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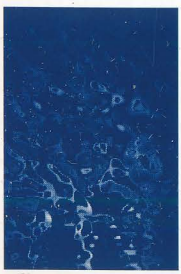

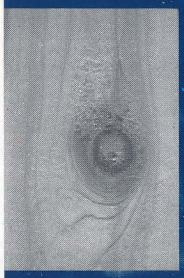

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Contents

Editorial

It is a particular pleasure to publish in this issue the essay which won the recent competition (*Faith and Thought Bulletin* 29, April 2001). Jacqueline graduated in Cell Biology and Genetics from the University of Birmingham, and is now working for an MA in Medical Ethics and Law at King's College, London. It is hoped that she will be free to attend the Institute's Annual Meeting on May 13 this year, and receive her award there. It seems appropriate that Dr. Caroline Berry, our guest speaker then, is addressing a very similar subject.

We continue to publish more of the cumulative index in this issue.

Christian Implications of the Human Genome Project

J. Engel

1. Introduction

Humans today have the opportunity to understand themselves at a level that would not even have been contemplated two thousand years ago. Once the belief in a 'god' of some description was the presupposition of every society, and people largely understood their existence in light of their faith in something beyond. We now live in an age that largely dispenses with such 'foolishness', so instead we look to ourselves for an explanation about our existence. Modernity held out the hope that scientific discovery would answer such questions, and enable us to solve our problems in the process. There are those within society who still put their faith in such scientific discovery. Others sense that the 'scientific revolution' has failed and are left to seek elsewhere for an understanding of

human existence and hope for the future. Many have stopped asking the 'big questions' about human existence altogether.

The modern western world entering into a new millennium consists of a huge spectrum of beliefs and coping-mechanisms for life. A plethora of '-isms' exist to which one may assign knowingly or unknowingly. The rise within society of eastern religious mysticism indicates the search for something other than 'just this'. A few still hold on to a personal knowable God in whom answers and explanations may be found. If the world is a stage, it is a very interesting one for the Human Genome Project to make his grand entrance into. Just what part will he play in this unfolding drama? What answers will he offer to the questions we have? Who on the stage remains interested enough to fully comprehend what he is doing?

This essay will not, I am afraid, contain comprehensive answers to the many questions that may be asked about the Human Genome Project. In this drama of life a lot is contained within the 'remains to be seen' bracket. Rather I shall seek to consider some of the implications that the Human Genome Project could have upon our society, and the questions that Christians may need to consider in this changing environment.

2. The Historical Development of the Human Genome Project

The Human Genome Project (HGP) is an international initiative with the ultimate aim of mapping (obtaining a complete description of) the human Deoxyribose Nucleic Acid (DNA) sequence. It was born out of many years of research and experimentation by scientists across the world, dating back to 1953, when the structure of DNA was initially described by James Watson and Francis Crick[1]. DNA molecules contain the basic information needed for life. Within each human cell there are 46 chromosomes (22 paired autosomes and two sex chromosomes) and each chromosome is made up of a long length of DNA wound up and packaged into a compact form. This packaging dramatically reduces the 'size' of the DNA; it is estimated that a single human cell contains 1m of DNA[1]. Within this DNA the instructions needed to make proteins, the building blocks of life, are contained. It is estimated that only 5% of our DNA actually codes for protein, the rest is termed 'junk' DNA but may have functions that we don't yet understand. The 5% of functional DNA codes for approximately 80,000 proteins; thus it contains 80,000 genes.[3]

Mapping of the human genome began with research into genetic diseases, as scientists were able to identify specific genes in association with certain familial disorders and to locate these genes within the human genome. The first international workshop dedicated to human gene mapping was held in 1973 at Yale University, and the pooling of information at that time allowed the mapping

of a total 25 human genes[2]. These meetings were then held every two years, such that an international body of scientists were working together to map human genes long before the HGP was officially formed. It wasn't until 1991 that the US Federal Government finally gave official approval to a US human genome project and funded it with an estimated three billion US dollars. The project was scheduled to run for fifteen years. Following this event, pressure from researchers in other countries led to funding initiatives in Europe , Japan and Russia. This is therefore a truly international project, although the overall coordination is based at sites in the USA and UK.

At the initiation of the US HGP, the following goals were set for the first five years[3]:

- Construction of a high resolution genetic map of the human genome
- Production of a variety of physical maps of all human chromosomes, and of the DNA of selected model organisms, with emphasis on maps that make the DNA accessible to investigators for further analysis.
- Determination of the complete sequence of human DNA and of the DNA of selected model organisms.
- Development of capabilities for collecting, storing, distributing and analysing the data produced.
- Creation of appropriate technologies to achieve these objectives.

By 1993 progress towards achieving these goals was on schedule or in some cases even ahead of schedule, and technological advances were dramatically changing the shape of the project so that a new five year plan for 1993-1998 was developed[4].

In 1998 all of the major goals in this plan had been achieved and a new plan was set for 1998-2003, which included finishing the complete human DNA sequence by 2003, two years ahead of the original schedule[5]. New initiatives of the HGP include:

- Mapping the major sequence variations in human genes and increase understanding of how these relate to multigenic traits and phenotypic variation.
- Methylation analysis of the human genome. This will provide further information of human variation and tissue specific genetic activity so that medical therapies can be designed on a more 'individual' basis.
- A Cancer Genome Project to identify somatically acquired sequence variants and mutations, and hence identify genes that are critical in the development of human cancers. This will then enable detection of germline mutations in non-neoplastic human genetic diseases through genome-wide mutation detection approaches.

These new developments are built on the groundwork that has been laid through the primary sequencing and mapping of the genome. Once the HGP is officially 'finished' there will still be plenty of research to do. It could be argued that only now, as it is coming nearer to completion, is the really interesting work beginning; the task of understanding *how* our genes actually work together to produce the complex organism.

At the outset of the HGP significant funding was also set aside for research into the 'Ethical, Legal and Social Implications' (ELSI) of the work. ELSI has its own extensive goals set for examining the wider issues raised by this new information and technology[5]. One of these is to "Increase the number of scholars who are knowledgeable in both genomic and genetic sciences and in ethics, law, or the social sciences." ELSI consider that the increased pace of genetic discoveries requires specially trained individuals to study the social impact of these discoveries. This may be an especially important area of knowledge for Christians to aspire to; perhaps we have a special responsibility to understand, and speak about, the implications that this science will have on society.

Scientists are primarily driven by a desire to know and to push forward the boundaries of knowledge as far as possible. By careful experimental investigation the scientist seeks to understand why the universe is as it is and works how it does. This is the fundamental nature of scientific discovery and on its own is innocently amoral. For a Christian, understanding the intricacies of creation is a good thing if it leads us to greater awe at the mind of the Creator. However, science does not happen in isolation, and in the current technological age the general rule is that a scientific discovery will result in some technical application. Furthermore, there are philosophical questions thrown up by many of these new discoveries about the world in which we live.

The repercussions of the HGP are far reaching. As stated by the directors themselves, "The Human Genome Project is fulfilling its promise as the single most important project in biology and the biomedical sciences - one that will permanently change biology and medicine."[5] Many of these applications are highly beneficial both to individuals and society as a whole. However, there are also difficult ethical questions raised by these developments. Within this essay the applications of the HGP within the medical arena and the further reaching consequences of these into society, and philosophical debates related to our 'genetic' selves are considered. There are also considerable issues raised by genetic technology in the areas of plant breeding, cloning and xenotransplantation which are not considered in this essay. For the Christian whose beliefs are already contrary to much in modern society, these technological and philosophical applications create a new forum for ethical and theological discussion.

3. Applications of the Human Genome Project

The HGP enables us to understand disease processes at a fundamental level. For many congenital malformations we can identify a causative genetic abnormality. Similarly for certain cancers a specific genetic cause, or genetic pre disposing factors, are known. Genetic research is searching for predisposing genes for heart disease, high blood pressure, certain psychiatric disorders and even alcoholism. By analysing the genetic makeup of an individual we seek to ascertain what diseases he may develop. As the HGP develops and specific genetic defects for disease are discovered, research is moving into the study of genetic 'predisposition' for multigene disorders and other human characteristics. A lot of this is still in the speculative stages and there are no clear correlations between genes and the more variable human characteristics.

The largest application of genetic technology in current medical practice is for the prevention of inherited genetic disorders. When the genetic cause of a disease is known, an individual's DNA can be studied for the presence of the specific gene mutation. This can be done at three levels: carrier screening of prospective parents, pre-implantation screening of prospective embryos (as a part of IVF treatment), or pre-natal screening of foetal DNA.

Inherited genetic disorder can be categorised into two groups (for simplicity in this essay, the picture is actually more complicated for many syndromes), recessive and dominant. A human cell contains two copies of any given gene (except those on the sex chromosomes, for males), one inherited from the mother and one from the father. If a genetic disorder is described as dominant it requires only one of these copies to be 'damaged' in some way for disease to be caused. Other disorders are recessive such that disease is only caused if both copies of the gene are damaged. Therefore a human can carry within their DNA a damaged gene but suffer no ill effects of this as the other copy of the gene can compensate for the loss. This person is described as a 'carrier' for that disorder and there is a 50% probability that they will pass the damaged gene onto any of their offspring. Mostly people remain happily oblivious to the fact that they are carrying genetic mutations and passing them onto their children. Problems only arise when two carriers have children together as any child has a 25% probability of inheriting two damaged genes, one from each parent, and will thus suffer the consequent genetic disorder.

Carrier Screening

There is a higher risk of children being born with recessive genetic disease when people marry within a 'family' as the two individuals will share a proportion of their DNA, having inherited it from a common ancestor two or more generations before. Some recesive disorders occur at a high rate within specific populations:

β-thalassaemia in Cypriots and Pakistanis, Tay-Sachs syndrome in Ashkenazi Jews, Cystic Fibrosis in Northern Europeans. For such 'high risk' populations there is the possibility of carrier screening whereby individuals are tested for the gene and, if found to be a carrier, can be advised about their reproductive options. Carrier-carrier couples may opt to have no children at all, or can have any potential children 'screened' for disease.

An interesting example of this population screening is seen among a community of Orthodox Jews in New York City[6]. A screening policy was adopted by this community to test teenagers in high school for Tay-Sachs carrier status and subsequently to discourage dating between couples who are both carriers. The information regarding carrier status is recorded at a central office and before embarking on a relationship couples are encouraged to check their risk of having children with the disorder. In the first ten years of the project "at least 67 couples who were considering marriage ... decided against it after being advised of their risk".

Pre-implantation testing

Parents who are at risk of having a child with a genetic disease have the further options of pre-implantation and prenatal diagnosis open to them. Pre-implantation diagnosis involves in-vitro fertilisation of the egg and sperm from the parents and cultivation of the fertilised egg to the eight cell stage at which point one or two cells can be removed from the blastocyst without damaging it, and used for DNA testing. For many this is ethically and emotionally preferable to prenatal diagnosis as it removes the option of abortion if the embryo is found to have a disorder. However, it has other ethical implications. Laboratory fertilisation involves the creation of a number of embryos from which some will be chosen for implantation into the mother's womb. Of those not chosen some may have the genetic disorder being tested for while others may be perfectly healthy but unfortunate 'extras'. For genetic disorders that are sex-linked, such as Duchenne Muscular Dystrophy, embryos for implantation can be chosen on the basis of their sex; probability indicates that 50% of those not chosen because they are the wrong sex will actually be perfectly healthy. As Christians what is our attitude to this selection of embryos? And what about those that are not chosen? Do we consider them as valuable, potential lives or are they merely a collection of 'spare' cells with no real relevance or value? If that *is* all they are why not use them for experimentation?

Pre-natal diagnosis

Pre-natal diagnosis can be carried out for a larger spectrum of disorders, not all of which need to be tested for genetically. The implication of pre-natal diagnosis may be beneficial in that it can enable the attending physicians to prepare for the

birth of a child that may need immediate medical care, and the parents to prepare themselves psychologically for the baby. There are also, however, many other implications which Christians and indeed others in society are concerned about. Termination of pregnancy is an option for a woman whose unborn child is diagnosed with a disorder. This option has resulted in the phenomenon of 'tentative pregnancy'[7]. Parents will have less commitment to their unborn child in the earlier stages of pregnancy, waiting instead until they have had all the relevant tests done to ensure that it is healthy. This emotional distancing allows a pregnant woman to retain the option of 'walking away' from the baby. Gilbert Meilander questons this distancing, "Perhaps the time of pregnancy will be better spent learning to love the child we have been given, before we evaluate and assess what our child is capable of ..."[8]. This attitude assumes however a belief in the 'givenness' of children that many in our society do not necessarily hold.

Treating Disease with Gene Therapy

For many genetic diseases the HGP is holding out the prospect of gene therapy to treat the disease, although the actual methods by which this may be done are complicated and not yet well developed. It is hoped that as techniques improve the genetic material of an affected individual will be manipulated to overcome the defect caused by mutation, this may be done in two ways. Treatment may be carried out after birth in order to alleviate the symptoms of disease. The foreign genetic material will only be present in the individual treated and will not be passed on to any children they may have, this is somatic cell therapy. This method is preferred by many as it does not permanently 'alter' the human gene pool. However, it also leaves the possibility that the person may pass on the genetic disorder to their own children, who will then themselves require therapy. Another option is germ cell therapy. This involves changing the genetic makeup of the individual at the earliest stages of development so that new genetic material is added to either replace or overcome the faulty DNA. Many are cautious about this type of therapy as the 'extra' material will be inherited by any children the individual may have and therefore be permanently present in the human gene pool. However, this also has benefits in 'treating' the familial genetic disorder for future generations.

Cancer Diagnosis and Predisposition

Another aplication of human genetics is in the realm of cancer studies, and seeking to investigate the role of genetics in development of different cancers. There are some tumours and cancer syndromes that are linked to very specific genetic mutations: retinoblastoma, Von Hippel Lindau disease, Li-Fraumeni syndrome and a collection of other familial cancers are linked to specific genes known as tumour suppressor (TS) genes. Loss or damage of one of these genes

does not result in tumour development but leaves the individual who has inherited the genetic defect susceptible to cancer as they are at risk of losing the other gene through various mechanisms.

Cancers also develop sporadically through spontaneous mutation of an individual's DNA, which may be caused by environmental factors (exposure to UV light, certain chemicals etc.) or merely as part of the ageing process. Study of the human genome suggest that there are susceptibility factors to cancer; a certain genetic variation may not definitely result in cancer development but leave the individual susceptible to cancer with other factors (environmental and genetic) either increasing or decreasing the likelihood of tumour development. Similar genetic predispositions are predicted for other human disorders such as diabetes, hypertension, coronary artery disease and schizophrenia.

The HGP has expanded its aims to include identification of genes involved in cancer development, and the major variations within the human genome which may be factors in the development of various diseases. Research into these predisposing genes may enable us to predict an individual's susceptibility to various traits.

4. The Wider Implications to Society

What are the implications for Christians of these methods by which we, as humans, may avoid and cure genetic disease? Carrier screening of parents appears to be a preferable method to pre-implantation and pre-natal diagnosis as it avoids the ethical issues related to spare embryos and abortion. The screening program adopted among the New York Jewish population promotes a responsible attitude among those screened and helps avoid an untreatable and debilitating disorder. The success of the program has led to it being extended to include cystic fibrosis and Gaucher's disease. Many would question this extension as cystic fibrosis is treatable and the symptoms of Gaucher's disease do not appear before age forty-five[8]. Is it acceptable to discriminate against these less debilitating disorders, and if we do are we on a 'slippery slope' towards eliminating other undesirable traits? At present, large scale population screening is impractical, but with the improvements in technology may come a more realistic option in the future. What if we could screen widely for genetic diseases and somehow 'manage' people so that they only have children with someone who is genetically compatible?

All of these technologies and options concerning childbirth have a hint of eliminating 'bad' traits. Obviously illness is an undesirable thing and something that the whole medical profession is geared up to alleviate, treat and prevent. But foetal screening is the only form of medicine in which doctors offer to treat a condition by eliminating the patient (or prospective patient)[9]. As the HGP is

set to complete the human DNA sequence within the next two years and to develop a comprehensive database of disease related genes, there will be an increasing number of human disorders which can be tested for . Currently women may opt for abortion if the unborn baby is shown to have a cleft palate, a disease that varies in its severity but can be repaired by surgical procedures and which many would argue is not serious enough to warrant abortion. With increasing knowledge there are many similarly less serious genetic disorders which we may be able to test for. How will we decide where to draw the line?

It is possible that we won't, and there may a gradual eroding of acceptable boundaries until anything that can be tested for will be tested for, and prospective parents will find themselves faced with an unprecedented choice about the child they are planning to have. A world can be conceived of in which all will be given the option of selecting the 'best' embryo from a number of viable ones, selecting for desirable traits rather than only seeking to avoid debilitating genetic diseases. Maybe one day we will even be able to engineer embryos to introduce desirable traits that don't naturally 'run in the family'. All of this seems very far fetched at the moment, but is it inconceivable? Furthermore, if reproductive technology does reach such a point, what will be the response of prospective Christian parents?

Creation of a genetic underclass

Let us imagine a society in which testing unborn children for genetic traits is a widespread phenomenon in order to avoid genetic disease, and predisposition to undesirable traits such as heart disease, diabetes, schizophrenia and depression. Knowledge and technology has reached a point where a standard test can be offered to all prospective parents, and the procedure for implanting healthy embryos is always successful. This is standard procedure. If parents do not comply with this they may be viewed as bad parents for not giving their child the best possible start in life. They also leave their child in a 'genetic underclass' in which life insurance will be higher and job prospects worse. As a Christian within this society a person may fundamentally disagree with the principle of selecting embryos in this way, yet the pressure to comply with the normal, accepted mode of action may be great.

Similarly a simple test using modern technologies could be performed on every individual to determine all the predisposing variations lying within their DNA. Life insurance brokers might ask for such a test, as might prospective employers. The analyst may take into account other factors such environment, fitness, whether or not a person smokes or eats high cholesterol foods, they may have a intricate equation that weighs up all the relevant factors to determine how 'risky' the individual is. People may find themselves being discriminated against for reasons beyond their control, their bad genetic inheritance. Surely we would never go

that far? These ideas seem extreme, but it is worth our considering as Christians the lengths to which society may go and decide beforehand how we believe we should act within that.

5. Healing and Wholeness

The medical applications of the HGP offer hope to many who suffer with illness and disease. The woman with a mother, aunt and sister who have all developed breast cancer will live with feelings of anxiety knowing that this may also happen to her and maybe to her daughters. Genetic testing within the family enables in many cases for more definitive information to be given; if she is found not to have the predisposing mutation she is relieved of the burden (although she still has the same risk of developing breast cancer as any woman in society). If she is found to carry the mutation extra care can be given to ensure that any tumours are identified early and thus hopefully treated more effectively. In rare cases women with such a genetic mutation opt for preventative double mastectomy (an extreme measure, the necessity of which is questioned by many) as a reassurance that she will not develop the cancer herself.

For parents who know they are at risk of having a child with a severe genetic illness the advances made through the HGP offer hope for overcoming that, and having a healthy baby. For those in desperate need of a new heart, liver, kidneys, the advances in organ transplantation techniques and xenotransplantation, which depend upon the knowledge of genes and immunity gleaned through the HGP, there is hope for faster and better treatment.

The information and technology available because of the HGP has speeded up the rate at which new scientific discoveries are made. In 1980 it took five years of work to locate the gene causing Cystic Fibrosis in a family. By 1999 these timespans were reduced to nine days when searching for a gene causing Parkinson's disease within a single family[10]. Such advances are resulting in a rapid increase in our knowledge of human genetic disease proceses, and this in turn promotes the development of better therapies for disease. In the example of Parkinson's the research cited above led to identification of a gene, a-synuclein, which if mutated causes the neuron death and associated degeneration that characterises Parkinson's disease. Mutation of a-synuclein is a rare cause of Parkinson's disease, but it is part of a common pathway that was not known about before this genetic information was available. Knowledge of this pathway initiated new ideas for therapies to treat the disease.

Physical healing for broken humanity is a fundamental aspect of Christian belief. The Hebrew Scriptures reveal a God who hears and heals his people, caring intimately for their spiritual and physical wellbeing. To Abraham he is El-Shaddai, the God who nurtures, nourishes supplies and satisfies, being all-sufficient and all-bountiful, and ultimately bringing forth a child from an old and barren couple[11].

In David's Psalms we frequently see a God who interacts and heals ("O Lord my God, I called to you for help and you healed me." Psalm 30 v 2). He restored Hezekiah to health and extended his life by a further fifteen years ("I have heard your prayer and seen your tears and I will heal you" 2 Kings 20 v 5). Then in Isaiah 61, 'The Year of the Lord's Favour' is proclaimed, with a prophetic vision of a time when captives will be freed, mourners comforted, the broken hearts bound up. Jesus claims this responsibility for himself when he stands in the temple and reads this scripture, announcing that it is fulfilled through him. The three years of his ministry are then filled with accounts of his healing people of various afflications ("Jesus went through Galilee, teaching in their synagogues, preaching the good news of the kingdom, and healing every disease and sickness among the people." Matthew 4 v 23).

The HGP has many beneficial implications in the area of healing disease and as such is something Christians can embrace. But it has other implications that we should question, and therefore presents a paradox of responsibilities. We must respond in love to the woman who is at high risk of having a severely debilitated child, and yet we may find ourselves disagreeing with the procedures she is employing to overcome that problem. Furthermore, healing humanity at the genetic level somehow goes 'deeper' than the medical treatment of other ailments. A secular psychologist has said, "I believe there will be a 'holistic psychology' in the not too distant future, like holistic medicine, (that) integrates scientifically based treatment approaches with alternative, more spiritually based modalities"[12]. While we may be concerned that the spirituality referred to here is not Christ-centred, we may still consider the benefits of a holistic approach to disease. Does the HGP offer such a holistic approach? Or does it rather, by understanding and treating (or removing) human disease at the fundamental level, distance us further from consideration of our spirituality?

6. Rights and Duties

The assertion of individual human rights within society is a common and highly acceptable phenomenon. Human rights are legislated for and form a basis on which many build their morality. Health is considered by many as a fundamental human right, along with the healthcare necessary to promote health. With the developments of the HGP personal genetic health may also become a right, and certainly the individual's right to have a healthy child is already part of medical practice. Personal rights and autonomy are an incredibly important concept to most people in society. But this often results in conflicts of rights, and as a society full of autonomous beings the result is a collection of people trying to fight for their personal rights against each other. If a right exists, there is a corresponding duty of respect for that right. Duties however can exist without corresponding rights. As Christians it may be better to consider society in terms

of duties. Our faith is founded on a man who never sought to assert his human rights but rather gave up everything, even the most basic human right to life. Instead He lived a life of responsibility and duty, to His Father and to fulfil His purposes on earth. Maybe as Christians we should let this sense of duty, rather than right, mould our responses to the HGP and its implications to our society.

7. Financing and resource allocation

A large amount of money is spent on the HGP. It could be suggested that this money would be put to better use solving other societal problems. It is humbling to draw back from the issues relating to our genetic discoveries and take a good look at the world as a whole. How much do the people of Afghanistan, living for years under the tyranny of the Taliban care about DNA and genetic predisposition? For them each day is a battle to survive, and life would be made considerably more bearable by having the basic necessities provided for. What significance do the ethics of reproductive technology have to the thousands living in shanty towns on the outskirts of Bombay? Of what help is research into a rare genetic disorder to those who die in Africa each year of Malaria and Diarrhoea?

In the West we have the privilege of having our basic needs met and material benefits beyond what we need. We have the time, money and inclination to explore the intricacies of our biological makeup, to delve the mysteries of human disease, and thus to consider how we might relieve our society of many ills. This is not a bad thing, but we would do well to step back and consider our responsibilities within the global community. Jesus came for the sick, the poor and the needy. He spent time with the lowest members of society and as Christians we are urged to do the same, we are encouraged to care for those that society doesn't. As Christians should we have a more 'radical' view of our Western privileges? Should we view the HGP with a doubtful eye, not because of the ethical implications that it produces, but because it embodies the arrogance of a people seeking to rid themselves of minor diseases before they would lift their brother out of a terrible situation they could prevent?

8. Philosophical Questions

God revealed through his creation

Genesis reveals a God who is actively and progressively involved in creation. Romans 1 v 20 declares,"... since the creation of the world God's invisible qualities - his eternal power and divine nature - have been clearly seen, being understood from what has been made, so that men are without excuse." As humans we are set into this creation with the unique ability to explore and understand it, to question the logic that governs it and our place within it; only *we* are set to turn on ourselves and wonder why we are here. The Bible clearly states that God is revealed through his creation, and therefore the exploration of our world should

lead us into ever greater understanding and awe of the creator. The HGP is a good thing if it causes people to marvel in this way.

However, the Bible also indicated that many are set to not realise this, in 2 Corinthians 4 v 4 "... the god of this age has blinded the minds of unbelievers ..." and in Psalm 14 v 1 "The fool says in his heart, 'There is no God'." As unbelievers delve further into the intricacies of creation and yet remain unmoved by God's revelation of himself through it, are they removing themselves further from him and rejecting the Spirit's work (Mark 3 v 29)? Does this continual rejection of revelation signify a hardening of their hearts (Psalm 95 v 8)? John Wyatt has described bioethics as a 'playground for philosophers'[9], which indeed it appears to be. The scientific exploration of our world has paved the way for many new discussions and theories about human life and meaning. The arguments put forward are very persuasive and knowledgeable, being the products of incredible intellectual minds. Christians can find it difficult to defend themselves and their beliefs against the onslaught of these theories, especially as they gain increasing prevalence and respect within society.

As Christians how can we defend ourselves against these philosophies? How can we equip others, both within and outside of the scientific community? How can we stand for truth in the eyes of a non-believing world and help those within society who may otherwise be take taken captive by these philosophies? Colossians 2 v 8 warns, "See to it that no-one takes you captive through hollow and deceptive philosophy, which depends on human tradition and the basic principles of this world rather than on Christ." We have a responsibility to understand these other theories and arguments and be able to give a reason for *our* hope in the face of them (1 Peter 3 v 15). Similarly we need to encourage one another in this, and especially in terms of teaching and equipping younger Christians who are entering this field of work and study.

Richard Dawkins and scientific reductionism

For a fuller discussion of science and religion, and particularly the arguments of Richard Dawkins, I refer the reader to some very useful articles by Mike Poole[13, 14, 15].

Scientific reductionism seeks to understand something at its most fundamental level. As a scientific method for research it involve reducing things to their component parts and is a useful, theologically benign technique. Dawkins describes himself as a 'hierarchical reductionist' who merely sets out to explain the complex entity at a particular level within the hierarchy of complex organisation[16]. However, as Michael Poole points out[15], this automatically leads Dawkins into ontological reductionism; since he believes that the natural world is all that there is it can only be explained in terms of its smallest components. Taken to its conclusion reductionism implies that, "... religion is just psychology,

psychology is basically biology, biology is the chemistry of large molecules, whose atoms obey the law of physics, which will ultimately account for everything!"[15]. Thus humans are reduced to mere atoms and DNA molecules and it is through these that we may understand our place in the world, our purpose and meaning.

The arguments put forth by Dawkins are very well known and respected within society, so that many may accept them without really questioning the validity of his claims. This is accentuated by the popular belief that science and religion are incompatible, that science has disproved God, that all serious scientists are atheists, a belief which is largely mistaken and yet propounded by the media's representation of such issues[14]. A recent Channel 4 series, 'Testing God', gave a clear and fair picture of many of the issues within the 'science and religion' debate with input from prominent professionals on each side. Yet its conclusion seemed to imply that though science hasn't disproved God, it has caused us (and the program focused predominantly on the Christian concept of God) to reassess our understanding of him. Somehow God was reduced to a creator who set the process in motion (with the big bang) and then stood back to let nature take its course. This assumption was made not in an attempt to reconcile the creation/evolution debate but rather to alleviate the age old problem of suffering for believers in a God of love and omnipotence; God's love was not questioned, rather the assertion of his power in our world.

Genetics enables us to understand our existence at the most basic level, and the big bang offers a scientific explanation for the beginning of the world. Put together these two scientific advances reduce humanity to atoms and chemicals, collections of particles which are here by chance - the product of years of evolutionary processes. These ideas, when taken as the only truth concerning our existence, are contradictory to the Christian concept of a personal God who created and is involved in His creation. This does not mean we should shy away from the scientific theories. As Christians we should be able to embrace all truth. If our faith is true, if it has reason and content, then although it may be shaken it will not fall. Rather, through testing, it may be proved to be stronger, more reasonable, and more contentious than ever.

9. Conclusion

The Human Genome Project is a brilliant advance in scientific knowledge and technology. The knowledge of how we biologically function should create a sense of awe at the mind that could create and hold together such a complex organism. We can understand disease processes as never before and this enables ever better methods for treatment and prevention of such ailments. However with knowledge comes responsibility, and the HGP entails an enormous responsibility because of the far reaching applications it may have within society. The HGP can play a twofold role in healing the sick and in promoting thought

among people about the big questions concerning human meaning and existence. It may also be capable of leading people into fundamentally wrong actions and philosophies. As Christians within this ever changing environment we have a duty to stand for truth and justice, to tend to the neediest within society and ultimately to proclaim the Good News of Jesus Christ. We may have to accept that we cannot impose our ethical stance upon a society that does not hold the same beliefs as we do. But this does not mean that we should withdraw from it. Rather we must be informed and thoughtful about these relevant issues, and ready to respond in love.

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All Bible quotes from the NIV.

Book Reviews

John Wilkinson
The Medical History of the Reformers: Luther, Calvin and Knox
Edinburgh: The Handsel Press, 2001. 119pp. pb. £9.95. ISBN 1-871828-60-0
Reviewed by Ruth Gouldbourne

It is all too easy to think of those who are heroes of the faith as being mainly or entirely minds and spirits, and to forget that they are and were people with bodies like the rest of us. In this study, Wilkinson helps to redress that unbalanced assumption. Using autobiographical material from letters and extracts of writing, and putting that together with his diagnostic techniques, he conducts a thorough examination of his three "patients", and presents us with a fascinating and compelling account of the various - quite normal - illnesses from which they suffered. He even comes to conclusions about the causes of their deaths. All of these men seem to have suffered from kidney stones and constipation, from gout and insomnia. Bronchitis, pneumonia and cardiac disease are also among the conditions described.

The medical detective work is fascinating - a type of jigsaw history, in which a skilled researcher is able to take small and apparently meaningless comments or throw-away lines in people's writings, and build up a picture which gives us a convincing representation of the physical experience of these men.

Wilkinson also engages with some of those who have attempted to write biographies of these reformation leaders - and is not unwilling to point out the places where unwarranted assumptions about the physical, mental or emotional state of the subjects have been drawn. As he shows, some of the critical or hostile conclusions that some have drawn about these men are based on a misunderstanding or a lack of knowledge about their physical conditions, and on medical knowledge and speech of the time.

Each essay was originally published individually, and although they have been rewritten to be put together in this book, there are places where the joins show and unnecessary repetition of facts or conclusions are evident. It would also have been helpful of the writer had included a glossary, or some description of the maladies he is describing for those readers, like me, who have little or no knowledge of the meaning of complaints like kidney stones or bronchitis. The book by no means assumes a significant medical knowledge, but the assumption of even less would have been helpful.

The book does not assume any historical knowledge beyond the fact that these three men lived and were part of the Reformation. By putting them in a historical context, we are better able to understand the import of the medical conclusions

that are drawn. There is little attempt to draw links between the medical conditions and the theology which each produced, and while such reticence may well be advisable, especially in the light of some of the weirder conclusions which have in the past been drawn, it would have been interesting if, for example, in a short concluding chapter, some consideration might have been given to such reflections. Wilkinson does however clearly demonstrate the importance of the living faith which each man had, the devotion with which each served, and the challenge which each therefore offers.

This is a very readable study about a fascinating topic, and one which reminds us that the people whose thoughts and theology we treasure were clay pots like the rest of us.

Ruth Gouldbourne is Tutor in Church History and Doctrine at Bristol Baptist College.

Stephen Hodge
The Dead Sea Scrolls
London: Paitkus Books, 2001, 234 pp, hb, £16.99. ISBN 0-7499-2165-X
Reviewed by Ernest Lucas

Since the fiftieth anniversary of the discovery of the Dead Sea Scrolls in 1997 there has been a spate of publications about them, much of it at quite a technical level. This is a book aimed at the general public and intended to give a general overview of the field of Dead Sea Scroll studies or 'Qumranology'. The author is a specialist in comparative religion but says that he has followed the story of the scrolls with keen interest. He rightly says that many of the books on the subject are written to support one particular theory or another. Since he has no personal stake as a scholar in the field he feels that he can provide a balanced presentation of the different views in the current debate.

The book is in four parts. The first tells the story of the discovery of the scrolls and the sorry story of the process of editing and publishing them. Hodge rightly explodes the 'conspiracy' theories which grew up around the lengthy delays in publication, explaining how they were the result of incompetent organisation and the scholarly possessiveness about new discoveries and their publication that arises from the desire to gain maximum 'kudos' from it.

Part II provides a clear and readable survey of the history of the Jews from the time of the exile in Babylon (586 BCE) to the Bar-Kokhba revolt (135 CE). This provides the historical background needed to understand the debate about the scrolls and community at Qumran.

The third part of the book explains the methods used in the attempts to date the scrolls and then goes on to discuss the contents of the scrolls collection in some

detail. In this section the reader begins to become aware of some of the areas of disagreement and debate among Qumranologists. This leads into Part IV, which surveys the scholarly debate about 'Who wrote the scrolls?'. Hodge discusses answers, ranging from the majority consensus view that they were written by a group of Essenes who had withdrawn from mainstream Jewish society to live in the desert at Qumran while awaiting the Messiah, to the bizarre view of Dr. Barbara Thiering that John the Baptist is the 'Teacher of Righteousness' spoken of in the scrolls and Jesus of Nazareth the 'Wicked Priest' who persecuted him! On the whole the different theories are presented fairly, with some judicious comments about their strengths and weaknesses. Hodge seems a bit too impressed by Dr. Norman Golb's argument that the buildings at Qumran were a fortified military post and so could not be the home of a religious group. Golb did not carry out any comparison with other fortified sites of that era. Those who have done so argue that Qumran rates as a 'fortified farm' rather than a 'military post'. There is nothing odd about religious settlement having the nature of a fortified farm given its isolated position.

The weakest part of the book is the final chapter. Here Hodge seems to be straining to find points of similarity between the Qumran community and the early Jewish Christians, despite the possibility that many of these may simply result from both groups sharing a common Jewish heritage. To be fair, he does note significant differences also. He gives too much credence to the very sceptical outlook of the 'Jesus seminar' scholars with regard to the reliability of the Gospel records of Jesus' sayings. They do not represent the mainstream of New Testament scholarship on the subject. He is right to stress the value of the scrolls in improving our understanding of Judaism in the time of Jesus.

There are a handful of 'typos', which for some reason concentrate on page 27.

Overall, this book can be recommended as a good, readable survey of the current state of knowledge and debate about the Dead Sea Scrolls and the Qumran community which does not presuppose any prior knowledge of the subject.

Ernest Lucas is Vice-Principal and Tutor in Biblical Studies, Bristol Baptist College.

Patrick Johnstone and Jason Mandryk
Operation World
Paternoster Press, 2001, 820 pp., pb, £12.99. ISBN 1-85078-357-8
Reviewed by A.B. Robins (Editor)

This book was received for review in early September 2001, shortly after the shattering events in New York and Washington. It was understandable therefore that I turned to Afghanistan to read about this particular country. I found very revealing information there, much of which has since become more public

knowledge, but I was grateful to be well-primed before this. Every country in the world is to be found in these pages, with information on history, geography, demography, religion, and all to be used for guidance in prayer. To that end, future needs are spelled out, not least in the challenges which are faced by Christians there. The book contains many lists - world leaders, web-site addresses, etc. There is also a CD-ROM available.

My only reservation is in the list of Mission Agencies, which seems somewhat selective. I realise that the ethos of the operation is evangelical, but as an Anglican I was disappointed to find that CMS and SAMS were mentioned, but no reference to USPG, now 300 years in the mission field. Moreover, where is the Methodist church mentioned? Is mission limited to evangelicals? I think not.

Cumulative Index Part 3

The first part of this index was published in Bulletin 27 (April 2000) and covers volumes 1 to 43 (1866 to 19121); Part 2 (Bulletin 28) volumes 44 to 70 (1912 to 1938); Part 3 which follows (now much fuller than the previous indices) covers volumes 71 to 100 (1939 to 1973).

Abbreviations

Asterisk (*) - the first page of an article; **c** - correspondence; **d** - contribution to a discusssion; **f** - and pages following (used sparingly; **frw** indicates that a further review by the same writer in the pages ahead); **n** - note; **ob** - obituary; **r** - review; **rw** - writer of a review.

Volume numbers are in **bold type**. In volumes 95 to 98 the paging in each separate issue starts again at page 1. In these volumes the issue numbers are indicated by parentheses. Thus **95** (2) 16 indicates page 16 of volume 95 part 2. Where a paper is followed by discussion and the discussion does not immediately follow after the paper, the page at which it starts is given by the number which immediately follows. Thus **85** 35* 107d indicates that the article referred to starts on page 35 of volume 85 and that the discussion starts on page 107 with other matter intervening. If the discussion is in the following volume this is stated.

To save space titles of papers and headings are indexed under key words and (with a few exceptions) not given in full.

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