing the practical. Now I suppose an ideal State would not be Plato's Republic. It would be more after the nature of the State which has just been hinted at by the previous speaker, where every man had a fair chance; where there would be nothing to repress individual attainment, where the gold would come to the surface, and

a man would find his rank according to his worth and according to his abilities. That would be an ideal state; but it appears to me that at present it is impossible for us to realize it. We may aim at it, and I think we should aim at it most decidedly. It is far better to have high ideals—even though we may fall somewhat short of them—than to be otherwise. Then we have had also the idea of the Church. Well, it is exceedingly difficult in these times to put into universal practice and to adapt universally any man's ideal of the Church or idea of the Church. Probably my idea of the Church would be different, indeed, from that of the gentleman who has addressed us this afternoon. I do not know. Possibly so. But there is where your difficulty comes in. When you are going to associate the State with the Church, what are you going to regard as the Church teaching which is to be given to these children who are to come under the education of the Church? That is where our controversy lies at the present time. I suppose that the great majority of sober-minded people would be fairly well satisfied at all events with the Bible; but there are some who are not content with that, and they would have a catechism of some kind. I should join issue with them at once. I desire most decidedly that every child in the State should have a religious education, but there comes the difficulty to define what religious education is. If you are going to associate any particular Creed that has been drawn up for any particular section of the Christian Church, that is not broad enough for the State to apply, it appears to me. So that you require to define your idea of what the Church is.

Then again, Mr. Chairman, I think it should be remembered, too, that the church of the New Testament is no mere external organization. (Hear, hear.) There are men who are Christian men, and who are members of the redeemed Church of Christ, who do not belong to any of our organized Churches. Consequently when you are associating the Church with the State, you cannot associate merely one particular organization. You want, therefore, a much more spiritual conception of the Church. When you take the New Testament conception of the Church, it is the redeemed, the regenerated, the true followers of the Lord Jesus Christ—no others, whatever their profession may be. The virgins in the parable were all, to external appearances, virgins, but there were those who had no oil in their lamps.

Then when you take the New Testament idea of the Church, how are you going to get the State to adopt that idea, and to act on that idea? If you had a Church and a State that were conterminous and coincident, then you might do it, but at the present time you have not. You have a State which consists of a majority of people that are not really in the Church of the New Testament at all. Consequently there arises your difficulty. You have tutors, teachers of various ranks in all our schools that are not in the Church of the New Testament. They may be registered as Christians because they are not Mohammedans or belonging to some other heathen body. But they are not members of the Church of Christ of the New Testament. They are not regenerated. The consequence is, you cannot at the present time carry out your ideals either in the Church or the State. What you have therefore to do is to aim at something that is practical. The State must always be below the Church until the millennium comes, or until the new heavens and the new earth, wherein dwelleth righteousness. At present you cannot bring the State up to the level of the Church. The consequence is the Church has to a large extent—and I am speaking of the Church of the New Testament, not any organic body—to pursue its course alone, and sometimes in antagonism indeed to the State, or rather, the State is in antagonism to the Church. Our educational system then, it seems to me, must be brought down to a practical level, and what is that practical level? Well, to endeavour to make men good citizens in the ordinary and common and lower sense of the term, and leave the Church to permeate the State, as the leaven did the mass of the meal which the woman inserted into it in the parable.

If therefore, we aim at making men good citizens, instructing them in their childhood sufficiently for every child to have an opportunity to rise and to exercise whatever special faculty he may have, it seems to me that at the present time is the most that we can aim at. The State! Why, the State is not yet in its legislation up to the level of the Ten Commandments. If you look into our Statute Book you will see that there are acts and deeds permitted by our statutory law that would be condemned by the Decalogue; and if the Statute Book is not up to the level of the Ten Commandments, how can you bring the legislation of the State up to the level of the regenerated Christian Church? So that we are at

present at all events obliged to be content with something less than the millennium, and pray that the millennium may soon come. (Applause.)

The SECRETARY.—This is a subject that is of the greatest interest to us all, especially when we consider the extraordinary confusion that now reigns on the subject of education. It is one of the most difficult problems with which we have to deal in this country. I have been in touch with education, both State and voluntary, for some time, and that must be my excuse for adding to the cloud of words in which our subject is getting so involved. There are some who consider that we should bring national education down to the lowest level, that is to say, to give the minimum to everybody, and not try and get beyond that minimum without which no manhood can thrive at all. Then there are those who go far beyond, and wish to give to all that advanced education which, at present, is only within the reach of the few. Between these there are all sorts of other ideals, and we all pursue our ideals in different ways. (Hear, hear.) We have elementary education, which embraces every child in the whole country from the highest to the lowest, for none can escape education. Then we have those various schemes for supplying the defects in our elementary education. Some are worked by the State, and some are worked by voluntary organizations. We have secondary schools and evening classes for those who have availed themselves of the primary education, and, therefore, are fit to go on to something better. But there are things really more interesting than that. There are growing up all sorts of organizations which the State is now beginning to assist, attempting to give education to those of the masses whose primary education has been a failure, and who must now attempt to make up for its blunders. Well, the fact that that should be necessary points to something very wrong at the beginning (hear, hear); so that we have to re-consider our whole primary education. And it is a very large question indeed, for, I suppose, after some experience in having examined the educational systems of Germany, Austria, and France, that our elementary education is probably the best that is given anywhere by the State, although our secondary education is probably the worst organized. And yet, with our splendid system of elementary education, there are all these gaps that require to be filled up;

and you may say there is a large part of the work which requires to be absolutely undone. The fact that there are these gaps, and so much that requires to be undone, has a great deal to do with the confusion that exists as to the position of the State as a moral and a religious teacher.

There is undoubtedly this terrible confusion, and yet, as Mr. Tuckwell has pointed out to us, the whole question is one with which we are not fit to deal at the present time, because of the position of the State, which is so far behind our religious organizations and our religious and moral ideals. It takes an immense time for the State to develop a moral sense. We have got to work at the practical side of the problem. One thing that must be insisted on with regard to elementary education is that it is no good having it all worked out on one pattern. Whatever else happens, we must have differences in different places. There must be acknowledged differences of capacity, and differences of circumstances and economic needs.

Rev. H. J. R. MARSTON.—Liberty to specialize.

The SECRETARY.—There must be, as Mr. Marston has just said to me, liberty to specialize, and also there must be that equality of opportunity which is demanded so loudly by people who do not all really know what it means. (Hear, hear.) I believe that we are giving an equality of opportunity, only those who get the opportunities will not recognize them.

If you would go round the corner, into Adam Street, you would find there the office of the "Workers' Educational Association." That Association is represented now on most University Boards in this country. There are more than a thousand trade unions belonging to it. It is a great and a national organization of working people to educate themselves; to do for themselves what the State has not been able to do for them, and what, so far as I can see, the State never will be able to do. It is an organization of those people to teach themselves, not how to work—they can be taught that by the State—but to educate themselves into being citizens. And how the State can really do that is quite beyond my comprehension. Unless the people are going to take that upon themselves, and the State is going to help them without restricting, I do not see how it can be done. If the State sets out in the beginning to make citizens, it is only too likely to attempt to make them of one

pattern. It will try to make them according to the pattern approved and sealed by the Government of any particular time, according to the ideals of the moment. But if the State will content itself with encouraging people to educate themselves into being citizens, and let them lay down the lines, that will be a very great work, and that is what we are trying to do all over the country by the co-operation of the Universities and representatives of the people and the people's organizations all over the country. Those who are doing this, you may say, are the successes of our present system of education. Some of them, of course, are, but more are failures, and they are all making themselves into citizens through a system of education which has little to do with technical education or the three R's. It is an education in the civic humanities, and attempts to make the cobbler not only a cobbler, but a man who can use his privileges as a citizen because he realizes what the State is, and what it means to him. And that, after all, is most important from the highest moral point of view. Every one has, as an individual citizen, an equal power in these days; but that is no good in itself: on the contrary, it is more likely to be a grave ill, unless the citizens know how to use their power, and it is a part of the duty of that great Church which stands outside all creeds to look to the question of the citizen's duties, and to assist in that part of education, just as much as in the teaching of religion as religion. In fact, it seems to me to be almost more important, although even more difficult to effect.

I mention the Workers' Educational Society because it does seem to me to point out in a degree how we are going to get at this question. It is not going to be solved through the State or through the Church. It is going to be solved through the people, but the Church and the State will both be needed to work with them and help them as far as possible, not lowering their own standard, nor yet attempting to force on the people struggling upwards an iron rule, but always holding the highest ideal before those who are striving after the best that they know.

The CHAIRMAN.—I think we must now close this interesting discussion by calling on Mr. Marston to reply as far as he sees it necessary.

I will just reply to one point upon which Mr. Tuckwell has laid emphasis—the difficulty of deciding about the religious education

of the child. I hold very strongly that it is the parent who is responsible for the education, religious, moral and social, of the child. Therefore, in whatever position they may be, the parent, the father or the mother, or both, have the right of demanding that their children shall be instructed in the form of Christianity which they themselves consider best for them. If a system could be inaugurated by which that principle could be carried out throughout our vast community, it would solve a problem which is now dividing class against class, party against party, and I am afraid is likely to do so for a long time to come; but I hold that if we maintain this principle, that the parent is the proper guardian, then he has the right to prescribe the form of Christianity, or even the form of religion other than Christianity, for we cannot neglect other religions, and the child ought to be brought up as far as it is possible in that form which the parent prescribes.

I shall now ask Mr. Marston to reply.

Rev. H. J. R. MARSTON.—Mr. Chairman, ladies and gentlemen, I thank all those who have taken part in this discussion, and particularly each one for the marked clemency with which they have dealt with my address.

I am happy to feel that as I designed, though I hardly ventured to expect quite so practical an application, that my lecture has stirred the feeling and the thought of the Society to discuss the greater problem of education.

I should like to say one or two things in reply.

First of all, I venture to say to my friend Mr. Coxhead that I do not think that he has proved that I failed to grasp the essential principle of the *Politeia*. I know, of course, that the object of that book is to ascertain what justice is, and I said so. I think I also said that education was the third of three of the principal topics, and I still retain that opinion, *pace* Mr. Coxhead.

As to the nature of education, and Plato's teaching upon it, I ought to add this, that Plato does say that the son of one who has the gold admixture may prove to be silver, or even iron. In that case, he must be degraded to the silver or the iron. Conversely, one whose parents are of the iron class may be born with gold or silver admixture. He then must be raised to the silver, or the gold class. So that although there is a very rigid division of classes ideally considered, he does make room for the transposition

of one to the other. In other words, he allows for the great principle which Mr. Oke dwelt upon, that where there is talent, talent must have the scope to assert itself, to realize itself, and to rise as high as the talent will go. (Hear, hear.) In point of fact, there is no country in the world where that has been longer or more liberally recognized than in England. England, with all thine educational faults, I love thee still! (Hear, hear.)

To go to another subject. In my closing sentence I said that according to the Christian doctrine of human nature it is impossible for any educator with eighteen centuries of Christian history and Christian consciences behind him, to allow that anything is really education which violates the highest qualities of human nature. We cannot tear up our New Testament; we cannot falsify centuries of Christian practice to please anybody. What I said was that however you interpret that thorny word "Church," according to my thesis the Church in some sense or other must have not only a say, but *the* say, the first and the last say in the matter of education. If the Secretary who made that interesting and inspiring speech cannot tell us better than this, that the State is so behind the times, and the Church is so divided that we cannot give an adequately Christian Education in Christian England, all I can say is, God help us, and God help those that come after. (Applause.)

A vote of thanks to the lecturer, proposed by Mr. BISHOP and seconded by Dr. HEYWOOD SMITH, was carried by acclamation.

The CHAIRMAN having given notice of the alteration in the date of the Annual General Meeting from May 2nd to May 9th, and having announced that the President, Lord Halsbury, would take the Chair, the proceedings terminated.

508TH ORDINARY GENERAL MEETING.

MONDAY, MAY 23RD, 4.30 P.M.

THE VEN. ARCHDEACON BERESFORD POTTER, M.A., IN THE CHAIR.

The Minutes of the previous Meeting were read and confirmed.

Announcement was made of the Election of the following Associates :

Mrs. Lucy Isabella Bartholomew.
Miss Florence Mary Edensor.
James Peddie Harper, Esq., M.D., L.R.C.S.E.
William Sylvester Walker, Esq.

The following paper was then read by the author :—

HEREDITY AND EUGENICS.

By Rev. Professor A. CALDECOTT, D.Litt., D.D., University of London, King's College.

HAVE Christian believers, and men of religion generally, any special interest in the question of Heredity ? Are we by our religious convictions inclined towards hoping to find that there is no heredity in the life of man, that each individual comes perfectly fresh into the world ? or towards hoping to find that heredity is deep-reaching and comprehensive, and that by far the major part of our nature is not at all new, but is passed on to us from the generations which precede ? A very high doctrine of individuality attracts us by the thought that evil results would perish with the doer, giving every child a fresh start, an open course ; while a very high doctrine of heredity would commend itself on the ground that it would mean that all good results are gathered up and passed on in unending service to humanity, so that each child would start from a higher level than its parents enjoyed.

Old Thomas Fuller saw this : considering the genealogy of the Kings of Judah, he notes that in four generations a bad

father begot a bad son, a bad father a good son, a good father a good son, and a good father a bad son: and his reflection is put in his own witty way: "I see, Lord, from hence, that my father's piety cannot be entailed: that is bad news for me. But I see also, that actual impiety is not always hereditary: that is good news for my son." Delightful filial regard and personal modesty guide the choice of the old divine. But taking a general view it would seem that we shall be inclined towards one or other of the alternatives, firstly, according to our estimate of the balance of good and evil in the world: pessimists will welcome the fresh start, the clean slate; optimists will welcome the passing on of trained faculties, of good habits, of high emotions. And, secondly, according to our estimate of the significance and scope of individuality. If we endorse Newman's view that religion is "a relation between God and my soul, my soul and God," then we shall expect each individual to be a new appearance, with its own nature and responsibility; but if we are more impressed with the thought of our common humanity, the social organism, the brotherhood, the kingdom of souls, we shall not have any objection to a widening of the scope of heredity if such should be suggested by enquiry.

Of course few people are likely to occupy either of the above extremes, either to deny heredity or to make it so comprehensive as to crush out individuality. But I think that we must all of us look round with keen interest when we hear on every hand that the evidence is increasing, whether the effect is to be what we shall welcome or shall regret. With this preface let me endeavour to set before you some reflections on the present position of thought upon the subject.

Heredity is defined by a leading biologist as "Genetic continuity between succeeding generations" (Thomson *Heredity*, p. 68). Every one knows that there is some such continuity in nature: the determination of the more or the less of it is one of the most interesting of problems.

I. *In the sphere of physical life: the plant world, the animal world and human nature in their bodily organisms.*

In this respect the most important conception of recent modern science is that of the Germ-plasm and Germinal continuity, raised into the definiteness of a working theory by Weismann. Organisms are understood to be constituted

fundamentally by a central core, the germ-plasm, which keeps on reproducing itself; by simple reproduction in some low stages of life, by intermixture of two germ-elements in all the higher ranges. And around this germ-structure is a soma or envelope, with some variety of which each germ will surround itself. The importance of this lies in that it points to the mechanism for transmission of qualities. In cases of simple reproduction, the new germ nearly repeats the former one, and continuity is, so far, complete: in the case of dual reproduction, the elements of both constituents come into operation, the new germ reproduces them both, in so far as they can combine. And the outer soma or envelope is determined according to the inner, deep-seated, germ.

The course of the life-history of any plant, for example, is all settled from the beginning; there is some little room for variation in response to environment and the way in which different environments would call into play reactions on the part of the plant. But these variations are small; the life of a spaniel in all its principal features will run on according to a formula; he may be somewhat larger than usual, a shade different from his tribe in colour, and by training or circumstance may become a trifle more clever than his parents; but these points are comparatively superficial, and it is quite likely that they will not reappear in his offspring. For the mass of qualities which is transmitted the theory of germinal continuity professes to point to the vehicle of transmission.

Obviously this conception of modern biology lends support to heredity by indicating the nature of the physical process which connects two generations. By penetrating into the recesses of organisms it indicates the mechanism of heredity; transmission of all important qualities seems assured; it is only superficial modifications which rise and fall within the compass of the individual. I do not understand that it is claimed that the Germinal theory is proved at all points; but for us it is important to note that it holds the field, and subject to emendations and qualifications it must be regarded by non-biologists as what we are called upon to take into account as the order of nature in this respect.

So far for continuity, the transmission of like natures from one generation to another. But the world is very complex, and presents a spectacle of an almost unlimited variety of forms of living beings, both plant and animal, all arising in course of thousands, possibly millions, of years, from a few simple forms. To the study of the rise of variations and the continuance of

them when they have arisen, the zeal and intelligence of biologists are being devoted all over the world to-day. It is highly imprudent for outsiders to commit themselves to taking sides in the controversies which have arisen. But I think we are bound to allow that the weight of authority seems to lie with those who seek for the mechanism of variation and of the transmission of its results in the germinal region. If this is so, then the transmission of the superficial qualities acquired by the individual is rendered improbable. This question is by no means settled: long debates are conducted with multitudinous pro's and con's; but at any rate I think that we must not set ourselves in opposition to the view that such characters are not transmitted, but must face the possibility of all transmission being effected by what takes place in the germinal region. In that region the situation has been brought to a clear issue by Weismann's application of Natural Selection. According to this use of it, the gains or losses of the individual's outer life perish with the individual: the arena of the struggle is the germ-plasm. There the variations which occur are preserved by elimination of those inferior in power to struggle, and the perpetuation of those which gain the victory. This is a selection in which the fortunes of an individual life count for almost zero: the change is due to processes prolonged over centuries, over millions of successions of individuals.

Allowing that this is the extreme theory, and that some scope for influences upon the individual and for the individual's own originality must be incorporated with the theory, still the broad impression upon the mind is that the individual withers in importance, and that man is a spectator of processes operating in recesses beyond his control. This was, I think, the attitude towards which we were being driven by Weismannism. Man's intervention in the selecting processes of nature was possible only in a small way; something he might do by assisting to eliminate forms of life which he did not value, and fostering a few that he cared for, as when the waving corn-field replaces the Canadian forest; some slight varying he might direct, as in the garden, the greenhouse, and the stockyard. But his efforts were watched jealously by Nature; ever she was ready to take advantage of the slightest pause in his industry; to resume possession of the wheatfield by rank grasses and weeds, to draw his garden back again to wilderness, and his herds to the rougher animals of the prairie, the moor, and the forest.

It is just when we have come to this point that a new door has been opened into Nature, an unexpected instrument for the

guidance of her processes has been placed at man's disposal. The keen sagacity of a Cambridge biologist in a happy moment discerned the far-reaching significance of the forgotten labours of an Austrian abbot, and has lifted Mendelism to the front rank of biological interest to-day.

This is not the place for attempting a sketch of the Mendelian theory as I understand it. I can only say that what seem to me to be its salient features are (i) the ascertaining that there are in organisms, in plants especially, certain qualities so defined and so regular as to be called "fixed" or "unit-characters," occurring either singly or in combinations; and (ii) the persistence of these by hereditary transmission, in spite of apparent disappearances or obscurations.

The importance of this knowledge is that when man has ascertained the presence of such fixed characters he can step in and can eliminate or foster them according to his own desires and purposes. His function as selector is enlarged by this knowledge, for he can learn what characters natural process has brought to fixity and can be depended upon to transmit from generation to generation. And more, he can manipulate the organic processes, so as to bring together combinations of such unit-characters, over and above those which Nature herself had, so far, produced. And these can be varieties not of a fleeting and precarious kind, but of a relatively high degree of stability. Man's range of control is enlarged from such violent changes as the suppression of darnel in favour of wheat, of substituting wolves by sheep. The empirical methods of guiding Nature hitherto used by breeders of stock and cultivators of plants are now placed on a scientific basis because we have penetrated more deeply into the way in which characters are formed and in which heredity transmits them from one generation to another. It is no wonder that Mr. Bateson and his followers speak in terms of animated expectation:

"The breeder may proceed to build up synthetically, character by character, the plant or animal which he requires." (Punnett, *Mendelism*, p. 58.)

"Mendel's clue has shown the way into a realm of nature which for surprising novelty and adventure is hardly to be excelled. It is no hyperbolical figure that I use when I speak of Mendelian discovery leading us into a new world, the very existence of which was unsuspected before." (Bateson, *Inaugural Lecture*, p. 4.)

So far, then, from biology we have laid before us an increased range of influence for heredity. The human interest lies in the

deeper scientific knowledge being such as to show man more clearly than he ever knew before where he can himself come in to control its operation in favour of his own desires.

Passing from plant and animal to the sphere of human life, for man's bodily organism the claim is, of course, made that it falls within nature, and that the teaching of biology applies to it in every respect. We, too, owe the form of our bodily frames to operations which work by heredity according to the germ-plasm process, and according to Mendelian law. This is so, *a priori*, for all the reasons which lead us to consider that the human body is of the same order as other living organisms. Of course this should be verified by inductive process, and there are many workers in the field of human anatomy and human physiology endeavouring to find evidence for these great laws. As to the Mendelic theory, I understand that not much verification has yet been secured; it seems illustrated in the iris, in certain diseases of the eye, and in some physical deformities; and not much farther, at present. But we must remember that there are special difficulties in the way of studying the biology of man; the successive individuals are so far removed that a century gives, normally, only three generations, which compared with the rapid production of successive generations of plants, where Mendelism has been most abundantly exemplified, is almost prohibitive of success: experiments are out of the question; and material adapted for observation is difficult to secure; but the study is only just commenced, and we shall learn more.

At the same time I think we must here put in a caveat against the complete identification of the biology of man with that of animals and plants. Man's body is the seat of a mind, and some of the changes which it undergoes are due in the first instance to changes which take place in the mental sphere. For example, while cancer is often caused by purely physical irritations, a specialist assures us that "by far the most common cause" is mental; "depression, emotion, trouble, worry, anxiety," are the chief factors in cases which amount to the great majority. (Dr. Snow of the Brompton Cancer Hospital, Lecture at Birmingham, October 18th, 1908.) The general influence of mind upon body is too far-reaching to be ignored.

But in the main we may acquiesce in the assignment of the human body to the sphere of biological law, and for our present study, to the influence of heredity as above indicated. From the religious point of view I see no ground for our shrinking from this. As soon as we have recognized that man's physical frame is not a special creation but a marvellous instance of the laws

of organic life, we have no interest in desiring its withdrawal from any particular biological processes; the laws of inheritance which are good for organic nature generally may be held to be beneficent at its summit.

II. *Mind.*

A quite different field of enquiry opens out when we ask, Does Heredity apply in the realm of Mind?

The leaders in scientific enquiry are apt too readily to "jump this claim,"—as the prospectors in mining districts say—and at once to extend to mental nature what they have established in the sphere of physical organisms.

But the standpoints as to the relation of mind and body are at least these four:

i. We may be Materialists: holding that the body is the reality, the mind a dependent and derived accompaniment.

ii. We may be Parallelists: holding that mind and body are equal as to reality, but run precisely parallel courses, never by any possibility interacting.

iii. We may be Interactionists: holding that although equal and different they are capable of mutual influence or of so interworking as to form a single series of processes.

iv. We may be Spiritualists: holding that there is a range of mental life only indirectly connected with bodily changes, running its own course according to its own constitution and laws, but doing so within limits arising from the physical organism.

These are fundamentally different philosophical views: they have stood in opposition whenever men have endeavoured to think upon the problem of mind and body, and they stand in opposition to-day.

In reference to Heredity the Materialist makes no question that the same laws prevail for mind as for body. He holds this *a priori*, from his view of the dependence of mind upon matter, and he proceeds to look for verification by observations as to inheritance with the same interest here as in the biological sphere. The Parallelist and the Interactionist can also undertake with zest investigations as to the facts of inheritance in mind equally with matter, and will expect to find that they prevail in both.

The Spiritualists will divide into two camps: (*a*) those who hold that the lower ranges of mental life are strictly and closely connected with bodily life will expect to find Heredity obtain for them, reserving only a region of higher mental life into which transference from the lower is inadmissible, and in which the problem of Heredity must be examined quite *de novo*; and (*b*) those who hold that all mind is essentially spiritual, the lower ranges being dependent upon the higher, and who therefore can find no ground for transferring to mental life any laws discovered to be true for the processes of physical life; for these the whole enquiry is a new one, quite independent of any other.

It is open to all therefore to enter upon an inductive enquiry as to the appearance of likenesses between successive generations, and to all but the thorough-going Spiritualist to regard the likenesses as due to transmission, *i.e.*, to heredity.

That children resemble their parents in mental character is, of course, matter of common observation, that they also differ from them is also beyond controversy: but which is the dominant thing, the resemblance or the difference?

The evidence for the dominance of resemblance and the probability of its being due to heredity is what strikes attention most forcibly. Men are born in races in their mental as in their physical nature: every member of a race has a fairly definite aggregate of qualities which are repeated from father to son: the wide contrast between Mongol and Aryan; the further grouping of characters as European or Hindu; further still as Frenchman or Swede, and so on. Whether or not we may suppose anything in mind on a par with the germ-plasm of physical organisms, to which we could attribute the processes of transmission in a similar way, psychologists have not yet investigated: at present they are dominated by the belief that the transmission is effected on the side of the physical organism and that mental life follows upon that. Further, that qualities of character become fixed, and fixed in combinations, after the Mendelian manner is plain, but whether or not they follow Mendelian principles in transmission no one has yet had time to work out.

But whether the laws of mental heredity are either identical with those of physical heredity, or similar to them, or not, the strong mental resemblance between parent and offspring, and the formation of race characters, national characters, even occupation-characters, is so wide ranging that ethnology seems to give Heredity the principal function in the formation of mental character.

On the other hand when we consider human nature we see that there is a larger scope for individuality than in the rest of nature. There is the important fact of long life and slow progress to maturity, during which each individual is the subject of experiences so complex as to be, strictly speaking, unique. True, the oak has a still longer period of youth, but its "experiences," so to speak, are not varied, and its range of variation is very limited indeed. And the elephant has as long a youth as man, with more range of variety in its experiences than a tree has, and in so far as this is the case we see the result in the differences of individual character.

But the principal difference lies in the extent and scope of consciousness; and the higher we look the smaller appear the resemblances between successive generations and the more prominently do the differences stand out. The variation of mental character between individual dogs is greater than that between individual sheep, and that between wild sheep which live by their wits greater than the difference between sheep living in a flock with all food and shelter provided and the minimum of demand made upon individual intelligence. And in the human race the differences between individual Negroes of the lower grades on the damp coast is much less than between those living in the exercise of more varied intelligence in the hinterland of the Sudan. In India the low-caste occupations and dead level of life exhibit almost identical individuals, as compared with the differences possible to the people of high education and more varied externals of life. But it needs no elaboration to support the statement that the higher the call upon mental faculty the greater the scope for individuality and the appearance of differences and variations as compared with the resemblances and identities of Heredity.

Hence it is that so little has been discovered for Heredity by investigations such as Sir Francis Galton's as to Hereditary Genius. Sir Francis might have known that he was searching in precisely the most unlikely part of the field, unless we take it that his courage is so high that he prefers to lead a forlorn hope and attack the problem just where it offers the smallest prospect of successful result.

Need we who are concerned especially with the highest experiences in the life of man, his religion, be averse to supposing that the biological processes of inheritance are in operation over the lower ranges of mind-life? or if not identical processes, some others yet to be discovered but quite similar to them? As I said above, I do not find that Biologists or Psychologists

have yet given attention to this problem, but seem ready to carry the laws discovered for physical life right over into the sphere of mind. Mr. Bateson, the biologist, unquestioningly places not only lower consciousness but intelligence and morals side by side with physical characteristics in relation to transmission (*Genetics*, p. 34); Dr. McDougall, the psychologist, assumes heredity for mental qualities "in much the same sense and degree as for physical" (*Sociological Papers*, III); and Sir Francis Galton formulates as a leading article in the programme of Eugenics "the fact that the laws of heredity apply to man equally with the lower animals and plants, and that the mental functions are subject to the same laws of heredity as the physical ones" (*Programme of the Eugenics Education Society*).

My own opinion is that in the lower ranges of mind the contention for Heredity is plausible, and that it is gaining in credibility apart from the suggestions of biology. There do appear to be root-instincts, elementary tendencies to action, primary feelings, which are fundamental as the germ-plasm is fundamental, and their reappearance in successive generations suggests the operation of transmission, and further, that there are some relatively superficial masses of mental "stuff," so to speak, carried onward by these deeper elements. And it is also certain that these tend to form fixed assemblages of qualities after the manner of Mendelic fixed characters; so that the process by which generation is linked to generation may be that of inheritance of root-characters, and variations may be perpetuated by selection for utility as natural selection indicates, and by fixity as the Mendelic law describes. But the field requires long and extended work if inductive verification is to be added to these general conjectures, and the peculiar feature involved in the intervention of higher ranges of consciousness must be kept constantly in view, and be expected to result in limits to heredity being drawn, which will cause the mental sphere as a whole to present a very considerably different view to that given by the sphere dealt with by biology.

For those who see nothing in mind but a stream of feelings, activities, and operations of intelligence the problem ends here. For these all is nature, and Heredity prevails wherever either life or mind is found, as we have seen. But the very crux of the problem stands yet unsolved for the Spiritualist, whether as philosopher or as religious believer. These are concerned to keep in view the conception of mind as in its essence spiritual, and therefore not within the nature-process. For the principal tenet of both philosophy and religion is that the

primary character of mind is its selfhood: that it is unitary, and that it is centrally originative in thought, in action, and in feeling, controlling the lower ranges in so far as these are in any way to be regarded as arising apart from the centre. In short, Philosophy and Religion both stand upon a belief in Personality.

Here I need not do more than say that whilst here and there a trained philosopher may be found to regard mental life entirely as a process, or processes, of the naturalistic kind, the main line of philosophical tradition adopts the conception of Personality in something like the above sense. And it is plain that for religion a doctrine of Personality is indispensable if religion is to take high ground, to look out into a world beyond the world, to see eternal things in things of time, to cherish ideals of goodness, and to lift man into life with God.

As to Heredity in personality, Philosophy can simply point to what she finds: explanation from deeper depths is impossible, for deeper depths there are not. At this centre of mental life every individual personality presents the appearance of being a new and fresh self: this is so for the individual, and it is so for the contemplator. We can find no way of conceiving how one personality can be related to another which may succeed it in time beyond the bare fact of succession. If there is Heredity we have no means of seeing how it could be effected: nothing corresponding to the germ-plasm and its reproductive processes is shown to us in the region of personality at its centre. Indeed, we may say that there is here no question of resemblances carried forward, for the fundamental character of every personality is the same. Each individual appears to emerge into being fresh from the Eternal Consciousness, says Philosophy; fresh from the Divine Spirit, says Religion.

What we have to note is the embodiment of personalities in physical frames, as the universal rule for man: and these frames, as we have seen, succeed one another by the connection we call heredity: an analogy would be the equipment of a number of musicians with instruments partly of different partly of identical nature, so that their musical careers would be affected by the nature and quality of the instruments severally allotted to them: on this influence of heredity upon our complex nature all are agreed. But some of us would carry on the conception of the instrument of personality to include lower ranges of mental life making these dependent to some extent upon the bodily equipment into which the soul is born; others regard these lower mental processes as themselves affected by the way in which the higher consciousness operates

as it comes within the limitations imposed by the physical framework. The former will hold that every personality enters into connection with a preformed mass of mental dispositions, instincts, and tendencies besides the settled peculiarities of his bodily frame: a tendency to strong or to weak emotionality, for example, a disposition for intellectual activity or an aversion from it, an inclination to egotism or towards benevolence, and so forth; and that these may be brought under heredity and its laws. The other view claims that every soul of man starts fresh, and can enter upon a self-chosen and self-directed course of life. One view would say that given the parentage and ancestry, the stock in short, there is but small room for individual personality to work out freely in, and expects to find resemblance entirely dominating the characters of children of the same stock. The other view consider that the similarities we find are rather the result of similar environment, education and opportunity, and is not surprised when novelty appears, when individuals of high power stand forth and defy the expectations which heredity raises. From this view it would be said that grapes might be gathered from thistles in the field of human character, only that the saying is inept, for the reference to the realm of physical nature is quite out of place as the ground of a comparison. And in support of it the insurgence of individuals from the lines of development foreshadowed by looking at their stock or their environment demonstrates the possibility of self-originality, self-directing guidance of life; and when the possibility is shown the situation is revolutionized; the course of heredity fails in these cases, and suspicion is thrown upon it all over the field.

If I am to state my own view, I should put it briefly in this way. It is impossible to account for consciousness as we know it by reference only to the consciousness we know. Consciousness is not self-explanatory as it appears in finite experience; we must perforce look beyond experience, and the inference I stand by is to a super-finite consciousness from which we come, which may be said to express itself in us. And this finite consciousness is of the same nature in us all, but it enters into our physical frame, settled largely by inheritance, and is at once limited according to the peculiarities of that frame in various ways. And I think that observation establishes a large concomitance of mental dispositions. But there is also so much inherent power of self-direction that the course of the individual life may be either one of subjection to that frame or of domination over it, in many degrees. And I regard education

as making an appeal to that inner self to come forth and take command. Further, that the inner self is endowed with a capacity of being conscious of the super-conscious spirit from which it has its being; the finite becomes aware of the Eternal, the imperfect of the Perfect; we can place the actual self in the attitude of obedience, the emotional self in the attitude of love and adoration. That this is the experience of religion is claimed by all the higher forms of it; clearly, richly, and pervadingly, in the experience of the saints; dimly and fitfully in the experience of ordinary religious men and women; potentially in every personality.

Hence it is my contention that Heredity does not hold for Spirit. I see no reason for thinking that soul succeeds soul in the way of generation. Certainly I find no glimpse of a way in which I can conceive it operating on the lines of physical heredity, nor do I think that it can be conceived as resembling the process of psychological heredity dependent as this is, as appears at present at least, entirely on the continuity of the physical basis of life; and I agree with Professor Henry Jones that "the way of virtue, so far as internal conditions are concerned, is as open to the child of the wicked as it is to the child of the virtuous." This is a hard saying to the man of science, whether physiologist or psychologist, but I hold that the philosophy of experience, fully worked out, endorses it; and the religious man is compelled to say, Amen.

I decline therefore to endorse Euripides when he says:

> "The offspring of good men themselves are good;
> Those of the base are like their fathers, base."

III. *Eugenics.*

I have left myself small space for the highly important practical issue which has arisen largely as a consequence of recent study of Heredity. The victories of Science in penetrating to the recesses—or towards the recesses at least—of the physical organism have inspired not a few acute and eager minds with a sense of exultation in the increase of man's power to direct the course of the successive generations of plants, animals, and men. By use of conscious selection, based on the knowledge recently gained, successive generations are to be improved: the human race is to be directed towards being better as a whole, and to be composed of better individuals. And so we have the newly named science or art of *Eugenics*, and Society is invited to embark upon a definite course of producing better men. If it

be true, as Professor Dendy, for example, claims, that "we can produce at will new combinations of selected characters, new forms of life which might never have appeared in a state of nature at all" (*Journal of Society of Arts*, May 14, 1909), it is plainly time that we set ourselves in earnest on so noble an enterprise. Professor Dendy was dealing only with physical organisms, but, as we have seen, other workers have stepped over into the mental sphere and are for pushing forward there also, although at present their endeavours are mainly confined to influencing the future by the improvement of the physical stock.

I am not able here to enter upon an examination of the very serious claim that Society should undertake the conscious and purposive guidance of its own future course. I can only indicate the very grave character of the conflict of ideas and of sentiments to which it gives rise: a conflict so momentous that the future is bound to be very largely affected by the clashing oppositions which must arise between its advocates and its opponents. For example, we may all have fairly the same ideas as to what constitutes a "better" physical frame, but can we say the same of the mental and moral character? There are some who advocate the fostering of modesty, humility, and benevolence in character: but from the followers of Nietzsche we have protests that self-assertion, and the full employment of the energy of the strong in furthering their own development are higher ideals: which side is Society to take? Again, there are some who are convinced that anything approaching other-worldliness is superstitious and pernicious, while others find in it the very salt of the life of the soul. Is Society to suppress either one of these in favour of the other? And are all the varieties of type of character to be reduced to uniformity? or is Society in possession of scales of values in morals, in art, in emotional life, which are infallibly accurate in some absolute way, and therefore to be applied without ruth in the selective processes which are to be enforced? At present Society in its most advanced modern forms leaves wide scope for divergent ideals. If Eugenists confine themselves to positive measures for advancing such ideals of character as they adopt, there is room for their action. It is the negative methods which give rise to most serious concern.

For the methods of Negative Eugenics cannot be stated without raising the problem of personality: and when Eugenics is put forth solely on the basis of the heredity which is established from nature, it cannot expect to be welcomed on the part

of those who have such quite different views of individuality and personality as those I have endeavoured to indict.

In the naturalist view, the imperfection or defect in a man may be so radical that his right to live fades away; certainly the right to enter into domestic life and share the high privilege of a family and a home of his own must be denied him: the individual of to-day must be made to bow before the claims of posterity and of society. Now the believer in a high doctrine of personality is obliged to recognize that there is a wide range of defect and of corruption in human nature, and he has to allow that Society is right in taking away liberty from the imbecile, the insane, and the criminal, possibly for the whole course of their earthly life. But respect for personality underlies the caution with which such restrictions are now imposed, and it is one of the most prominent marks of the advance of civilization that their application should be more and more cautiously and reluctantly made, and that always there should be anxious endeavour to remove the defect and to reform the criminal so as to allow the restrictions to be removed as soon as possible. But the lower regard for individuality obviously tends to work in the opposite direction. To the forms of insanity and crime disease is to be added as a reason for segregation and enforcement of the celibate life: and the range of insanity and of crime which are to be the grounds for interference is to be indefinitely widened. It would be different if the course taken were the making appeal to good sense and public spirit and the virtue of self-sacrifice, as personal motives in the individual for voluntarily renouncing family affections; but this appeal cannot be directed with much prospect of success in the very cases before us, the imbecile, the diseased, the insane, and the criminal. For the convinced believer in the dominance of Heredity in human nature both physical, mental, and moral, there is therefore no remedy but a wide extension of forcible restriction imposed upon individuals by society.

It is therefore an extremely practical issue which is raised by the differences of conviction as to the extent to which Heredity affects human character. The improvement of society which all hope to see and all would endeavour to promote is undertaken on quite different methods according to the Naturalistic or the Personalistic view of human nature.

The Personalist, as I have said, holds that every child of man comes into being with a central freshness and potentiality over and above the inheritance which attaches to the physical frame

and, possibly, to the mental dispositions: the Naturalists urge that by far the principal part of the whole nature is inherited. The Personalist holds that the offspring of parents themselves deficient or diseased or even immoral have an original and central core in their mental nature which may enable them to shake themselves loose from such defects as are transmitted to them and to develop eminent ability, healthy feeling, and high moral character. The Naturalist says that the stock is all-important, the limits of influence of training and environment very narrow: the Personalist says that the inherited stock is of much less account than is claimed because from the point of view of mental and moral character it is superficial, that it is the power of education, training, and opportunity for the inner soul that is the important source of assistance to the formation of high and happy character. The Naturalist, finding that variations due to the individual perish with him, ceases to regard him as the principal end and object of social action; the Personalist declines to relinquish the hard-won conception of the infinite value of the soul, and holds that Society itself depends upon the inherent sacredness of its individual members being never subordinated to the supposed welfare of the whole.

If we review the course of civilization we find that its advance has been along the lines of an ever-growing respect for Personality, an ever-increasing confidence in its inherent powers, and a constant enlarging of its privileges and rights. Social evolution, or civilization, is not produced after the manner of biological processes, but by the conscious interposition of ideas and ideals, of which personality is the seat. In so far therefore as Eugenics is advocated on grounds which ignore personality, or at least reduce the range of its powers and its rights, we have evidently before us an endeavour to stem the tide of civilization as we know it, and to reverse the course which it has taken by a resort to social action which places a slight estimate on individuality, a resort which is in many respects a recurrence to the methods of society in times we thought we had passed through, in Europe at least. The sentiment of individuality so slowly formed is being challenged once more; the claims of the race are being reasserted as supreme, and the guidance of human life in its tenderest and most intimate relationships is being removed from the range of Personal to that of Collective wisdom and responsibility. So great a revolution in moral and social policy must divide men into opposing camps, and I can see signs of an approaching

conflict which will dwarf into triviality many of the contentions which at present cause our differences and oppositions.

The believer in the higher religion is plainly committed to a high doctrine of personality. For him religious education and training constitutes a potent force, more powerful than inheritance. Religion greets each soul as it appears and invests it at once with an environment which shall be a matrix for its personal development, knowing that even from unpromising "stock" souls of pure lustre and high spirituality are possible because they are found; and believing that the reason is that they come not through lower ranges of being but direct from the Eternal Spirit.

In reviewing from the point of view of the Christian believer what I have attempted to sketch I would offer two reflections. Let us on no account set ourselves in opposition to the evidence that is offered us that an insight into the procedure of Heredity has been gained such as was never before in man's possession. There is still much difficulty and much darkness, but it is for us to acclaim whatever is brought into light. The scope of Heredity in the physical sphere, over the range of plant-life, and the animal world, and of human nature on its bodily side is widened or rather deepened, and conceptions of its operation sketched out for us. These conceptions have been won by arduous toil and acute intelligence on the part of our fellow-workers in the field of knowledge, and we congratulate them on their successes. In the area of the lower ranges of consciousness, however, there is not any similar gain: most of the claims made are of an *a priori* nature, and therefore there is no call upon us, at present at least, to definitely take a side as to the possibility in the scope of heredity in mind in its lower stages. For myself I am prepared to accept it to a considerable extent. But I hold that we are called upon to decline to follow any attempt to claim heredity for the personal spirit of man in its own central selfhood, and in its large power of taking up and controlling the lower processes of consciousness. In the Old Testament we see the gradual advance towards a recognition of the value of the individual, and the Gospel is based upon it, upon the infinite value of the soul, as Harnack puts it, *i.e.*, upon the incommensurability of the soul with all else that is in the world we know; and this amounts to a protest against transferring to the spiritual world laws which have been discovered and established only in a totally different sphere. This does not assert individualism in a way which opposes the corporate view of

humanity for religion; it holds that the true corporate view is attainable only by basing it upon the existence of souls of infinite worth, who find their life in mutual society and their supreme end, on the finite level, in common well-being. But still more, only by standing firm upon personality can we keep secure a direct way of access for the soul to the presence of the Divine Spirit in a way that can be truly communion of personal man and personal God.

And for Eugenics, I am sure that the amelioration of society must rest ultimately on appeal to the voluntary choice of the individual: that it is reactionary to think of sacrificing the freedom of human action. Earnest effort may well be made to induce persons of weak or diseased physical frames to adopt celibacy as their vocation, and it may be that the Christian churches have been too keen in their approval of universal marriage to see that this exceptional vocation needed to be highly commended. But even so, we do not share the depth of the alarms and the anxieties as to the transmission of defective stock which distress those who regard man as a purely natural being of the biological order fast bound by heredity even in the very centre of his character. The idea of personality and the sentiment which belongs to it give to the Christian the hope and conviction that in weak physical frames, in defective mental equipments, and even in unpromising moral dispositions, the soul may find itself able, by the co-operating assistance of Divine grace, to develop itself along paths of integrity, virtue, and piety. It is not in physical robustness or in intellectual vigour, but in the power of the spirit to express the Spirit of God, that we are to look for the secret of noble individual life and the presage of the perfection of Society.

Discussion.

The paper was followed by a discussion opened by Rev. Chancellor Lias, M.A., who said:—

It is, I believe, an acknowledged fact that the less a man knows about a subject, the more easy he finds it to talk about it. This may be one reason for my commencing the discussion this afternoon. I know very little indeed of Heredity or Eugenics. But I may

indicate another reason for breaking the silence. There seems some reluctance to commence our usual debate, and I should be sorry if the formal thanks of the Chairman were the only notice taken of the valuable paper of my friend Professor Caldecott. Little as I know about the subject, I may at least be able to express adhesion here and there, and to ask a few questions.

I do most emphatically associate myself with Professor Caldecott's objections to what he calls "jumping the claim." It must be confessed that in recent scientific investigation there has been a great deal too much assumption. One feels that even the great Darwin himself, in putting forward his conclusions, did not sufficiently recollect how difficult it was for any one brain to co-ordinate into a theory the countless millions of facts with which he had to deal. And so it has come to pass that new schools have arisen since his time, which have given them other explanations. The wiser men of science are now complaining of as great a tendency to dogmatism among scientific teachers as is even found among theologians. Professor Caldecott has given us a startling instance in the decidedly sweeping assumption by Sir F. Galton that "the mental functions are subject to the same law of heredity as the physical ones." The fact is that science admits no such thing as assumption. Guesses there may be, indeed must be, but the induction is not complete until the conclusions of the assumed laws have been compared with the facts. Not until their agreement is demonstrated can the correctness of the supposed law be regarded as proved. Astronomy is perhaps the most exact of the inductive sciences on account of the extent to which its conclusions have been verified. Circumstances are not so favourable for verification in sciences which deal with such problems as heredity and the origin of species.

I might venture to ask whether the condition of the low-caste inhabitants of India of whose "dead-level of life" Professor Caldecott speaks, may not be attributable to their education, which tends to cause their faculties to stagnate, rather than to any transmission of acquired characteristics.

The writer of the paper introduces us to an old controversy, commenced as early as the second century A.D., by Tertullian, and warmly debated in mediæval times. I refer to the controversy between Creationism and Traducianism, that is to say, whether the

soul of each person brought into the world comes direct from the Creator, or whether it is derived from the parent. Professor Caldecott declares for the former theory, and who shall gainsay him? At least, if there be any natural law involved in the transmission of souls, it has not yet been discovered. Science, in that matter, is rather in the position of Harold, whose alarm at the appearance of Halley's comet in 1066 is unmistakably depicted in the Bayeux tapestry, than in ours since its orbit has been accurately ascertained. It seems to me quite clear that genius is not the result of an ordinary process of mental evolution, but that it has no demonstrated connection whatever with the mental condition of its possessor's progenitors.

On only one more point in the paper will I venture to remark. I desire to associate myself with Professor Caldecott in his opposition to the extent with which collectivism is now being carried, and to express my hope that we shall continue to leave the individual as free as is consistent with the welfare of society. *Some* restrictions on individual freedom there must be. But it will be a fatal blow to the future of humanity if those restrictions are carried too far.

Professor LANGHORNE ORCHARD said he had much pleasure in seconding the vote of thanks so felicitously proposed by Chancellor Lias. Indeed, they all seconded it. They thanked the learned author of the paper for the marked ability and suggestive thought with which he had assisted their consideration of a subject of special interest and importance, and in these days very much to the fore.

They would all agree that whatever Heredity may, or may not, do in the human body, it does not hold for spirit. What, in fact, is Heredity? It is the inheritance of a peculiar nervous organization, including in that term the nerve-centres of the brain and the cerebro-spinal system. It has been shown by Dr. Hill of Downing College, Cambridge, that nerve tracks vary in character, and that will-mandates travel more easily and pleasantly along certain tracks than they do along others where the way is less smooth or broad. Therefore, since we are not usually fond of the difficult, we feel tendencies to act in particular directions, and the will is solicited to proceed along some line of least resistance. But such solicitation, however strong, can never pass into command. The will always retains its freedom, otherwise it were not will.

If we elide the phrase "a preformed mass of mental dispositions . . . ," from the first sentence on page 283 of the paper, the foregoing considerations will to a large extent harmonize the differing views there represented.

Every school of eugenics which ignores human free will is doomed to failure. Realization in practice of the materialistic aim would first degrade the unhappy subject of the social experiment into a slave, and ultimately into a mere link in a long mechanical chain. For true social amelioration the good of the individual and the good of the race must be pursued concurrently, and work together *pari passu*. To quote the concluding words of the paper, "It is not in physical robustness or in intellectual vigour, but in the power of the spirit to express the Spirit of God, that we are to look for the secret of noble individual life and the presage of the perfection of Society."

Rev. A. IRVING, D.Sc., B.A., thought the paper perhaps the most valuable from the point of view of philosophy of all the papers read during the present session of the Victoria Institute. The subject was dealt with by the hand of a master. While recognizing *inter alia* the necessary place of evolution on the scientific side, it seems to assign to it its proper limitations. The speaker was glad to be able to claim from this paper the strong support of such a high authority as Dr. Caldecott for his own contention on scientific grounds for years past, and more especially in the concluding paragraph of his paper read before the Institute on March 21st, 1910, and during the last two or three weeks in the *Guardian* newspaper. The speaker went on to quote Dr. Caldecott's words from his introduction to a recent work, *The Inner Light*, by Arnold Whately*:—"Each man is a soul, not has one; and he expresses his being in his activity, his thinking, and his feeling. Such is the depth of his nature that in the greatest possible expansion of his expression he is still but partially manifested. Behind the rich variety of even a Shakspeare or a Goethe there was an unmeasured personality still unexpressed. All that psychology can do is to take into account so much of personality as finds manifestation in different men." Such a position is far removed

* *The Inner Light*, by Arnold R. Whately, M.A. (Camb.), D.D. (Lond.); Swan Sonnenschein and Co.

from those lower regions of form and physical life which are the proper province of evolution, and in which that truly manifests itself to the student of science. Within that region it is (as Whately points out) "the true work of reason so to clarify and systematize the various items of our belief that the God-consciousness automatically draws them within its own circle" (p. 207). Again, "we need a philosophy that instead of subsuming religion under evolution, shall subsume evolution under religion—a higher, deeper, and broader doctrine of experience" (p. 222). So "the scientific man who knows little of religion is not competent to criticize it from the standpoint of science, any more than the schoolmen were justified in deciding physical questions on grounds of theology. . . . . The mere evolutionist is the victim of an arrested apperception" (p. 224). Once more, "The discovery of our deepest *selfhood* affords the only true reconciliation between the flux of human thought and the need of the individual for a foothold beneath his feet and an abiding object for his grasp. . . . Christianity is no product of evolution; for evolution itself has its significance within the synthesis of Christian Theism" (pp. 232–3).

We cannot study "heredity" apart from evolution; and the above quotations from a deep thinker go a long way to strengthen Dr. Caldecott's rejection of Professor Bateson's empiricism, when he "jumps at" the opening which Mendelism seems to offer for making evolution and heredity commensurate with the whole of that range of Being which is comprehended in human life and consciousness. They clinch Professor Caldecott's contention (p. 288) that "We are called upon to decline to follow any attempt to claim heredity for the personal spirit of man in its own central selfhood, and in its large power of taking up and controlling the lower processes of consciousness." We are of course here in the region which belongs to Volition, the essential factor of Personality. As a serious student of science, who in the years that are past has become more and more impressed with the limitations of natural science, and its insufficiency of itself to serve as a basis for either philosophy or religion, though it can and does throw much light on both, one can go thoroughly with Professor Caldecott, when he says:—"Consciousness is not self-explanatory, as it appears in finite experience; we must perforce look beyond experience," and conclude that "a super-finite consciousness, from which we come, may be said to

express itself within us." That (it may here be added) was seen long ago by even the scientist Tyndall, when in his Belfast Address to the British Association he compared attempts to explain "consciousness" to a man "trying to lift himself by his own waistband"; and the fallacy has been more recently put by the late Professor Alexander Bain (to whose writings some of us owe much) when he compares it to an attempt "to get sunlight out of the cucumber," which is itself a product of sunlight. One can join hands with Professor Caldecott in his "contention that Heredity does not hold for Spirit," though it may operate as a more or less powerful factor in the lower grades of Being which belong to the environment (physical, mental, and social) of the individual.

Rev. JOHN TUCKWELL, M.R.A.S.:—Mr. Chairman, I welcome as an antidote to a paper which was read here a few weeks ago on Darwinism and Malthus, the very valuable paper to which we have just listened. That paper subordinated the rights of the individual to the claims of society to a dangerous degree. This one restores them to their place. But there are one or two expressions in it to which I should like to refer for a moment rather in the spirit of enquiry than of criticism. The professor says, "The inference I stand by is to a super-finite consciousness from which we come which may be said to express itself in us." I confess this looks very like pantheism. If it means that that super-finite consciousness continues all the way through our life and expresses itself in all our thoughts and words and deeds, and in our whole conduct, I do not see how that can be consistent with our separate individuality, and if we have no individuality separate from the definite or super-finite consciousness from which we are supposed to proceed then that *is* pantheism, and I should emphatically differ from the learned professor.

I notice also a sentence on the following page at which I am made to pause. The professor says, "I see no reason for thinking that soul succeeds soul in the way of generation."

This may involve very serious conclusions. If soul does not succeed soul in the way of generation then each soul must be derived immediately from the infinite. But life in the organism is continuous from the moment when the two germ cells become one. Is there at this moment a second life added from the infinite? So far as I know no biology or physiology or psychology has any evidence to give

concerning this second principle of life. But to my mind the professor's suggestion becomes still more difficult in view of the Scripture doctrine of sin. If the soul be a super-added entity direct from the Infinite then there can be no hereditary taint of sin or tendency to it in the soul unless the Infinite Creator Himself be sinful. To that conclusion I am sure the professor would not desire to lead us. The only other alternative so far as I can see is that the hereditary taint of sin is simply in the body and not in the soul at all. Consequently the only real gospel for our sinful race is the new science of eugenics. To eliminate sin from the world of humanity all that is necessary is to quicken the action of the supposed process of evolution and we shall have "the new earth" if not the "new heavens wherein dwelleth righteousness." I am bound to say also that I do not see what reason there was for the awful tragedy of Calvary, and why it should have been postponed to so late a period in the world's history when by a correction of the faulty physical organization of the first generations of mankind, the whole sad story of our race might have been avoided.

There is one other sentence to which I would refer. Four pages further on I read, "Religion greets each soul as it appears and invests it at once with an environment which shall be a matrix for its personal development, knowing that even from unpromising 'stock' souls of pure lustre and high spirituality are possible because they are found," and in a little aside the professor spoke of the value of baptism. As I heard it I could not help thinking of a visit I paid to the Penitentiary at Melbourne when I was in Australia. I asked the warder who took me round if they ever had any Roman Catholics there. "Oh yes," he replied, "a good many." "And do you ever get any members of the Church of England here?" "Oh yes, we get some of them." "And do you ever have any Methodists?" "Well, yes, a few." "And do you ever get any Baptists here?" "Oh no, we never get any Baptists here." I am afraid therefore that the "matrix" afforded by baptism as an entrance to the Church is too often a failure, and that the only true matrix is that unto which we pass when we enter into Christ by a living conscious personal faith. "If any man be in Christ he is a new creature, old things have passed away, and all things have become new."

Dr. HEYWOOD-SMITH said that Dr. Archdale Reid and others had maintained acquired characteristics were not transmissible, but

the difficulty was to determine what characteristics were to be deemed acquired. A man got a certain trick or peculiar gait in his walk, and one could recognize his son a long way off by his similar gait. So too there was often a more pronounced likeness in the voices of a family than in their features. A man becomes a drunkard or a criminal—his children have a tendency to follow his steps; the question arose whether that was from heredity or from their environment. The introduction of eugenics with Biblical philosophy was a tacit acknowledgment that certain characteristics were hereditary, and that by a proper selection we might obviate the degradation of the race. But while such selection might be made with regard to the lower animals, yet as long as free will and love existed as attributes of humanity an election in breeding was an impossibility. The science, therefore, of eugenics seemed to beg the whole question and was, at all events at present, outside the range of practical application.

The CHAIRMAN pointed out that while the lecturer stated in clear terms his belief in the power of heredity in the physical organism, and not in the mental, yet he admitted "that in the lower ranges of mind the contention for heredity is plausible." But how can we distinguish between the lower and higher minds? Can we, if we accept evolution, draw a sharp line between the two? Are not also the physical and mental so bound together that they interact so that we cannot separate the two. An irritable man is so because of physical weakness. So heredity may act at any rate indirectly on mind through the body which ultimately affects the mind.

The lecturer having replied briefly, the meeting adjourned at 6.15 p.m.

509TH ORDINARY GENERAL MEETING.

MONDAY, JUNE 6TH, 1910. 4.30 P.M.

D. HOWARD, ESQ., D.L., F.C.S., F.I.C. (VICE-PRESIDENT), IN THE CHAIR.

The Minutes of the previous Meeting were read and confirmed.

The Chairman announced that this was the last Meeting of the Session, and congratulated the Institute on the success that had attended the Meetings of the year, and the admirable quality of the papers which had been read thereat.

The following paper was then read by the author:—

DETERMINISM AND FREE-WILL.

By Archdeacon B. POTTER, M.A.

ONE cannot help feeling, notwithstanding the contrary view of some German philosophers, that purely speculative questions cannot boast of the same claim on our time and thought as those which concern conduct. Conduct is the all-important thing in life, and a man's life is so short that it seems wise to confine, as far as possible, our intellectual investigations to questions which bear on its guidance. Now the question of Determinism or Non-Determinism of the Will on which I am asked to read this paper, is essentially a practical one. On our view of it largely depends the line we shall adopt in the conduct of our lives. If we have no power over our wills, they being determined independently of us by circumstances, by heredity, character and desire—then the natural conclusion is to sit down and acquiesce in the inevitable. If on the other hand the will is entirely uncontrolled, it becomes unnecessary to take any steps to influence supposed controlling powers. So if we look round us and observe the lives and actions of men who think, we shall find that the goodness or badness of their ideals and conduct depend to a very considerable extent on the intellectual view

they have formed for themselves on the question: "Is the will free, or is it controlled?" You will find religious and anti-religious literature much concerned with the subject. You will find men excusing license or urging control of desires in accordance with their view as to whether or not we possess freedom.

But the second thought which arises in view of this subject is whether the question is soluble. There is much that might lead us to consider it not so. Because it concerns human personality in the depths of its mystery; and there is no doubt that here we are face to face with a problem which eludes us almost as constantly and rapidly as problems concerning the Divine Nature, or the nature of our Lord Jesus Christ. Mystery dwells not only in the infinitely great, but in the apparently comprehensible. Still we have always this comforting reflection that even in the most abstruse questions, where the intellect finds itself, as Kant described it, attempting to fly in a medium of pure space, where for lack of atmosphere, it cannot make any way with its wings; even here, there are practical solutions of all the problems. And the practical solution is usually arrived at by an admission of the incomprehensibility of the question in all its bearings. The human mind naturally seeks to unify—to bring every phenomenon into a mathematical system, which it can thoroughly comprehend. It is this tendency which has led, in philosophy and theology, to so many errors, so much bitterness, so much strife. In the free-will problem, men start with the assumption that all the phenomena must come under one law, just as in theology they have tried to reconcile Love, Mercy and Omnipotence in the Creator. But the effort fails; the solution lies in the admission that we must accept contrary facts which we cannot reconcile; and yet which we know must both be true.

Now what I propose to do to-day is to place before you as clearly and honestly as I can, the various arguments, so far as I understand them, which have been and are being used, on the two sides of this question. I shall then ask you to consider whether these opposing theories can be reconciled; and if so, what is the true method of reconciliation, and lastly, ask you to bear in mind the practical results which are deducible from the conclusion at which we arrive.

First then to take the arguments for Determinism, *i.e.*, for the doctrine that men's wills are ruled by character, desire, circumstances, and outside influences.

The matter may best be dealt with by looking at it to

begin with from an *à priori* point of view, and then coming more closely to the problem, and examining our consciousness, and seeing what we find there in favour of this hypothesis.

The *à priori* arguments may be divided into four—education, religion, the science of government, and history.

There are few, if any, serious-minded persons who do not believe in the importance of moral and religious education. The battle has been raging in this country as to the form which that education should take, whether it should be abstract and undenominational, or definite and denominational. But few have denied the value and the importance of some kind of moral training. The reason is not far to seek. It is because we believe that the life of the man is influenced by the training of the boy. True education aims above all things at forming character. We know there is innate character in every child. But we also know this can be influenced and moulded. By wise and careful teaching, combined with correction and reward, a child may develop noble sentiments, high aspirations, affection, conscientiousness, truthfulness, honour. As these principles grow and become exercised, they become more strong. The character is moulded by them, and the will responds to them. There doubtless are exceptions where the desired results are not attained, where the boy surrounded with moral and religious advantages grows up a worse man than others less advantageously placed. But this is because the lessons given have not been assimilated. The character has not improved, and so the life has not improved. But where the education is effective—the result seems invariably to follow. Where principles are instilled and imbibed, the daily conduct answers to the helm; and you can feel assured that the man will act as the boy has grown to be. On the theory of free-will this would not be so. If a man is free to act independently of character and influences, he probably will so act: and if he did, our anticipations based upon the principles we have instilled into him, would be disappointed.

Let us next take the question of religion. The main idea in the minds of that large class of people who believe in religion is that through its forms and ceremonies, and more especially through prayer, and in the sacraments, an influence or influences come from the spiritual world into the inmost being of the person who prays, or who is prayed for, and that this influence affects his will and actions. This is certainly the main thought in Christianity. Our Lord promises absolutely an answer to prayer which is directed towards the

gift of the Holy Spirit. Some Christians believe that Jesus Christ lives in them, others that it is the Third Person of the Trinity sent by the Father, and by him, others in the influence of angels, others in the influence of departed saints. But all persons who believe at all in religion believe in some kind of influence which, in response to prayer, enters the heart of a man, acts on his feelings, desires, and principles, and so constrains his will to act according to certain defined principles approved by conscience, and in accordance with the will of God. It is the belief in this influence which leads people to use the ordinances of religion, and which comforts them, and gives them hope regarding their future and the future of those they pray for. Although they may feel an innate evil nature ready to burst out at any moment, still they feel confidence in this grace as a preservative of their will and conduct.

But on the hypothesis of free-will, no such influence could convey any certainty. Man's will at any time might and would rebel against these influences, and the holy, pure, truthful man find himself under punishment for vice, for lies, or crime.

The third *à priori* argument is from the science of government.

There is no doubt that a large factor in the success of rulers and directors of the world's affairs is a clear perception of the characters of men. The diplomatist must know the men with whom he comes in contact. He must know their ambitions, their ideals, their desires. His art is so to arrange affairs that the persons, or groups or persons, from whom he desires to obtain some concession receive in return for it something which to them is valuable; and he is not disappointed.

The same principle applies to the statesman, or general, or organizer in any department of life. Men succeed not so much by what they do themselves, as by what they can make other men do. He who can pick his men, place the brave man where courage is required, the honest where integrity is important, the wise where judgment comes into play, such a man is invariably successful; he rides to the attainment of his ambitions on the shoulders of the agents he has selected to do his work. But all this would be impossible if the will were free. You could not depend from one hour to another that the person selected for a particular duty would perform that duty. At any moment the most carefully laid plans might be defeated by the exercise of the ungoverned will of a subordinate.

In fact, in every department of life we assume without argument that men's actions are determined by their character. The man who is good at knowing character is a perfect prophet in predicting action. The wise and shrewd man gets help or money or sympathy with his aims, largely by playing on the strings of human character, which he is clever enough to understand.

If I am not wearying you, I will add one more argument for determinism from the law pervading history. Every historian traces law in the development of nations; so manifest, that from the history of one nation you can predict that of another, *e.g.*, the Romans rose to greatness when surrounded by difficulties; but when they attained luxury and power they began to lose their energy, and to sink down to the position of a decadent race. The reason is obvious: poverty and difficulty are a stimulus to energy. When attainment comes, the stimulus disappears. This law is universal, and from it we can predict the fate of existing nations. But the law shows that nations, like men, are determined in their actions by the conditions amid which they are placed. And the historian writes on this assumption.

Having endeavoured to show that men act on the assumption that the will is determined, I will now try to grapple with the question as to what the verdict of our intellect is when we come to examine into our own nature. We may, I think, divide all our actions into two divisions—first, unconscious actions, secondly, conscious. But the conscious consist of two kinds, impulsive and deliberate. As regards unconscious actions, they seem to take place without any movement of the will. One does not resolve to breathe or to blink with one's eyelids. But there are conscious acts which constantly pass into the region of the unconscious. When a child begins to play the piano, it consciously places each finger on a certain note; but later on the action becomes instinctive; that is unconscious. So that we may class both these kinds of action as determined.

With regard to impulsive actions, these seem directly caused by passion or feeling. The man who commits murder under strong excitement which clouds his judgment and moral sense is not usually considered so responsible as the one who plans beforehand to commit the crime. There are instances of temptation which seems too strong to resist. I have known a prisoner say that if a certain temptation were before him, and the gallows staring him in the face, he would be compelled

to yield. No other theory than that which allows that the will is ruled by passion seems able to account for the fact that after months and years of imprisonment men will immediately return on release to the crime for which they were punished.

But, lastly, to take the case of deliberate action, here at any rate we may say consciousness proclaims us free. I know I can choose. I feel myself free, this is the verdict of self-consciousness.

Let us take the case in which freedom seems most apparent. A man resists inclination, conquers impulse, does something he does not like to do. Surely this proves him free, and yet, if he reflects, after his action, on the cause of his action, he will find that a motive determined his will. We say a man has a strong will who decides for duty against inclination. But we must not forget that the action was due to a higher motive being brought into prominence. There were in the man's personality feelings of honour, of duty, of affection. Passion clouded these, and the will was giving way. But some influence came to bear—a friend's advice—a thought—a memory—a suggestion from the spiritual world; and the higher motive came out into prominence, and overcame the passion. If we could recall any decision, which had not behind it a motive, a reason—then we might deny determinism. But this is not so in any single action of our life. Some philosophers have ascribed this choice between lower and higher motives to reason. But reason does not act immediately on the will. Reason is simply the intellectual faculty which penetrates into the meaning and results of actions, and makes it clear to the self what will follow them. The self then decides. But in its decision, it is determined by its character.

I will now notice two objections usually brought against this doctrine. One is that responsibility implies freedom. But as Riehl says, "a being whose actions do not depend on anything, and therefore do not depend on the consciousness of responsibility, cannot be responsible. A free unmotived choice is purely accidental, and no one is responsible for an accidental occurrence. A free being can have no definite character—the essential mark of character is persistence." Again, "how can determinism contradict responsibility, if responsibility is one of the determining causes of the will?" Fowler says, "I have said nothing of reward or punishment or responsibility, which may be explained as liable to punishment, because I think that all these facts are equally explicable on the Determinist hypothesis."

Again it is objected, morality is inconsistent with determinism. Here I must quote Riehl again. He says "morality stands, and determinism is a scientific truth. As the result of a will acting under law, morality is only possible in connection with determinism. Morality is the *ratio cognoscendi* of determinism—determinism the *ratio essendi* of morals."

Let us now look at the other side of the question, and see what can be said in favour of Free-Will. And the one great argument, whose force is felt by every thinker, is the universal fact of Consciousness of Freedom. As Illingworth puts it, "Free-Will is a fact of immediate and universal consciousness, *i.e.*, of my own consciousness, corroborated by the like experience of all other men." Fowler says, "we seem to be free, to have the power of shaping our own acts." Why should we praise or blame others, or approve or disapprove our own actions, if we regard others and ourselves as determined. Spinoza admits that "men must regard themselves as free, because they are conscious of will and of desire," though he explains away the meaning of this by the theory that it is ignorance of the causes behind the will which makes men think themselves free. Riehl admits our consciousness of Freedom, and explains the reason of it as Spinoza does, only he advances a step further and claims to show why men are ignorant of the causes which move their will. He thinks that the causes of our actions precede self-consciousness, and thus do not enter into it. That is to say, we do not become conscious of self till the cause has passed into an act of will. So the latter only is perceived—and the former not. So he says: "It is easy to see why the necessary ignorance of the proper causes of our actions must produce the illusion that they are not caused." Ladd says, "They who urge the speculative tenet that all conduct is strictly determined, practise as though they were, what they really are, as free as the gods themselves." He speaks of the consciousness of freedom as, first, consciousness of ability—that is of the self as active: and secondly, a consciousness of imputability, that is of the self as responsible. Sedgwick says, "against the formidable array of cumulative evidence offered for determinism, there is to be set the immediate affirmation of consciousness in the moment of deliberate action." However strong may be the rush of appetite or anger, it does not present itself to me as irresistible.

And if we deny the reality of this belief of consciousness, that I can choose between two alternatives, it would seem as though we reduced the whole universe to subjection to material

law. If man is not free, God is not free. Consequently there is no difference between mind and matter. All are under necessity. In fact the great argument for belief in God disappears. The world is not subject to a mind and heart. It is under universal self-caused law. It is of no use for me to exercise my will, or to try to do anything, for every action is predetermined by a force which cannot be resisted. I cannot make my character, because in making it I am ruled by motives, and these motives if not there, I cannot place there. Is this then the result at which we are to arrive as a result of deep-thinking on this mysterious problem ?

There are also strong feelings in man which imply freedom, *e.g.*, remorse. How can a man be tortured by remorse if in sinning he had no power over his actions? Why should he be condemned to punishment for sins he was bound to commit? Why should we feel angry with a person who has wronged us, if in doing so he was the slave of character; and if in the formation of that character he could have had no part ?

Let me now endeavour to place before you some of the ways in which different thinkers have tried to reconcile our consciousness of freedom with the apparent law that every act is determined by character, or motive, or circumstance.

We may divide these classes of explanation into two heads. First, those which try to explain away free-will and make it an illusion; secondly, the opposite line of thought which tries to reconcile a real freedom in the will with the facts making for Determinism. My own belief is, as I have said, that both efforts fail; and that the real fact is that these apparently totally opposed phenomena of human personality are both true, and yet both irreconcilable by the human intellect.

Riehl claims to have solved the problem. His words are: "Modern philosophy may claim to have discovered the laws of motive for the will, and to have reached the true conception of mind." One agrees with Riehl in saying that "morality stands and determinism is a scientific truth." But one differs from him in thinking that the combination is comprehensible to us. If it be true, as he and Spinoza say, that the will only appears free because the causes which move it do not come into consciousness, can we understand the use of appealing to the will, and of a person trying to exert will? If the will is determined by character, how can the will influence character ? In its motives to improve itself it is ruled by a pre-existing condition. If that condition had not existed, it could not act so as to improve its character. Riehl distinguished between

fatalism, determinism, and free-will. He says, "Fatalism is a motive not to act—determinism the strongest motive of action —indeterminism, a source of foolish complaint against oneself. He says again, "the obedience to law which determinism ascribes to action is not a blind, but a discriminating obedience."

I confess I cannot realize this distinction between fatalism and determinism. If the will is really ruled by motives—then the whole man seems the slave of the history which has evolved his character.

Another objection to this explanation is that it makes nature a deceiver. It is desirable that man should believe himself free, because if he did not he would not exercise his will, and so would relapse into idleness and uselessness. It is the belief that he is free that rouses him to action. If this belief is a delusion, then nature deceives us, and the ignorant man is a better member of society than the educated thinker. The latter is aware of the deception, while the former is ignorant of it. "Ignorance" in this case is truly "bliss," as it is essential to action. Riehl's argument regarding freedom resembles Comte's regarding prayer. The latter did not believe in answers to prayer, and yet strangely was so alive to its good effect on the subject praying that he advised his followers to observe the practice. But such a theory is open to the same objection as Riehl's, that if this is so, nature deceives, and ignorance of the reality of things is better than knowledge.

Green in his *Prolegomena to Ethics* sums up his view in this way:—"Will, then, is equally desire and thought, as they are involved in the direction of a self-distinguishing and self-seeking subject to the realization of an idea." It must be a mistake to regard the will as a faculty which man possesses along with other faculties. The will is simply the man; any act of will is the expression of the man as he at the time is. The motive issuing in his act, the object of his will, the idea which for the time he sets himself to realize, are but the same thing in different words. Each is the reflex of what for the time the man is; in willing he carries with him his whole self to the realization of the given idea.

This certainly is a good description of what takes place in the act of willing. But we can hardly say that it makes the process less a mystery to us.

Ladd thus explains the phenomena: "That man is in some sort the creature of circumstances, and that many men are

largely so, who would venture to deny. But that man is by deeds of will also in some sort the creator of his own character and the moulder of society and of nature who would venture to refuse to admit." Again he says, "the character of a self always includes choices and the results of the choices, in exercising which it has been self-determining. On a basis of inherited potentialities, and under a variety of influences from the total constantly changing environment and in a certain subjection to the principle of habit the self nevertheless progressively determines its own character. Habit is strong, and its bonds often difficult to be broken; but habit itself is itself very largely a record of self-determining choices, a child of moral freedom." This all seems true, but is it comprehensible, for the original acts which produced habit were themselves the result of habits and character then existing.

Illingworth puts it thus: "The freedom of the will does not mean the ability to act without a motive. But it does mean the ability to create, or co-operate in creating, our own motives, or to choose our motive, or to transform a weaker motive into a stronger by adding weights to the scale of our own accord, and thus to determine our conduct by our reason." Again, "I can present to my mind appetite, pleasure, utility, as objects to be attained, and choose between them, nor is it to the point to say I am determined by my character, for my character is only the momentum which I have gained by a number of past acts of choice." Here this writer seems to forget that these past acts of choice were influenced by previously existing character and motive. Consequently, he is as far as ever from a definite conception of real free-will.

Must we not then accept the position as the result of our deliberation, that the will is in some mysterious way both free and determined; able to take part in shaping its own character, and yet in a sense the slave of previously existing character, and that although the truth of these apparently opposite facts is incomprehensible to the human intellect, it must nevertheless be accepted as a guide to human life.

Professor Fowler seems to fall in with some such conclusion as this, when he says: "Here then we seem to be on the confines of human knowledge, and to be compelled to recognize that in the sphere of human action, as well as in that of metaphysical speculation, there are apparent contradictions which we cannot reconcile. However unwillingly, we must perforce acquiesce in the limitation of our faculties." Malebranche says: "La liberté est un mystère."

Kant can only explain the problem by a distinction which Schopenhauer calls "the most beautiful and profound which humanity has produced," between the empirical character, and the intelligible character, which Schopenhauer compares with his great philosophic distinction between phenomena, and things *per se*. Man is transcendentically free, empirically, or phenomenally determined. But this distinction amounts to admitting our incapacity to understand the combination.

It may, however, be objected that this is a poor solution of a great subject—simply to point out our ignorance of it. May I ask you therefore to consider some reasons why it should be the right, and only solution. Human personality resembles the Divine, in its incomprehensibility. Our Lord constantly reminded men that they were Sons of God. The ancient philosophies of the East, equally with the writing of our best moderns, have held that a belief in the pre-existence of the soul is the greatest proof of future immortality. To live for ever *à parte post*, and not to have done so *à parte ante*, they pronounce to be inconceivable. "Our birth is but a sleep and a forgetting; the soul that rises with us, our life's star, hath had elsewhere its setting, and cometh from afar." Our birth and personality then are mysteries; who will say he understands either? Does it not follow that the problems connected with them must contain mystery? We cannot reconcile evil and good, or understand how one omnipotent Creator can rule in a world where both seem eternally existent, yet we accept the incompatible facts. So with free will and determinism, the two seem irreconcilable, yet both must be believed. In fact, if we could unify our conceptions of personality and make these two opposite principles in us clearly apprehensible to our minds, then we might assume that, as there was no mystery in our human nature, we did not partake of the Divine.

What then are the practical conclusions to be drawn for our daily life from the solution I ask you to adopt? There are first the conclusions to be drawn from the fact of freedom, and secondly, those deducible from the fact of determinism.

We must always act as if absolutely free. We do so in many affairs in life. If we did not, the world would come to an end. Men and women would sit still and do nothing; it is surely inconsistent to act as if free in certain relationships of life; and to make belief in determinism an excuse for not acting in other relationships; and this is what the practical necessitarian does. If the house in which a man was living were on fire, would he

sit still and excuse himself from moving by saying his will was determined, even if he called himself a determinist?

Secondly, we must remember the lessons of determinism:—

(*a*) To cultivate character in ourselves and others, that it may influence life. The very fact of doing this involves both freedom and determinism. We must believe ourselves free when making the effort to improve. We must believe ourselves determined when we aim at character as a necessary goal.

(*b*) We must conquer habit.

(*c*) We must seek Divine grace.

In each case the two beliefs must influence us.

Thirdly, I think the question of punishment is largely affected by our view of this question. We should not punish for vengeance. Many a criminal is really insane, others have such inborn and developed proclivities that they cannot resist acting as they do. When we punish a dog, we do it to teach him to do some things and not do others. He learns by punishment carefully administered. Vengeance and anger do not enter into our feelings—nor should they when we punish human beings.

The growing improvement in men's notions on this subject, and consequent alleviation of the hard lot of many half-insane criminals may be looked on as a happy result of the deeper study of the subject we have been considering.

Fourthly, we should avoid remorse. Repentance is useful. Remorse is worse than valueless. As regards the past, we may remind ourselves more of the results of determinist philosophy than of the free-will doctrine. It is over. What has happened must have happened. Now at any rate it has passed into the region of consequences resulting on antecedent circumstances. As regards the future, free-will is the important thing to remember. On *us*, depends our future. That is, we can, at any rate, use circumstances to mould character, which will secure future action.

"Thou seemest Human and Divine,
The highest, holiest manhood Thou,
Our wills are ours, *we know not how*,
Our wills are ours to make them Thine."

Discussion.

On the conclusion of the paper the Chairman called on the Rev. Gregory Smith, M.A., LL.D., to open the discussion.

Dr. Gregory Smith, after thanking the lecturer for his very able address, demurred to the opinion expressed, that it is "impossible" on this vital question (because we have to accept two propositions, each true, but the one diametrically opposed to the other) to arrive at any logical conclusion. This would be so, if we had to reconcile Free Will with Divine Omniscience. But our question is narrower; how to reconcile Free Will with Determinism—an ambiguous word, used to mean, that people, who may seem to be very "determined" in the ordinary sense, are merely creatures of circumstance. To affirm that man is free to choose one motive or another, when they clash, is not to deny that he is always influenced by a motive.

There is no need now and here,* to comment in detail on the arguments quoted by the Archdeacon against the freedom of the will, "Solvitur ambulando." For instance, in any misfortune the sharpest pang is invariably if we have to blame ourselves. Determinism is right, for instance, that heredity, environment, etc., etc., may put an almost overwhelming pressure on the will, but the solid fact remains that, normally, one has to choose and to decide. It is by this reiterated act, which begins with the beginning of intelligence, of choosing the good or evil, that the will makes itself, what it becomes, and forms the character. Ἔθος grows into ἦθος.

It is a question of psychology, on which subject our thoughts are rather hazy. We must go back to "il Maestro di tutti chi sanno," keenest and closest of ethical philosophers. The advance of physical science may demonstrate more and more positively, that our mental and emotional faculties are mechanical; but the "spirit in man," the will, the self has to control these operations. The

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* See *What is Truth?* (Murray) and *Characteristics of Christian Morality* (Bampton Lectures, Parker and Co.), etc.

motor-car has its driver. It is noteworthy that Aristotle assumes, not proves, the Freedom of the Will. It is assumed in the teaching of our Lord.

The Rev. F. D. MORICE alluded briefly to the difficulty of combining a belief in an omniscience to which nothing further is unknown, with a belief that will can ever be absolutely free, which implies that it is an open question—a question not yet decided—which of two alternative choices is in fact going to be made.

Rev. R. V. FAITHFULL DAVIES.—The subject is eminently one on which clear definition of the terms used is essential. Do any supporters of Free Will claim that the will is entirely uncontrolled? or that Heredity and Environment have no influence over its decisions? Do many Determinists assert that man is entirely a machine? Even Mr. Blatchford says, "I know that I can make myself better or worse if I try."

Substitute the word "influenced" for "ruled" or "determined" in the arguments which the Archdeacon, with characteristically scrupulous fairness, brings forward on the Determinist side, and you would have a large body of doctrines which would probably be accepted by both sides in the perennial controversy.

The Archdeacon says (page 299), "If a man is free to act independently of character and influences, he probably will so act." But why? Surely the probabilities are all the other way. It is indeed possible that a man of high character may act, on a given occasion, in a manner entirely contrary to his usual habits. But the probability of his doing so is so slight that the possibility may safely be ignored. May it not be the case that the whole subject suffers from attempts at over-analysis? To quote the words of John Caird (*Philosophy of Religion*, p. 115), "In every part of consciousness the whole is present; in all the phenomena of mind, the ego or self is the universal and constant factor. You may attempt, as has often been done, to apply material analogies to mental phenomena, as when moral action is represented as the result of the force of motives acting on the will. But the analysis here is a purely fallacious one. . . . It is the mind that is moved which constitutes or gives their constraining power to the motives that are conceived to move it."

The freedom then that we claim is not specifically the freedom of the will, in isolation, but the freedom of the whole personality to

choose between the various motives, whether suggested from without or self-supplied, to add to, or subtract from, the weight of each, and then to follow the strongest.

Sir Oliver Lodge claims it as the distinctive character of man that "he has a sense of responsibility for his acts, having acquired the power of choosing between good and evil, with freedom to obey one motive rather than another." (*Catechism*, p. 24.)

I heartily join in thanking the Archdeacon for his careful and instructive paper.

Rev. W. TEMPLETON KING, B.D., said that previous speakers did not seem to realize the difficulty of the question.

He put forth as a possible solution the thought that the will might have power not to act against overwhelming influences, but to choose among contrary motives which it will yield to.

Professor H. LANGHORNE ORCHARD.—I wish to join in thanking the learned author of this paper for a thoughtful and suggestive inquiry into a problem of such subtlety that leaders in philosophy have taken views which have issued in contradictory solutions.

On some points in this valuable paper I find myself unable to concur with the author as, *e.g.*, in the statement (or belief) that the will is at one and the same time both free and not free (see p. 304, par. 4); and he seeks to justify this idea by asserting that, if it were not so, "we might assume that, as there was no mystery in our human nature, we did not partake of the Divine" (p. 307). Surely there is enough "mystery" in human nature, without adding to it the insoluble complication that contradictory propositions are simultaneously true. The paper omits what appears to me to be an important argument in favour of Free Will, drawn from our intuition of Causality. We may state the argument as follows:—Every effect has a cause, *i.e.*, the power producing the effect. But power is incompatible with the presence of constraint. Power implies absence of constraint, implies, therefore, freedom. Cause, then, is free. Consciousness gives the idea of cause in will; therefore, will is free.

Perhaps the strongest of all the arguments for Free Will is the testimony of consciousness, held by Sir Wm. Hamilton to be decisive. We know *intuitively* that we are free to will for or against, and to choose this or that. To assume that our intuitions deceive us would be to suppose God a deceiver. Further, since, in the last analysis,

the validity of all reasoning rests upon premises intuitively admitted, an argument which denied the truth of the intuition would *ipso facto* fail to establish its own validity. The testimony of consciousness is in itself adequate to establish the freedom of the will.

Every argument adduced for "Determinism," or Necessitarianism, is vitiated by the logical fallacy of "begging the question." The most plausible, drawn from government and history, tells us that "in every department of life we assume without argument that men's actions are determined by their character." To which the obvious reply is that the fact that, in a given set of circumstances, men *usually** act in a particular way, does not prove them obliged to act in this way. The fact that they sometimes do not, proves there is no compulsion. And it is to be remarked that the will frequently alters the circumstances.

May I again thank the author for the intellectual treat which he has afforded us in this admirable paper.

Rev. C. L. DRAWBRIDGE said: The question is, are we merely the creatures of heredity and environment, or has the self some power of self-determination? Every human action has a cause, but the question is what is the nature of that causation. I maintain that when alternative actions are presented to the mind, and rival motives are present, we are partially free, not only to select between those that are present but also to create our own motives. The determinist, on the contrary, maintains that we have no alternative but to follow the strongest motive, and that circumstances over which we have no control decide which motive is the strongest. He therefore contends that praise or blame are utterly out of place, and that the word "ought" should be excluded from the vocabulary of philosophy.

One or two speakers confused (God's) foreknowledge with predestination. The two are not identical. I may foresee a street accident without causing it. My contention is that God has given us a measure of free will—self-determination—and we are, and feel ourselves to be, responsible for our use, or abuse, of our power of initiative. God is responsible only for the gift, we, for our employment of it.

We have to consider the evidence of consciousness as compared

* See, on this subject, the Discussion on Professor Caldecott's Paper, "Heredity and Eugenics," read before this Society on May 23rd.

with the conflicting conclusions of abstract thought. The former is the truer guide. All of us are conscious of some measure of freedom of will, and we invariably act upon that consciousness in the affairs of daily life. When we find an irresponsible person, we place him in an asylum. A strong-willed man, who was arguing with me in favour of determinism, suddenly beat his dog for its misbehaviour, so I asked him why he acted on the assumption that his dog was responsible for its action, if its master was irresponsible? Of course, heredity and environment are factors which do much to determine the actions of the will, but the will also determines its response and reaction to circumstances. The terms *moral* and *immoral* are meaningless, unless the words *can* and *ought* are applicable to human conduct, and according to Determinist philosophy our will is the mere slave of circumstances. This applies to the community as a whole—which is made up of individuals. All human achievement is born of the conviction that we are justified in saying "I ought, I can, I will."

Rev. JOHN TUCKWELL, M.R.A.S.—At this late hour I will not do more than add briefly one or two thoughts to this discussion. First of all I fear we are too apt to confuse our wills with our personality. Surely the will is the power of self-determination possessed by the ego. All language recognizes this fact. We consider the course of conduct we propose to ourselves and then we say, "I will." We must admit also, I think, that we have the power to choose from what motives we will act, and that our character is formed by the frequency of our choice from one set of motives. But it is impossible to get back to the beginning of the formation of character. How it is that a child in the first dawn of its intelligence is prompted to act from one motive rather than another we cannot tell. It tells a lie, perhaps, and finds that it gains some advantage thereby. The first success may become a motive for repeating the act until it grows to be a liar.

If, however, we accept the view of the Archdeacon and believe in the pre-existence of the soul, then it seems to me we are floundering in a Serbonian bog. How can we tell with what impact from that previous state we come into the world? And how can we tell to what extent we are to be held responsible for our actions? The Archdeacon says, "our Lord constantly reminded men that they were the sons of God." But He told certain of the Jews who

rejected Him, "Ye are of your father, the devil." Are we to suppose then that some men have had a devilish pre-existence, and others a divine? These expressions surely were used to indicate character and not pre-existence; and the proof of our immortality lies in our nature and not in any such hypothetical pre-existence.

Referring to the subject of punishment, he says that many criminals "cannot resist acting as they do." I remember my old theological tutor dealing with that plea said that any man brought before a magistrate who should plead it might with equal force be answered by the magistrate, "I cannot resist punishing you, take six weeks' imprisonment." It is answering a fool according to his folly.

Then with regard to the advice given at the close of the paper to "avoid remorse," if he had said "avoid the occasion for remorse," the advice would have been sound. But remorse is the penalty inflicted by the Moral Governor of the Universe upon wilful and irremediable wrong doing, and to tell us to avoid remorse is advising us to do what is impossible, and to fly in the face of our Creator.

COMMUNICATIONS.

Professor J. KIRKPATRICK (Edinburgh University) writes:—

Although an old student of philosophy, I fear I am not at all competent to grapple with the old problem of Determinism *versus* Free Will. I shall therefore not presume to criticise Archdeacon Potter's very able address, except in a few very slight particulars.

On p. 299. "He will probably so act" does not seem to me very clear. "Free will" in this case appears to be used synonymously with animal propensities or evil passions—the free will of an animal, but surely not the free will of a *man*, however savage?

A somewhat similar remark applies to a passage at the foot of p. 300. An absolutely ungoverned will is surely not to be found in human beings, except where a taint of hereditary insanity, or preternatural craving for drink, or abnormal animal passions, reduces them to the level or below the level of the lower animals. There is therefore little probability of trust being reposed in such persons by the statesman or the general.

I venture to think that a first step toward a solution of the problem (if problem it be) would be to define "Determinism" and "Free will."

Does not Determinism, in the usual and narrow sense, mean the sum total of those influences and impulses which are absolutely irresistible? In such cases freedom of will is *nil*, and the ego is either an insane person, or an incorrigible drunkard, or a man-animal. But in the higher and wider sense which you, I think, most rightly adopt, does it not rather mean the sum total of all influences, including religion, education, art, science, taste, etc.? In this case, too, one's freedom of will, though by no means *nil*, is morally reduced to a *minimum*, one's conduct being morally *determined*.

These are, of course, extreme cases, conduct in the one case being physically, on the other morally determined. But the intermediate cases seem to be those where the conflict between determining influences and will really arises—the conflict of the will with *all* influences, both good and bad, both physical and moral.

Professor H. WHITE (King's College, London) writes:—

One of the chief points with which I was struck was that almost all the writers quoted seemed to confuse between *moral* freedom and what I may call *philosophical* freedom of the will.

We must all agree that action is the result of motives, and that when we do anything it is because the motives which urged us to do it were stronger than those which urged us not to do it. We must all be deterministsin this sense: we are all slaves to motives.

But this is something in a quite different category from the question of a man feeling within his better self that he ought to act one way, and then being driven by passion to act another: he is here a slave in a new sense, because he is not free to do what conscience tells him he ought to do.

Then moral freedom does not mean uncertainty: if a man is absolutely upright and has his feelings thoroughly under control, he has freedom of the will in the moral sense; and yet you can calculate, sometimes with almost mathematical accuracy, and a long way ahead, how he will act in certain given sets of circumstances.

Mr. A. C. CHAMPNEYS writes:—

It appears to me:

(1) That whatever arguments may be used in favour of Determinism, the underlying presupposition almost always is that the will must follow the analogy of material things, which appear (at all events) to follow an unchanging sequence or "law."

If, however, the human will is something different from these, this is merely false analogy.

(2) It is constantly assumed that if a motive is to be a cause at all it must be an *irresistible* one. This is "begging the question." [This fallacy seems to be present on p. 299, and in other places in the paper.]

(3) The immediate consciousness of freedom (especially when it is supported by the whole practical experience of the human race, as shown in praise, blame, repentance or remorse) must be infinitely less liable to error than any roundabout calculations of probability.

(4) As to some details:

(*a*) On p. 299. "But where the education is effective," etc., appears to be obscurely thought out. There is no mark of a thing being effective except that it acts. So that the sentence appears to me equivalent to "When the result follows, the result does follow."

I do not think that those who have had much to do with boys will feel that there is any certainty as to the effect on them of their (moral) education. This uncertainty is thought by ordinary persons to depend on their choosing or not choosing to go the best way. And this really does not seem an unreasonable explanation.

(*b*) Judgment of character (p. 301) is not really an exact science at all. I know *no one* who has not made or does not make mistakes in judging it. [There is here, one would think, an indication of the presence of an incalculable element.]

The argument from history is not really sound at all. If one person chooses energy and another one slackness, the choice of one neutralises the choice of the other, and thus the choice is eliminated, leaving the balance of other causes to act in the nation as a whole. But in any case prediction in history has been so often wrong, and is so uncertain that it appears quite too unsound to contribute to the argument.

(*c*) I do not think that the criticism of Illingworth on p. 306 is sound. It would only be necessary for Illingworth to go back a step or steps further. It is quite possible to contend that the man's character is formed at various points, by

acts of choice, though of course the character, so far as it is formed at each stage, *predisposes* the child or boy or young man to particular lines of conduct and makes the opposite choice increasingly difficult.

If the proofs of Determinism were stronger and *sounder*, I should agree with the Archdeacon's conclusions.

The Lecturer's Reply.

Aristotle doubtless, as Dr. Gregory Smith states, assumed that the will is practically free. But Dr. Gregory Smith in his *Ethics of Aristotle*, p. 16, states the latter's view in the following terms:—"Will," he says, "with all its arbitrary changefulness may indeed be subject to laws as unvarying as those which govern a chess board. But so long as these laws lie beyond his cognisance, man is practically free."

Dr. Gregory Smith admits "an almost overwhelming pressure as the will," but claims still for the will the power to decide. Mr. Faithfull Davies says much the same thing, "Substitute the word influenced for ruled or determined," and it would be accepted by both sides. But when, under strong passion, the will is overborne, the word "ruled" seems more applicable than "influenced." Take the case of the man who constantly goes to prison for the same offence. When his will is debilitated by yielding to passion is he free to resist the passion? If so why does he not do so, when he knows the inevitable consequence. A man's best chance is to get into his nature other and higher influences, which may serve to conquer the force of the temptation which his will is unable to resist. Moreover, in my paper I showed, that even if the will succeed in resisting the passion, it is ruled in this resistance by higher principles, such as a sense of duty, love, honour, so that even when we prove the will to have been victorious over passion, we have not got rid of Determinism.

The Rev. W. Templeton King seems to have got as near the solution as it is possible for us to reach, when he says:—"Possibly the solution of the mystery lies in a power in the will to choose between motives which are both seeking to influence it." Possibly there the solution lies, but it is still a mystery, because when the will makes its choice as to which influence shall rule it, in making that choice, it is influenced by inherited and created character

The mystery resembles the old problem: Which existed first, the hen or the egg? or again: Did the soil formed from decayed vegetation or the vegetation which produces it, first exist? The point of my paper was that a mystery exists—not that the will is not free. I believe it to be free. I also believe it to be determined, but I cannot reconcile the two things. They *seem* entirely incompatible. Professor Orchard objects to a solution which "adds the insoluble complication that contradictory propositions are simultaneously true." But that is the very position we are forced into as regards many problems in philosophy, *e.g.*, the love, power, and justice of God.

If God be all powerful and all just, is not even momentary injustice inconsistent with these attributes? The apparently contradictory may not be contradictory, owing to our limited knowledge, just as real miracles—I mean those that actually happened —only *seem* at variance with law, because our knowledge of law is limited.

Professor Kirkpatrick finds a difficulty in my saying that if the will is absolutely free, a man will probably sometimes act in opposition to his training and character. But absolute freedom implies this. If you toss a penny a hundred times, it will at least once fall head downwards. So that if the will is not in any sense ruled by motives or character, it *must* sometimes act contrary to character. But it never does: because when it apparently does, there is at work some ruling principle which hitherto unseen is now at work.

Professor White agrees with my view. We are practically free. But clearly as he puts it, this freedom still remains incomprehensible. I do not think Mr. Champneys realizes the difficulty of the question. He says Illingworth need only have gone back a step or two further. But he did not, and if he had, he would have come to law, cause, determinism. Illingworth in the passage I referred to distinctly overlooks the crux of the whole question, viz., that the "acts of will," so called, which go to build up character, are themselves determined by pre-existing character.

Mr. Champneys does not seem to understand what I mean by "education being effective." I mean that when a boy is really influenced by moral education, so that it forms and improves his character, then in his after life the result *invariably* follows, viz., his conduct responds to the character so formed.

It may be open to argument whether or not the boy in imbibing moral teaching so as to improve his character is exercising free will, or being influenced by pre-existing character. But I did not refer to this in the passage referred to, my point was that when the character is formed the after conduct answers to the helm.

Mr. Champneys states that arguments in favour of determinism almost always presuppose that the will must follow the analogy of material things; but in my paper there was no such assumption, and no reference to material law, nor was there any assumption that a motive to be a cause must be irresistible—only the bare statement proved by examples that motives do influence the actions. At the same time it must be remembered that although history and judgment of character may not be exact sciences, the reason of this may be the infinite number of causes, many unknown to the actor, behind the human will. Mathematics is an exact science, because its scope is limited.

Professor Kirkpatrick seems to put the matter very clearly. He sees that I do not use the word determinism in its narrower sense: but in its "higher and wider sense," in which as he says it means: "the sum total of all influences including religion, education, art, science, taste, etc.," and in this case he admits that "our conduct is morally determined."

Mr. Tuckwell thinks we are in a "Serbonian bog" if we believe in the pre-existence of the soul. Has he noted that the great mass of the arguments in the Phædo for immortality depend on the belief in pre-existence? If we came into existence at birth, does it not seem probable that we pass out of existence at death? How can there be an immortality *à parte post*, if not *à parte ante*?

As regards punishment, even if a man could not resist temptation, he still should be punished, because the fear of further penalties will act as a deterrent, by bringing the motive of fear into play.

BIOGRAPHICAL NOTICE OF THE LATE REV. GEORGE FERRIS WHIDBORNE, Member of the Council.

Rev. George Ferris Whidborne, M.A., F.G.S., F.R.G.S., late of Hammerwood Lodge, East Grinstead, son of the Rev. George Ferris Whidborne, who was descended from Sir Richard Whidborne, one of the men of Devon who provided ships to go to fight the Spanish Armada, and a founder of Newfoundland; born at Plymouth, in 1846; educated at Clifton College, and late Scholar of Corpus Christi College, Cambridge; B.A., (Senior Optimes and 3rd Class Classical Tripos), 1868; M.A., 1872. Ordained Deacon, 1881, and Priest, 1882, by the Bishop of London; formerly Curate of St. Pancras, 1881–86; St. Paul's, Onslow Square, 1886–88; Vicar of St. George, Battersea, 1888–96; succeeded to The Priory, Westbury-on-Trym, Gloucester, 1894, and resided there for seven years, during which time he took a prominent part in Bristol church work; was a Life Governor of the Church Missionary Society; a Hyndman Trustee; member of the Islington Trust and of the Church Trust; one of the founders and for many years Hon. Secretary of the National Protestant Church Union, and took great interest in the work of its successor, the National Church Union; was well known as a geologist, and since 1876 had been a Fellow of the Geological Society, and for many years a member of Council; also member of Council of the Palæontographical Society, and several times elected Vice-President; member of the Victoria Institute, and member of its Council; contributed papers to the *Geological Society's Journal*, and published between the years 1888 and 1898 three volumes on the Devonian fauna of the South of England.