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Evangelical Perspectives on Science and the Christian Faith

In this issue . . .

"The fear of the Lord is the beginning of Wisdom." Psalm 111:10

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Putting Things in Perspective

Explanations for scientific phenomena as well as historic events (recent and ancient) sometimes appear to be mutually exclusive. All too often we respond to the resulting confusion with attempts to reduce the problem to an oversimplified "either-or" choice: there are only two possible explanations and the one I accept is right while the other explanation must be wrong. The solution to such a problem sometimes comes through education. Often it turns out that both of the previous explanations are partly right and/or partly wrong. Sometimes we find that both were totally wrong and the truth is found in some new and unexpected direction.

In recent years there has been a growing awareness that some natural phenomena must be viewed from what appear to be mutually exclusive perspectives. The nature of light—whether viewed as waves or corpuscles—has become a classic example of differing perspectives on the basis of the experimental methodology involved. For the Christian it is especially important to consider the relationship of scientific and biblical explanations since our understanding of one source (science) sometimes seems to conflict with our understanding from the other source (Scripture). Often these apparent conflicts are the result of using the wrong source to answer our questions.

The purpose of ASA "is to explore any and every area relating Christian faith and science." In addition to an honest and zealous discussion of these relationships, we need to carry out our exploration in a consistently Christian manner. First and foremost, we are not to think more highly of ourselves than we ought, but to think with sober judgment (Romans 12:3), and most of us have trouble with such humility when we think we have some answers. I hope that in all sections of this journal, including 'Letters to the Editor,' we can discuss the great issues of life in such a humble and honest form. This issue of the *Journal* has several papers that should help us in our thinking about some of these weighty matters at both the theoretical/philosophical and the ethical/practical levels.

The first paper, by Robert Herrmann and John Templeton, reviews some of the major advances in genetic research in recent years. These mind-boggling discoveries are discussed within the framework of the increasing interest in the philosophical and religious questions posed by modern science. The elaboration of the structure of the DNA molecule by Watson and Crick has increased our understanding of heredity. The intricacies of these body processes should be further cause for reflection on the marvels of God's creation.

The next two papers discuss some of the far-reaching implications of the proposition that biblical exegesis and scientific investigation are complementary approaches to truth. John Cramer evaluates what he considers to be the strong points and weak points of

Donald MacKay's concepts of the compatibility of science and Christianity. He discusses "science," "scientism," and "Christianity" in the light of various interpretations of "complementarity." Howard Van Till concludes that science and Scripture are "categorically complementary" and, therefore, neither contradictory nor concordant. He outlines a "creationomic perspective" as the means of properly integrating science and scripture. Both of these papers should help us in our thinking about problems for which we are often given simple "either-or" choices.

Many of our current problems would be considerably simplified by a careful study of history. The development of modern science has been related to the Protestant Reformation by many historians of science. Nevertheless, the relative roles of theology and sociology, of Calvin and "Calvinists," are frequently obscure or are misconstrued. Sara Miles gives us a helpful analysis of how the theology of John Calvin provided "the rationale for, and the methodologies of, the study of nature characteristic of the scientific revolution."

The above-mentioned papers explore areas relating science and Christian faith. In some points these authors do not agree with one another or with other writers and scholars on these subjects. There are certainly readers of the *Journal*, including fellow evangelical Christians, who will take exception to parts or all of the positions taken. In the search for truth, especially eternal truths, by mere mortal human beings, this is to be expected. When "we see through a glass darkly," none of us is going to see perfectly. However, in our discussions—orally or in writing—we are to be controlled by basic biblical principles: we are "to speak evil (or slander) of no one," we are to "avoid quarreling," to be "gentle," "peaceable," "considerate," and "to show perfect courtesy to all men" (Titus 3). Not the least of all the guidelines for our words and actions is in Exodus 20:6—commonly known as the ninth commandment—where we are told not to give "false testimony against our neighbor." This means, in part, that the position of those with whom we disagree must be honestly represented.

The paper by Gareth Jones, "The View from a Censored Corner," is the saddest paper I have accepted during my short term as editor of the *Journal*. My first contact with *Brave New People* was through some of the strongly negative reviews which he quotes in his paper. When I was finally able to locate and borrow a copy—I felt like I was acquiring some underground bit of pornography or treason!—I was shocked to realize that most of these reviews had seriously distorted Gareth Jones' position. First, the book is a presentation of a series of important ethical issues associated with biomedical technology; it is not a book about abortion. Second, Dr. Jones is positively against the overwhelming majority of abortions, although he does accept certain types of therapeutic abortions under a few extreme conditions—a tiny fraction of the horrendous number of the unborn who are terminated for selfish convenience, usually associated with violation of the seventh commandment, that against adultery. To castigate Dr. Jones as "pro-abortionist," or to question his evangelical commitment on the basis of the content of *Brave New People* is simply not warranted. Such unfounded assaults upon the author and his work are open to the serious charge of "slander" and "false witness" and are a far cry from the "gentleness" and "perfect courtesy to all men" recommended to us by Paul, let alone from courtesy to a Christian brother.

I personally am not defending all of Dr. Jones' views on bio-medical ethics, and I am not, as I am sure he is not, suggesting that his views are the only views to be held by Christians or the ASA. He was presenting a whole series of difficult moral and ethical dilemmas, most of which his critics ignored in their efforts to castigate him for what they considered to be a weak statement on abortion. At least some of these critics seem to elevate 100% opposition to all abortion as the most important mark of the Christian. When we need to join together to express our dismay over birth control by abortion why do we have to vent such unchristian anger over one small area of disagreement? Even if all therapeutic abortions are wrong, the other abortions are clearly far worse.

For any of our readers who might be disturbed by Professor Jones' paper and its publication in the *Journal*, I would suggest two projects. First, get a copy of *Brave New People* and read it all the way through. As I read the book—after reading the reviews—I had the impression that some of the critics had never read the book. Allegations based on quotes out of context and incomplete information is false witness! Second, after having read the book and finding areas of disagreement, read some of the biblical recommendations, such as Titus 3, Romans 12, II Timothy 2, and other passages that remind us of the words of our Lord that, "All men will know you are my disciples if you love one another." Even if you consider that Gareth Jones has suggested serious error in some points, much of the language used against our brother failed to demonstrate that the writers were followers of Him who not only commanded us to love one another but to love our enemies.

As evangelical Christians we need to be making a biblical analysis of the many areas of biomedical research that have serious ethical implications. In the early stages of that analysis there will certainly be serious disagreements; the human race has never han-

dled such powerful, manipulative knowledge before. However, we need to learn to disagree in a reasonable, gentle, Christian way. Whether we disagree on some facets of abortion or the time and nature of creation or if and when there will be a millenium, we need to be honest, to avoid misleading quotes, and to be willing to recognize that only the infinite, holy God of the universe understands all of these difficult problems. Most importantly, while we search for and defend truth, we must speak and write in accordance with all of the godly principles of the Word of God.

WLB

"You, my brothers, were called to be free. But do not use your freedom to indulge the sinful nature; rather serve one another in love. The entire law is summed up in a single command: 'Love your neighbor as yourself.' If you keep on biting and devouring each other, watch out or you will be destroyed by each other."

Galatians 5:13-15

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The Vast Unseen and the Genetic Revolution

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A contemporary tension exists among scientists, born out of the growing complexity of scientific explanation and the resurgence of philosophical and religious questions. It is proposed that the tension arises because of a too narrow view of truth. Even where the data seems to lend itself most readily to a deterministic view, as in molecular genetics, the system can be seen to be fraught with spectacular beauty and to be characterized by ever-increasing complexity. When seen properly as the handiwork of the Creator, as it was by renowned scientists of the early days of science, it opens to us the vast unseen of His creation.

On Seeing The Unseen

God has woven a marvelous tapestry for the eyes of his creatures to behold. But there is a sense in which we have lost a certain level of perception, a dimension of seeing, a sense of a Presence in the providential design of all that is. Michael Shallis of Oxford University notes this in a recent paper entitled "The Point of Cosmology" where he speaks of

> . . . a change in perception occurring in the late Middle Ages. The allegorical world view was turning from a representation of man's relationship with the Creator and the cosmos to being a veil, masking reality. The real nature of things was seeming to become more material and less symbolic. Man's vision was being diverted from where the material signposts were pointing to an increasing desire to understand the real nature of the signposts.[1]

Yet the curious result for many who chose this focus for the search was the conclusion that there was nothing there! Nobel laureate physicist Steven Weinberg says, for example, "the more the Universe seems comprehensible, the more it also seems pointless."[2]

It would seem appropriate to ask what it takes to see the hand of the Creator—writing large—in everything, regardless of its degree of comprehensibility? Does it demand the eyes of faith, or is it there for anyone to see who will just *allow* the opportunity for reflection? C.S. Lewis argues in *The Abolition of Man* that our narrow approach to scientific truth threatens the very existence of mankind. He calls for a "regenerate science", with the following character:

> When it explained it would not explain away. When it spoke of the parts it would remember the whole . . . . Its followers would not be free with the words *only* and *merely*. In a word, it would conquer nature without being at the same time conquered by her and buy knowledge at a lower cost than that of life.[3]

The implication of these remarks is that the scientist is faced with a choice. He may maintain a narrow, reductionist view of his science, with the risk of depersonalization, or he may broaden his view to allow for an occasional enriching glimpse of the artistic, the poetic, the religious, as he surveys the implications of his data.

The difficulty of the choice is well presented by Alan Lightman in a *Science 82* article entitled "To The Dizzy Edge".

Most scientists will tell you there is a clear line between science and philosophy, between those questions that are answerable by logic and experiment and those that must forever float in the nethers of epistemology. Such is the heritage of Bacon and Galileo. Following this comfortable approach, *many of our finest biologists, chemists, and physicists have nestled into numbers for the duration.* And it's not surprising. In this strange and deep universe, humankind has an urgent *desire to know some few things with certainty.* But the philosophers will not leave us our scattered harbors. Listen to the persuasive words of Bertrand Russell, philosopher and master logician: 'The observer, when he seems to himself to be observing a stone, is really, if physics is to be believed, observing the effects of the stone upon himself.' What can we know, if not the world as it appears? And adding to our anxieties, modern science, through no fault of its own, repeatedly brings itself all the way to the dizzy edge of philosophy.

In the last few decades, science has plunged headlong after many other long-standing philosophical problems. An old debate is the question of free will versus determinism in human actions. The Heisenberg uncertainty principle in physics, stating that the trajectories of individual particles cannot be predicted precisely, has provided welcome ammunition to the free willists, while the studies of genes, DNA, and the newborn field of sociobiology surely put glee in the hearts of the determinists. And then there's the ancient controversy about whether mind is distinct from matter. I imagine the "mind-body problem" has had to take stock of recent developments in neurobiology, especially the results indicating that specific mental activities like language and emotions may be localized to specific halves of the brain. Science has not really answered any of these questions but continues to sharpen the focus.

And, no matter how far it progresses, science generates more questions than it answers. Questions that disturb. Perhaps there is in science an inevitable incompleteness, analogous to that in mathematics proved by Kurt Godel. Before Godel's proof, it was widely believed that each branch of mathematics, given sufficient axioms or rules of the game, was self-contained. In 1931 Godel rigorously demonstrated that arithmetic contains true theorems that cannot be derived from the rules of arithmetic. In a similar manner I believe there may be meaningful questions about physical reality, the territory of science, whose study is intrinsically beyond the reach of any equations or experiments.

In all these mysteries we see ourselves. Would we be so intrigued if we did not ponder why as well as how, if we did not have our Dali's and Sartre's as well as our Madame Curie's? This is surely a miracle, like the fragile balance of nuclear forces and the just-right release of the cosmic pendulum.[4]

And so, we plead with those who have "nestled into numbers for the duration" to look beyond the numbers to see the object, the process, the model, the phenomenon as part of a larger, more marvelous and mysterious whole. Albert Einstein, perhaps the greatest scientist who ever lived, was forever fond of contrasting his mathematics with his aesthetic view of reality. Timothy Ferris quotes him in an October *Science 83* article, "I want to know how God created this world. I want to know his thoughts, the rest are details." Ferris goes on to say:

Einstein saw God as dressed in questions more than answers—'What really interests me', he told his assistant Ernst Straus, 'is whether God had any choice in the creation of the world'—and his personality was imbued with a deep sense of the mysterious. 'The most beautiful experience we can have is the mysterious,' he said. 'It is the fundamental emotion that stands at the cradle of true art and true science. Whoever does not know it is as good as dead, and his eyes are dimmed.'[5]

We plead with those who have "nestled into numbers for the duration" to look beyond the numbers to see the object, the process, the model, the phenomenon as part of a larger, more marvelous and mysterious whole.

Similarly, K.C. Cole writes in an article entitled "The Scientific Aesthetic,"

Artists approach nature with feeling; scientists rely on logic. Art elicits emotion; science makes sense. Artists are supposed to care; scientists are supposed to think.

At least one physicist I know rejects this distinction out of hand: 'What a strange misconception has been taught to people,' he says. 'They have been taught that one cannot be disciplined enough to discover the truth unless one is indifferent to it. Actually, there is no point in looking for the truth unless what it is makes a difference.'

The history of science bears him out. Darwin, while sorting out the clues he had gathered in the Galapagos Islands that eventually led to his theory of evolution, was hardly detached. 'I am like a gambler and love a wild experiment,' he wrote. 'I am horribly afraid'. 'I trust to a sort of instinct and God knows can seldom give any reason for my remarks. All nature is perverse and will not do as I wish it. I wish I had my old barnacles to work at, and nothing new.' The scientists who took various sides in the early days of the quantum debate were scarcely less passionate. Einstein said that if classical notions of cause and effect had to be renounced, he would rather be a cobbler or even work in a gambling casino than be a physicist. Neils Bohr called Einstein's attitude appalling, and accused him of high treason. Another major physicist, Erwin Schroedinger, said, 'If one has to stick to this damned quantum jumping, then I regret having ever been involved in this thing.' On a more positive note, Einstein spoke about the universe as a 'great, eternal riddle' that 'beckoned like a liberation.' As the late Harvard professor George Sarton wrote in the preface to his *History of Science*. 'There are blood and tears in geometry as well as in art.'[6]

Cole's physicist friend is surely on the right track. *What truth is makes a difference!* There neither is nor should be a prohibition of the subjective, the poetic or the religious in the scientist's quest for truth. Perhaps Nobel Laureate Richard Feynman says it best in a poem quoted by K.C. Cole.

> Poets say science takes away from the beauty of the stars—mere globs of gas atoms. Nothing is 'mere.' I too can see the stars on a desert night, and feel them. But do I see less or more? The vastness of the heavens stretches my imagination—stuck on this carrousel, my little eye can catch one-million-year-old light . . . . For far more marvelous is the truth than any artists of the past imagined! Why do the poets of the present not speak of it? What men are poets who can speak of Jupiter if he were like a man, but if he is an immense spinning sphere of methane and ammonia must be silent?[7]

And what of religion? How have we come to the point where science and theology seem so utterly divorced from each other? One of us spoke to this question in a Yale Medical School address some years ago.

> Paul Tillich once referred to this age (our culture) as 'the land of broken symbols'. That break is at least partly science derived, based upon the assumption that objective scientific study would produce a complete description of all of reality and preclude any other source of truth as out-moded and irrelevant. So, the little boy would say, 'Science is material and religion is immaterial.' And so, scientists and theologians have gone their separate ways.
>
> It was a sad parting, I feel, because each discipline had done so much for the other. It is no mistake that science came out of a Christian culture, for example. For the biblical perspective of an utterly trustworthy Creator whose universe was ordered and rational was essential to the scientists' expectation of meaningful experimentation. As Einstein later wrote, 'God who creates and is nature, is very difficult to understand but He is not arbitrary or malicious.' Then, too, to be a scientist was an honorable and worthy occupation, in contrast to the pagan idea of science: Prometheus stealing fire from the gods, who were jealous of mortal man's possession of their knowledge. Biblically, man is presented as a creature of God and his work, as part of the Divine unfolding, to have dominion over the earth, always with the proviso to love God and neighbor. So the scientist is no unwelcome interloper but a servant-son in his Father's creation. As Oxford's Charles Coulson once said, the practice of science is to be seen as a fit activity for a Sabbath afternoon.
>
> Science, in return, has given the theologian a real world. As Walter Thorson has expressed it, 'medieval society and medieval thought were . . . centered on a fundamentally religious conceptual framework with a *papier-mâché* sort of physical universe which had no more meaning than a kind of 'stage prop' on which the drama of salvation was enacted.' By comparison, science 'took the secular world and the secular calling more seriously. Instead of a *papier-mâché* universe, God had made a real one, and the basic inspiration for the scientific revolution was a passionate belief that, in exploring and knowing what God had given us men in creation, we would find a larger framework in which our grasp of our role and destiny—could grow and develop further.'
>
> The challenge came in the words of Francis Bacon, 'if . . . there be any humility towards the Creator, if there be any reverence for or disposition to magnify His works, if there be any charity for man . . . we should approach with humility and veneration to unroll the volume of Creation.' Science thus came as an outgrowth of religious concern, not as a competitor but rather as a complementary activity, to enlarge our view of God's Creation.[8]

And what of the study of genes, DNA and sociobiology? Do they, as Lightman suggests, really support an impersonal deterministic philosophy? We think not. For here again, it would seem, God is weaving a tapestry of great richness, beauty and intricacy. And it seems an ever-growing, dynamic phenomenon, this structure of truth, this "volume of Creation".

What men are poets who can speak of Jupiter if he were like a man, but if he is an immense spinning sphere of methane and ammonia must be silent?

The Genetic Revolution

The explosive increase in our knowledge of the gene began in a very quiet little garden in an Austrian monastery in the City of Brunn in the year 1865. The experimentor was Gregor Mendel, a monk, and his ten years of work, presented at the Natural History Society of Brunn, was scarcely noticed. But what Mendel discovered was truly earthshaking—that characteristics

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in his pea plants such as seed color or shape, and pod color or shape, were inherited as separate entities and were expressed in either of two ways which he designated "dominant" and "recessive."

Dominance was observed in the first genetic cross. If, for example, plants with smooth seeds were crossed with plants having wrinkled seeds, then the first or "F_1" generation displayed only one of the two seed shapes, that of the smooth or "dominant" character. Crossing hybrid plants led to a surprising result, the re-appearance of the "missing" or recessive characteristic—unchanged—in one quarter of the progeny. Mendel's conclusion, that there existed a fundamental unit of heredity, was expressed in his now famous paper as follows:

> The constant characters that appear in the group of plants may be obtained in all the associations that are possible according to the mathematical laws of combination. Those characters which are transmitted visibly, and therefore constitute the characters of the hybrid, are termed the dominant, and those that become latent in the process are termed recessive. The expression 'recessive' has been chosen because such characters withdraw or disappear entirely in the hybrids, but nevertheless reappear unchanged in their progeny in predictable proportions, without any essential alterations. Transitional forms were not observed in any experiment.[9]

But an appreciation of Mendel's discoveries did not come about until 1903, when a visual basis for inheritance came about with the discovery of chromosomes as structures with properties which exactly corresponded with Mendel's units of inheritance. Chromosomes could be observed prior to cell division to be divided longitudinally into two copies, and each copy to be subsequently pulled toward opposite poles of the cell. In this way each daughter cell received one copy of each chromosome—a complete set of genetic instructions.

The non-protein components of genetic material had been the subject of a study, carried out by Friedrich Miescher in Basel, in the same time period as Mendel. Miescher had studied the nuclear material from two very different sources, the sperm of the Rhine salmon and pus cells from bandages from the local hospital. Both contained a substance he called "nuclein", which many years later was shown to be DNA. He also described another component of the salmon sperm, a very basic protein called protamine. Protamine had the usual structure of a protein molecule, a long series of amino acids linked to each other in so-called peptide linkage, but there was a preponderance of basic amino acids—arginine, lysine and histidine.

These, then, were understood as the fundamental components of the chromosome—a variety of basic proteins called protamines and histones and some less well characterized organic phosphorus compounds.

It is amusing to speculate on the kind of reaction Gregor Mendel might have displayed if he were suddenly thrust into our era and given a molecular biological explanation for his genetic experiments.

The genetic aspect was generally assumed to reside in the protein components, but in 1944 O.T. Avery and his collaborators, at what was then the Rockefeller Institute, demonstrated that a strain of the pneumonia-causing bacterium, *Pneumococcus*, could be transformed from a non-virulent to a virulent type by a non-protein component of chromosome-like material obtained from the virulent type. This substance was the highly-polymerized phosphorus-containing compound deoxyribonucleic acid (DNA). Avery's description of the isolation of this curious substance, which had somehow never been suspected of being present in *Pneumococcus*, reads as follows:

> When alcohol reaches a concentration of about 9/10 volume there

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> separates out a fibrous substance which on stirring the mixture wraps itself about the glass rod like thread on a spool and the other impurities stay behind as a granular precipitate. The fibrous material is redissolved and the process repeated several times. In short, this substance is highly reactive and on elementary analysis conforms very closely to the theoretical values of pure DNA (who could have guessed it). This type of nucleic acid has not to my knowledge been recognized in *Pneumococcus* before, although it has been found in other bacteria.[10]

His conclusion on the induction of virulence, which is accompanied by the appearance of a new cell surface polysaccharide, is also interesting.

> The inducing substance, on the basis of its chemical and physical properties, appears to be a highly polymerized and viscous form of DNA. On the other hand, the type III capsular substance, the synthesis of which is evoked by this transforming agent, consists chiefly of a nonnitrogenous polysaccharide . . . . Thus it is evident that the inducing substance and the substance produced in turn are chemically distinct and biologically specific in their action and that both are requisite in determining the type specificity of the cells of which they form a part.[11]

The unique character of DNA as the conveyer of hereditary information was finally and unequivocally established in 1953 with the publication of the Watson–Crick model for DNA. The structure of DNA at once suggested its hereditary role—two helical chains in which nitrogenous bases attached to the sugar-phosphate backbone of each chain were bonded to each other by weak, so-called hydrogen bonds. The bases were of four kinds called adenine (A), guanine (G), cytosine (C), and thymine (T), and bonding was specific. Each time an A appeared in one chain, a T was found opposite it. Likewise, each time a G occurred in one chain, a C was on the other. This system of complementary base-pair formation—A always opposite T and G opposite C, immediately suggested the basis of a hereditary mechanism. If the chains of nucleotides—as bases attached to their sugar-phosphates are called—were separated and a new copy of each fashioned according to the base-pairing rules, the original molecule would be exactly reproduced. Presumably, too, the sequence of bases in the polymer was the information content of the molecule. Studies of mutation in which a single base was changed showed that the exact linear sequence was essential for proper functioning of the gene.

The story of how Watson and Crick arrived at the structure of DNA reads more like a spy thriller than a journal article.[12] In one of the great ironies of scientific research, the principal contributors of the data—Rosalind Franklin and Maurice Wilkins, the crystallographers whose data revealed the double helix, and Erwin Chargaff, the organic chemist who discovered the equality of A and T and of G and C—were bypassed, essentially by their own choice. They simply did not take the biochemist James Watson and his physicist friend Francis Crick—a kind of scientific "odd couple"—seriously. Indeed, Chargaff has become an outspoken critic of the entire genetic enterprise, pointing to the way in which its practitioners have sought to explain away the mystery of nature. He writes in his autobiography, *Heraclitean Fire,*

> If it is the real purpose of science to teach us true things about nature, to reveal to us the reality of the world, the consequences of such teaching ought to be increased wisdom, a greater love of nature, and, in a few, a heightened admiration of divine power. By confronting us directly with something incommensurably greater than ourselves, science should serve to push back the confines of the misery of human existence. These are the effects it may have had on men like Kepler or Pascal. But science, owing to the operation of forces that nobody, I believe, can disentangle, has not persisted in this direction. From an undertaking designed to understand nature, it has changed into one attempting to explain, and then to improve on, nature.[13]

Chargaff's conclusion, while somewhat embittered (he says of himself that he was born with a stone in his shoe), is a sobering one. It would seem that molecular genetics fits the mold of that unregenerate science which C.S. Lewis has described. Wondrous discovery seems always tainted by a certain arrogance.

But once DNA's role in heredity had been established, another question loomed large. If DNA is the genetic material, then its role must be to direct the synthesis of all the cell's proteins. Yet protein synthesis was known to occur in the cell's cytoplasm, while DNA was restricted to the cell nucleus. How then did DNA transmit its instructions?

The answer to this question was first formulated by Francois Jacob and Jacques Monod, two French biochemists working at the Pasteur Institute. They were studying a fascinating bacterial phenomenon called induction, in which a new degradative enzyme was produced by growing cells when a substance was introduced into the culture medium which could be broken down and utilized for growth under the agency of that degradative enzyme. Furthermore, the process was reversible. On removal of the substance serving as a food source, the degradative enzyme quickly disappeared from the bacterial cells. Perhaps the most interesting aspect was that the induction process was under genetic control. The gene which produced the degradative enzyme was regulated by a second, closely linked gene. The French biochemists hypothesized that the gene producing the degradative enzyme was copied to form an intermediate template which was unstable, being constantly broken down and resynthesized. This molecule was proposed to be made up of ribonucleic acid (RNA), a close relative of DNA, which had been found in high concentration at the site of protein synthesis in growing bacteria.

Subsequently it was shown in several laboratories that DNA was actually copied into a polymer called messenger RNA (mRNA), again by complimentary base-pairing to ensure a faithful copy, by an enzyme system called RNA polymerase. Enzymes called DNA polymerases had previously been described which were responsible for copying DNA, and they used so-called deoxynucleoside triphosphates, activated forms of the A, T, G, and C bases attached to the sugar unique to DNA, 2-deoxyribose. The RNA polymerase used a similar set of precursor molecules, A, U (uracil), G, and C, but this time the sugar was ribose instead of deoxyribose. Verification that this mRNA molecule was the "transcript" of the genetic material was obtained by demonstrating its movement from the site of synthesis in the nucleus to the protein-synthetic machinery in the cytoplasm. This machinery consisted of a complex structure called a polysome, made up of a series of so-called ribosomes attached to the long mRNA molecule, rather like pearls on a necklace.

The future of genetic research, its application in medicine, agriculture and industry, for the benefit of mankind, is tremendously promising.

It had also been shown that there was a direct linear relationship between the DNA sequence of a given gene and the amino acid sequence of the protein for which that gene coded. How, then, was the mRNA sequence in the cytoplasm translated into the sequence of its protein product? The answer was that there needed to be adapter molecules which could "read" the sequence of bases in the mRNA and then introduce the correct amino acid into the protein chain at each point. It was found that this function was performed by another type of RNA molecule called transfer RNA (tRNA). This molecule was essentially two-headed, as might be expected for an adapter; one end carried the specific amino acid and the other a series of bases which served as a recognition point for a particular three-base sequence in the mRNA. Each tRNA had its unique "anticodon" recognition site, unique to the amino acid it carried. So, for example, the mRNA sequence CCC dictates the binding of a tRNA with the anticodon GGG which carries at its other end the amino acid proline. Every time CCC appears in the mRNA sequence, a proline-tRNA will bind by base-pairing of its GGG anticodon to the mRNA codon CCC and its proline will be introduced into the protein chain. In the total code word dictionary there are sixty-one combinations of three bases which code for a specific amino acid and three others which signal the termination of protein chains. Almost all the amino acids have more than one code word, hence more than one tRNA carrying that amino acid. This "degeneracy", as it is called, presumably allows for some mutations to occur without leading to errors in the sequence of amino acids in the protein. The code has been shown to be universal. All species of organisms use the same code word dictionary.

The Future of Molecular Genetics

Here, then, in outline, is the state of our knowledge of molecular genetics. The future of genetic research, its application in medicine, agriculture and industry, for the benefit of mankind, is tremendously promising. Already our knowledge of the hereditary mechanism has opened up new avenues of investigation in understanding cellular differentiation, and the de-differentiation which goes on when tissues become cancerous. New insights into the production of the antibodies which protect us from invasive agents and tumor-forming cells are forthcoming.

One of the most powerful "tools of the trade" is gene splicing, a process whereby genes from different sources can be joined in new combinations for study of their interaction or for amplification of a given gene sequence. The key step in the process is the application of a unique group of enzymes called restriction endonucleases which cut the DNA double helix in a special way to yield what are called "sticky ends". Two different DNA molecules so treated can then be mixed and joined in new combinations never before possible. One such new possibility, which is really foundational for the whole process, is the subsequent joining of the DNA molecule(s) of interest with a special DNA structure called a plasmid. Plasmids are circular DNA molecules found in certain bacterial strains as a separate replicating element, like a miniature chromosome. When opened by treatment with restriction enzymes, they, too, form "sticky ends", and, after joining with the new DNA combination under study, can be reintroduced into the bacterium and allowed to reproduce. In this way, the new DNA sequence introduced into the plasmid may be replicated thousands of times, thereby providing large amounts of that particular gene for study. Genetic engineering applications include the treatment of genetic disease, the production of new plants for increased world food production and the design of new bacteria to break down industrial pollutants.

One of the most exciting opportunities provided by the new genetic techniques is the study of the numerous cellular proteins for which no known function

exists. The enormous resolving power of the gene splicing approach is brought to bear on these unknown substances by making use of the fundamental molecular relationship between the synthesis of DNA, RNA, and proteins which we have just reviewed. The process begins with the isolation of a new protein molecule which it is desired to study as to structure and cellular function. As in most cases, the amount of material available for study is miniscule, but there are, because of molecular genetics, some new tricks to play.

One approach is to determine a short part of the protein sequence of the new protein, perhaps a length of six amino acids at one end. This can be done with a few micrograms of the protein. Then a "gene" is synthesized in a DNA synthesizer with the proper sequence to code for the six amino acids—eighteen nucleotides in the sequence, each triplet the complementary sequence to the mRNA codon for that amino acid in the code word dictionary. This eighteen unit DNA sequence, radioactively labeled to allow for its subsequent identification, is then introduced into an extract of the total cellular RNA of the species from which the unknown protein had been obtained. In this extract are all the mRNAs of the cell, and the eighteen nucleotide long DNA fragment selects from the entire mixture the only *completely* complementary sequence, that of the mRNA coding for the unknown protein, and forms a stable DNA-RNA "hybrid" of the kind which forms transiently during the process of transcription. Since this is the only DNA-RNA hybrid in the extract, nuclear DNA having been excluded, the unique binding characteristic of double-stranded nucleic acids allows for a separation of this molecule from the rest of the cellular RNA.

Actually, the molecule as it emerges from the separation process is still mostly single-stranded mRNA, but with an eighteen nucleotide section at one end bound to the synthesized DNA fragment. This structure can now be converted to a completely double-stranded hybrid DNA-RNA molecule by means of another enzyme, found in certain viruses, called reverse transcriptase. This enzyme, as its name indicates, can take an RNA template and make a DNA-RNA hybrid, given the appropriate activated building blocks, the deoxynucleoside triphosphates. In this way the entire mRNA molecule is converted to a hybrid structure—in essence the mRNA has been re-converted to the form of one strand of *its original gene!* Now we can separate the two chains, and treat the DNA single strand with DNA polymerase to generate the double-stranded DNA, its form as a gene.

In the double-stranded form, DNA can now be spliced into a bacterial plasmid, as outlined earlier, and the plasmid placed in a bacterium and multiplied. After large-scale growth of the bacterium, the plasmid can be re-isolated, and the DNA, coding for the unknown protein, introduced into a protein synthetic system for the large-scale synthesis of the still unknown protein.

The tremendous resolving power of the molecular genetic system is now apparent. All that is needed in this case is a tiny fragment of information—a six amino acid sequence of a huge protein molecule—and we can synthesize the *entire* protein in large quantities for detailed studies of its structure and function.

A Genetic Pilgrimage into the Center of a Pea Plant

This, then, is the present state of our understanding of the molecular biology of the gene. It is amusing to speculate on the kind of reaction Gregor Mendel might have displayed if he were suddenly thrust into our era and given a molecular biological explanation for his genetic experiments. When he first observed the results of his pioneer experiments with smooth and wrinkled peas, he could never have dreamed of the drama that was acted out within the intricate structures of his little garden plants. The pollen grains which he took with a fine camel's hair brush from the stamens of one smooth-pea plant, when dusted on the stigma of a second wrinkled pea plant, actually introduced into the plant's reproductive apparatus a molecule of DNA. This molecule, it turns out, was totally responsible for Mendel's observation of invariable formation of hybrid plants which produced only smooth pea seeds.

The mechanism of this kind of inherited change constitutes one of the most fascinating processes ever elucidated in the natural sciences. As we follow the DNA molecule from its source in the pollen grain into the recipient plant's reproductive apparatus, the first step in the process involves an interaction with the tissues of the stigma and the swelling and germination of the pollen grain. A pollen tube then forms and penetrates the ovary at the base of the stigma. The sperm cell, carrying its DNA molecule, enters the embryo sac and fertilization occurs. Complex mechanisms ensure that only one pollen tube enters the ovule, regardless of the number of pollen grains which germinate.

Fertilization brings the sperm cell into close association with an egg cell in the embryo sac. The DNA molecule of the sperm cell and the corresponding DNA molecule of the egg cell are then brought together, and the result is a new cell with two copies of each gene of the pea plant, one gene copy from each of the two DNA molecules. Included in this genetic repertoire would, of course, be the gene sequence encoding the instructions

for smooth pea seed coats from the sperm and of wrinkled pea seed coats from the egg. How, then, do the results of this combination, the hybrid plants, finally yield only offspring with smooth seed coats? Mendel had talked about dominant and recessive factors in the expression of seed coat shape, but what was happening at the molecular level? The answer, stated simply, was that the gene sequence dictating smooth pea seed coat carried information for the conversion of all seed coat components into the variety producing smooth peas. But to do this, a vast panorama of events were first necessary. To begin with, the single fertilized egg must undergo a series of cell divisions, each time first duplicating its two DNA molecules and then segregating them into the daughter cells in such a way that a perfect copy of each of the original DNA molecules appears in each. The process of duplication of the DNA molecules, mediated by a DNA polymerase, is enormously complicated in higher organisms. The DNA of the pea plant, as in all higher organisms, is present in all its cells in the form of a complex DNA-protein structure called chromatin. The fundamental unit of the chromatin is a bead-like structure called a nucleosome which is composed of several kinds of histone proteins surrounded by several coils of the double-helical DNA. In its extended form, as, for example, during replication, the chromatin looks very much like a string of beads, the individual nucleosomes linked to each other by connecting segments of the continuous DNA double helix. At other times, the chromatin structure is more tightly folded into helical structures in which the subunit is made up of six tightly associated nucleosomes. In this form there are approximately 1000 lengths of DNA per unit length of chromatin.

Because the protein components provide stability and assistance in folding during formation of the chromosomal structures essential to cell division, it is equally essential that the integrity of chromatin be maintained during DNA duplication. The mechanical requirements of this process are staggering. To begin with, the DNA molecule in higher plants carries about 2 billion base pairs and has an overall length of about 60 cm. Given the fact that the average plant cell is microscopic in size, it is evident that the DNA molecule must be very highly folded and compacted. Yet, for copying to occur, this structure must be unfolded at least transiently, and also unwound, since the DNA is still in a double-helical form. The copying by DNA polymerase occurs at a rate of 1000 base pairs per minute, with as many as 10,000 polymerase molecules functioning at different points along the incredibly long DNA-protein structure. The complexity of this unfolding-untwisting process is awesome, given the highly compacted state of chromatin, the simultaneous copying at 10,000 points, and the high rate of movement of the polymerase molecules. One turn of the double-helical structure is duplicated each second, and the process is complete in three and one-half hours. A carnival night in midsummer is dull by comparison with this spectacle!

Then, in order for cell division to occur, the two newly formed duplex DNA molecules must be completely separated and then divided into the 14 chromosomal segments characteristic of the pea plant at cell division. This part of the process, because of its visibility in the light microscope, is more familiar to us. Yet, even here, the molecular events, involving the enormous compacting of the chromatin and the formation and movement of the mitotic spindle, which aligns and then separates the pairs of chromosomes, are staggering in their complexity. The chromosomes of the pea plant are formed from chromatin by a supercoiling process in which the already tightly wound nucleosomal arrays are wrapped back and forth in a process which may somewhat resemble the way you might make a narrow compress out of a roll of bandage. At this level, there are 10,000 lengths of DNA per unit length of chromosome! As for the other components involved in cell division, we are only now elucidating the structure of the contractile proteins of the spindle fibers and we have only the barest understanding of the microfilaments in the cell cytoplasm which they presumably work against to effect the movement of chromosomes and the formation of the new cell membranes of the daughter cells.

The analogy here might be to a giant steel fabrication plant in which massive wheels and conveyer belts cooperate to twist and turn, unwind and rewind, bend and stretch, open and close mile long sections of a fifty mile-long flexible steel bar to produce the half-mile long finished product!

Thus far we have followed our DNA molecule through one stage of division of the fertilized egg, and this process must be repeated many, many times to produce the mature seed in the pea pod. But what of the read-out of the DNA molecules' genetic information? How is the information of the DNA molecule of the sperm cell finally utilized to bring about the morphological change in the seed? For this to happen,

processes of transcription of the DNA into messenger RNA and then translation into protein must occur. The latter process has been well characterized over the past decade but the process of transcription is only now beginning to be described for higher organisms. It begins in the cell nucleus with the synthesis of an RNA transcript of the DNA. This molecule is a precursor of mRNA, and contains, in addition to the sequence of codons which will be used for protein assembly, a series of internal sequences which must be removed before the molecule leaves the nucleus. At present we have no hint as to the function of these internal sequences, or "introns", but they are present in most genes of the DNA of higher organisms. Our gene for the synthesis of the smooth seed coat will therefore first need to have its intron sequences removed and the coding sections spliced together in the precise order for the sequence of protein to be produced. The picture is one of a long RNA molecule being generated from the DNA template—with transient unwinding and separation of component nucleosomes in the chromatin matrix as with replication—and the sequential excision of intron sequences and re-splicing of adjacent coding sequences as the RNA bends and folds to bring each succeeding intron into the proper form for action. The analogy here might be to a giant steel fabrication plant in which massive wheels and conveyer belts cooperate to twist and turn, unwind and rewind, bend and stretch, open and close mile long sections of a fifty mile-long flexible steel bar to produce the half-mile long finished product!

But our pea seed coat mRNA is not ready yet! After transcription, a special enzyme introduces a long sequence of adenine nucleotides to form what is called a "polyA tail". We are not certain as to the function of this structure, though mRNA molecules with the polyA are somewhat more stable. At the same time, a second enzyme system works on the head-end of the mRNA molecule to add a short sequence called a "cap". The "cap" generally involves a G nucleotide and sometimes added methyl groups. In our pea seed coat mRNA molecule there would be a methyl group on the G nucleotide and another on the next base in the sequence.

At this point the completed mRNA is transported to the site of protein synthesis in the cytoplasm. Special proteins then combine with the mRNA, perhaps to enhance ribosome binding. Ribosomes then attach at appropriate points and tRNAs with their attached amino acids come into play as dictated by the mRNA sequence. The growing protein chain, as it elongates and extends from the polyribosomal structure, is channeled through the cell membrane surface so that modification of the seed coat components can occur "on location".

And so ends the journey of our gene for smooth pea seed coat; reproduced, transcribed and the transcript modified, translated and the protein product delivered to the seed. The total number of steps in all these processes exceeds many hundreds, and almost all have their origin in a specific gene as well. We have touched on only a few of the most important steps. We have not touched on the myriad of events involved in the process of embryogenesis, whereby that single fertilized egg differentiates into all the tissues of the plant. But there is little known of this process from a molecular standpoint at present.

Science in Historical Perspective

If and when we have completed our exploration of this vast complexity, will we be tempted to say that we have *explained* it? Does our mechanistic explanation really suffice? Certainly it did not suffice in the minds of many of the early scientists, who found in their work the opportunity to explore God's creation and that "larger framework" in which to grasp their role and destiny. Malcolm Dixon, world-renowned biochemist of King's College, Cambridge, spoke of the religious faith of some of these in an address at the meetings of the British Association.

> Robert Boyle, who . . . might as much as any man be called the founder of chemistry . . . also played an important part in the foundation of the Royal Society. He stated that he found few atheists among men of science. He wrote much on the relations between Christianity and science and learned Hebrew and Greek in order to study the Scriptures. He gave away a large part of his income for Church and missionary work, spent large sums on translations of the Bible, and by his will founded the Boyle lectures for the defence of Christianity against attacks.
>
> . . . Kepler, the great astronomer, . . . worked out the laws of motion of the planets which were employed by Sir Isaac Newton in his great work on gravitation. He believed that in discovering natural laws he was, as he put it, 'thinking God's thoughts after Him.'
>
> Newton himself was perhaps not quite orthodox, but he was a firm believer in God and in the Bible, and wrote a great deal on theology and on biblical interpretation. I need not remind you of the tremendous importance of his contributions to science: gravitation, the laws of motion, astronomy (especially of the solar system), the tides, optics, the telescope, spectroscopy, the nature of light, the differential calculus—these are only some of the subjects on which his work makes him the greatest British scientist of all time. One of his letters throws some light on the motives behind his work. Writing about his great work, the *Principia*, he says, 'When I wrote my Treatise about our system, I had an Eye upon such principles as might work with considering men for the Belief of a Deity and nothing can rejoice me more than to find it useful for that Purpose.'[14]

Dixon then goes on to extend the list of eminent physicists—Michael Faraday, Lord Kelvin, Sir George Stokes, Clerk Maxwell, Lord Rayleigh and J.J. Thomson, each of whom was a devout believer.

As to the faith of other groups of scientists, he goes on to say,

> At Cambridge in the first half of the 19th century there was little or no science; the credit for creating an interest in science there is due to two deeply religious men, Adam Sedgwick, Professor of Geology, and J.S. Henslow, Professor of Botany. Professor Coulson mentioned last year how Sedgwick preached to the miners at Newcastle. It was Henslow who got Darwin interested in science, and Darwin spoke of his deep religious sense. It seems that Darwin himself was a believer at the time when he did his great work on the origin of species. In that book he speaks of the laws impressed on matter by the Creator and of life having been originally breathed into a few forms or into one, and he prefixed to the book a quotation from Bacon, 'Let no man think . . . that a man can . . . be too well studied in the book of God's word, or in the book of God's works'. Later, however, he tells us rather sadly that he gave up his faith and subsequently even lost all appreciation of beauty in poetry, music and art. Alfred Russel Wallace, who independently arrived at the same conclusions as Darwin, and at the same time, was certainly an orthodox believer.

The list of religious men in the fields of biology and medicine also includes Lord Lister, Sir James Simpson, Edward Jenner, Louis Pasteur and Gregor Mendel. Dixon concludes:

. . . These men largely *made* the scientific method and yet were firm believers in Christianity, and they were not aware of any inconsistency.

The stock explanation advanced by those who believe that religion and science are irreconcilable is that they must have kept their religion and their science in watertight compartments in their minds. But there is not the slightest evidence for this, and as we have seen in many cases there is evidence that this was not so. It would be much truer to say that they approached their research in the spirit of the 'research worker's text', that text which Lord Rayleigh prefixed to his collected scientific papers and which is carved on the great door of the Cavendish Laboratory, 'The works of the Lord are great, sought out of all them that have pleasure therein.'[15]

Perhaps we will be tempted to say that our scientific forebears knew so much less than we. And, clearly, our knowledge of the gene has grown a thousand-fold beyond what Mendel could have even dreamed of! Yet, in all their magnificent complexity, present scientific descriptions seem to be only partial and tentative pictures of what we are studying. There is, in fact, a strong feeling that there may be another whole layer or level of detail behind every process we have examined, so that the aggregate may be another thousand-fold level of complexity yet to be explored!

As Lincoln Barnett says in *The Universe and Dr. Einstein*,

> In the evolution of scientific thought, one fact has become impressively clear: there is no mystery of the physical world which does not point to a mystery beyond itself . . . . Man's inescapable impasse is that he himself is part of the world he seeks to explore; his body and proud brain are mosaics of the same elemental particles that compose the dark drifting clouds of interstellar space; he is, in the final analysis, merely an ephemeral conformation of the primordial space-time field. Standing midway between macrocosm and microcosm, he finds barriers on every side and can perhaps but marvel, as St. Paul did nineteen hundred years ago, that the world was created by the word of God so that what is seen was made out of things which do not appear.[16]

What, then, of the Author of this magnificent work? How do we view our Creator in light of all the ever-multiplying complexity and diversity which confronts us. Can we not see Him as grander and mightier than we ever dreamed?

As St. Paul also reminds us, "For 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 . . . ."[17]

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"It is the glory of God to conceal a matter;
to search out a matter is the glory of kings."

Proverbs 25:2

Science, Scientism and Christianity: The Ideas of D.M. MacKay

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Those who reject neither science nor Christianity are forced to undertake three tasks to distinguish science from scientism and from Christianity and to show compatibility between science and Christianity. The work of D.M. MacKay is examined as an example of the carrying out of these tasks. Particular attention is given to complementarity and the idea of levels of explanation.

The tremendous impact of science on modern thought has created subtle but serious problems for Christian thinkers. The tension between scientific attitudes and conclusions on one hand and Christian faith and beliefs on the other has propelled Christians into a spectrum of reactions toward science. These reactions have ranged from outright rejection to uncritical acceptance of science. A less extreme and certainly popular strategy for alleviating the tension is based on the claim that science is distinct from scientism (or "false science"). The tension is then regarded as originating with the scientism and the proponent of this view proceeds to accept science but reject scientism. Not surprisingly, the definition of "scientism" varies, but generally it refers to improper extensions of science.

This strategy can obviously be quite successful at reducing the tension between science and Christianity. The success, however, hinges on whether or not several key propositions can be plausibly defended. The first proposition is that science is not the same as scientism; there is a real distinction to be made between them. Secondly, science neither logically nor even probably entails scientism because, if science and scientism go together like a horse and carriage, "you can't have one without the other."

If these first two propositions can be established, one still must show that science and Christianity are compatible though distinct. Thus there are three propositions to be established in carrying out what we might call the compatibilist strategy. First, science must be distinguished from scientism. Then, the distinction must be shown to be profound enough to allow separation of the two. Finally, science should be shown to be compatible with Christianity.

Once the strategy is outlined, it is not difficult to see that many thinkers employ variations on this basic theme as they seek to defend and advance Christian ideas. Of course, the terminology is variable. Some writers never use the word "scientism," preferring instead more pejorative terms, such as "science falsely so-called." Also, the definitions of "science," "scientism" and "Christianity" vary. Nevertheless, however terms are defined, once the basic decision to accept both science and Christianity has been made, it is almost inevitable that this strategy will be followed. Anyone who deviates from the pattern must be regarded as highly original.

MacKay's Strategy as a Compatibilist Strategy

A good strategy must be supported by good tactics if any effort is to succeed. In order to see the compatibilist strategy in operation and as an opportunity to judge the effectiveness of some of the tactics that have been used, I would like to examine a particular example. The choice of the ideas of Donald M. MacKay[1] as an example is not random. MacKay's ideas have had considerable influence both in England and, more recently, in the United States. Hence, he must be considered an important (though perhaps not an intentional) practitioner of this strategy.

MacKay supports the first proposition, that science is distinct from scientism, by defining science and scientism in such a way that it is obvious they are different. He characterizes science as an approach to understanding the universe in which one assumes the existence of an ordered universe and then proceeds to test postulated orderings of that universe against experience. Owing to the inherent limitations of empirical procedures, science is tentative in the sense that no claims of absolute certainty can be made for its conclusions. Additionally, MacKay attaches considerable importance to observational detachment as a feature of scientific methodology.

Scientism is not a common word in MacKay's writings but I think we can fairly generalize from his remarks with respect to specific forms of scientism, e.g., Evolutionism.[2] Evidently, for MacKay, scientisms would be extensions of the methods (and, perhaps, theories) of science into a metaphysical *modus operandi* of the universe. Scientisms then use the explanations of science to debunk religious explanations.

If this interpretation is correct, MacKay distinguishes science from scientisms primarily in terms of correct and incorrect use of methods. In science, the methods used are consistent with the goals, substance, and conclusions of the discipline while in scientism those same methods are used outside their range of proper applicability.

When it comes to the second proposition, that scientism does not necessarily flow from science, MacKay's efforts are confined primarily to one area in which he, as a brain physiologist, has special interest. He is quite properly concerned with the implications of a form of scientism he calls "machine-mindedness." As he defines the position, "machine-mindedness" is the dual conviction that man's mind is causally determined and man's decisions are, therefore, governed by "moral determinism." In order to show there is no *logical* connection between causal determinism and "machine-mindedness," he uses an interesting example[3] in which he allows for the sake of argument that causal determinism is true of the mind.

MacKay's discussion of the example hinges on the distinction between the terms "inevitable" and "inevitable for you." Suppose, he suggests, some clever person were able to precisely ascertain your brain state so that correct predictions of your decision following any brain state became possible. MacKay admits this clever observer would then be correct to regard your decisions as inevitable and, hence, determined. However, MacKay insists that the decision is still not inevitable *for you* and the future is not inevitable for you. The reason is that your brain state in belief is different from your brain state in unbelief. For a particular predicted brain state to be inevitable *for you*, you must consider and accept the prediction as true (inevitable) and that must alter the brain state on which the prediction is based. If the observer adjusts for that and bases his prediction on the state of your brain when you believe, then by not believing you nullify the prediction by not being in the state on which the prediction was based.

MacKay's point is that the causal determinism noted by the clever observer does not imply that your decision is *logically* determined. Consequently, moral decisions are free in some sense and moral determinism does not follow from causal determinism. In my terms, the science (used by the observer) does not entail the scientism (moral determinism).

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MacKay's argument has received mixed response.[4,5] C. Stephen Evans comments, "This is a puzzling argument and it is difficult to know what to make of it."[6] For me, the most puzzling feature of the argument is how discussion turns from a causally determined situation into one where the subject suddenly has a choice. It seems that the term "inevitable *for you*" is a magic wand! When the subject examines the cleverly adjusted prediction which will be true only if he believes it to be true, why does MacKay think the subject can choose not to believe? The obvious answer is that we all *know* he has a choice. That, of course, begs the question.

MacKay never actually says the subject *can* choose to not-believe. He says the subject would not be wrong to not-believe. If he really means the subject would not be wrong to not believe but still cannot choose to not believe, I think he should say so explicitly to make clear what sort of moral indeterminism he is offering us. Of course, then it is hard to understand how he can say the future is not determined for you.

Taking MacKay's side, I think the reply is that *logical* indeterminacy is the issue here. Perhaps he would say that the introduction of a conscious agent into the situation renders the *logically* possible also *physically* possible.

A thorough causal determinism, as assumed at the start of the example, permits no such response. Conscious agents are causally determined with perhaps illusory options but certainly no real options. Logical truth tables of what is true or false if this or that happens can never tell us just what *will* happen.

MacKay can still salvage the argument if he equates logical inevitability with moral determinism. Then the existence of two logical possibilities does indeed imply moral indeterminism. Perhaps he *does* mean this but then it is hard to see why an involved discussion is necessary to establish the point. However, if this is what he means, then the subject would not be wrong to not-believe the prediction but neither would he be *able* to not-believe it. If this is freedom, it isn't worth much.

Strategically then, at best, MacKay has driven a wedge between science and one form of scientism. Showing that science does not logically entail scientism is vital but it is desirable to use as many wedges as possible in order to secure the split. Differences in method or epistemology or esthetic sense should be demonstrated if and where possible.

It is to the third proposition, that science and Christianity are compatible though distinct, that MacKay gives most attention. He shows science is distinct from Christianity in at least five ways.[7] Firstly, he suggests science does not deal with or usually ignores certain important questions. Questions of the significance of the universe or of human existence lie outside the self-imposed limitations of science. Secondly, he holds that science is ". . . not an alternative to God as a source of truth, but a specialized way of gathering and discovering patterns in data. . . ."[8] Thirdly, he views theological statements as not readily testable against experience. Fourthly, he notes that detachment, which he insists is necessary for science, is neither appropriate nor possible in Christianity. Finally, he argues that science provides no information on man's spiritual needs of forgiveness from sin and of healing the broken relationship with God.

The compatibility of science and Christianity is a major theme of MacKay's work. Briefly, he argues for compatibility by insisting that science and Christianity ". . . are not rivals but are complementary, each appropriate to an area of experience largely ignored by the other."[9] In fact, both views are necessary; ". . . there is not only room for but *need* for stories of both kinds to be true at the same time. What we have to ask is . . . which story is relevant to a particular context."[10] However, ". . . the religious account of reality is logically 'higher' than the scientific: it presupposes that some scientific description can be given of the world of created events, and goes beyond it by claiming to reveal the significance of those events. In this sense . . . the biblical-theistic account of reality embraces the scientific."[11]

Showing that science does not logically entail scientism is vital but it is desirable to use as many wedges as possible in order to secure the split.

MacKay safeguards this complementary relationship by attacking "nothing-buttery" which is the conviction that once science has explained a phenomenon, no further explanation is needed or possible. His attack takes the form of a number of examples which, he is convinced, show that an explanation in one set of terms does not necessarily debunk an explanation in another set of terms. Specifically, he regards these examples as counter-examples to "nothing-buttery."[12]

I think it is clear from the previous outline that MacKay's ideas can be fitted into the pattern of the strategy I have described. Although I regard the strat-

egy as fundamentally sound, I have a caveat. Generally, the approach suffers from excessive confidence in the making of distinctions. It is, after all, an *assumption* that the scientific world-view is constructed of two separable parts, one good (science) and the other bad (scientism). Certainly there are those who contend the parts are not only inseparable but naturally (even logically) connected. When the Christian thinker has made his distinctions and distilled the impure mixture down to a residue of pure science, what guarantees the residue will be all good? Might not "pure science" need purifying?

The Tactical Use of Levels of Explanation

Turning from strategy to tactics, I want to focus especially on the arguments and concepts MacKay employs to show science and Christianity are compatible. Key concepts here are "levels of explanation" and "complementarity." We will examine these in the next two sections. Additionally important is the conclusion that an explanation at one level does not invalidate an explanation at another level.

Because of its importance in the discussion, let us define "explanation" as a set of statements about a set of phenomena and their interrelationships. This is obviously a very minimal definition which overlooks many important features of an explanation. The quality of an explanation is surely important, as is internal consistency but such details need not detain us. When any statement of one explanation contradicts any statement of another explanation, I will call the two explanations "contradictory explanations."

As an illustration of the idea of levels of explanation, MacKay calls attention to a sign reading "EXIT" where the letters are cut from newsprint.[13] Focusing first on the microscopic dots of ink comprising part of a letter "e" in a word on the newsprint, we see only a random set of dots. If we lower the magnification or back away, the letter "e" itself is visible. At even lower magnification, the word of which the letter is a part, perhaps "set," appears. At a greater distance we recognize the newsprint. From a yet greater distance, the word "EXIT" is discerned. An account of what we see at any of these stages is an *explanation* of what is seen at that stage. MacKay says these various explanations of different stages are different levels of explanation of the ink dots. At the lowest level (highest magnification) we might explain them as random dots. At the highest level we would consider them to the extent they help to convey the message "there is an exit over here."

Note that each level explains different data. For example, the dots against a white background are the subject of the first (lowest) level while the whole sign and its message is the subject of the highest level. In this example, the subject of any level is part of the subject of any higher level. For example, the random dots are still accounted for at the level where the letter "e" is recognized but here they can be seen to fit into a larger context. In other words, the subject of any level is a subset of the subject of any higher level of explanation. Levels related in this manner I call "nested levels" of explanation.

Explanations might be related in other ways. Subject sets might overlap, having an area in common. With a large degree of overlap, it might make sense to refer to explanations of these subject sets as different levels of explanation and I will call them "overlapping levels" of explanation.

An extreme form of both overlapping and nested levels is the case where the subject sets are the same. I will call different explanations of the same subject "homologous" levels. A higher level of two homologous levels would be the more complex of the two.

. . . The subject of any level is a subset of the subject of any higher level of explanation.

Two nested levels of explanation will not necessarily invalidate each other. An explanation of the ink dots as part of the letter "e" certainly is compatible with the view of the dots one might take at the level where the newsprint was under consideration. However, it is *possible* that an explanation at one level could invalidate another level of explanation. An explanation of the ink dots along the lines that their configurations were carefully chosen by an abstract artist must be regarded as false once we have recognized the dots as parts of a piece of newsprint.

Can a lower level of nested levels ever invalidate higher nested levels? Since a higher level is constructed from more information about the context of the data of the lower level, we ordinarily do not encounter examples of this sort. For example, if we say science is a lower level explanation of the universe and Christian Science (as formulated by Mrs. Eddy) is a higher level explanation (by virtue of its scope), can we say that science invalidates Christian Science? The two are surely contradictory and incompatible but what criteria do we use to show that one invalidates the other? The criteria for higher and lower levels are of no use

here. Certainly we will not say that Christian Science invalidates science because it is a higher level explanation. Thus, conflicts between nested levels are not resolvable without reference to criteria beyond those that distinguish higher from lower.

In the same way, overlapping levels of explanation may or may not invalidate each other. Likewise, determining which of two levels is higher has no bearing on the question of which one is invalidated if and when explanations at different levels disagree.

As an example of invalidation in overlapping levels of explanation, consider: a) all the paintings of Picasso, and, b) all abstract paintings. Some but not all Picasso's paintings are abstract and some but not all abstract paintings are Picasso's. Now suppose an art critic finds a convincing way to argue that all Picasso's work was motivated by financial considerations alone. This explanation surely contradicts an attempt to explain all abstract painting as an exploration of territory newly opened up to artists by changing ideas of space, time and motion. Of course, a synthesis may be possible but the point is that not all overlapping levels of explanation are mutually compatible.

We then conclude of nested and overlapping levels of explanation that each situation must be considered separately. If two levels contradict, there is no *a priori* certainty of how the situation will be resolved. A higher level does not necessarily have preference, so questions of what constitutes a good or complete explanation must arise.

Questions of higher and lower are obviously irrelevant for identical levels of explanation where the subjects are the same. Again, questions of what a good explanation is must arise. Another criterion appropriate to homologous levels which cannot be applied for debunking purposes to other types of levels (although it *can* be used to show the need of another level) is Occam's razor. According to this rule, we decide which explanation is preferred on the basis of not proliferating assumptions and concepts beyond what is necessary. The best explanation has no more and no fewer than the requisite number of concepts. The rule should not be used until considerations of goodness and completeness have been weighed.

We have found, then that the claim that two explanations are explanations at different levels tells us nothing about which is to be preferred. Claims about different levels must be handled on a case by case basis. If two explanations are contradictory we still do not know which is preferred because contradiction is a symmetrical relationship. However, it is obviously impossible for both of two contradictory levels to be accepted in unaltered form.

Evidently MacKay views the explanations of science and Christianity as nested levels. He tells us that "the biblical-theistic account of reality embraces the scientific."[11] The Christian explanation encompasses the significance of phenomena while the scientific explanation virtually ignores such concerns. As to contradiction, MacKay clearly does not expect science and Christianity (as properly formulated?) to contradict each other. The non-contradiction is insured by complementarity, on which I will have more to say shortly.

To this point in the discussion of tactics, I feel relatively comfortable with what MacKay is doing. When he turns the concept of levels of explanation into an attack on "nothing-buttery," problems appear.

The problems center on the word "debunk." When

We are forced to conclude that MacKay's tactics against "nothing-buttery" are largely unsuccessful.

does one explanation debunk another? MacKay appears to mean "debunk" in the sense "contradict" when he says, "it is only where we can demonstrate that the truth of a theistic claim would logically rule out the truth of a scientific one, or *vice versa*, that we have a right and duty to see them as opposites."[14] However, when he explicitly sets out to answer the question of the meaning of "debunk" he says one explanation debunks another when one story ". . . would have had to be different if the other story had been different."[15] This is a test of relatedness but it gives us no criteria for deciding which story should be judged to be debunked.

This vague treatment of the word "debunk" is no virtue in light of the important role it plays in the attack on "nothing-buttery." His argument against "nothing-buttery" is essentially the remark, buttressed by examples,[16] that an explanation in one set of terms does not necessarily debunk an explanation in another set of terms. The remark is true but irrelevant because, as we have seen, regardless of which sense of "levels of explanation" is in use, the question of contradiction between levels must be handled case by case. Likewise, the examples are irrelevant when case by case handling is needed.

Unfortunately, MacKay makes no attempt to show that "nothing-buttery" *in actual fact* does not debunk Christianity; he only suggests it might not (does not necessarily). Apparently he does not appreciate the case by case nature of the situation. Even for one who believes the argument and examples have weight, this omission is astonishing. He should press on. His conclusion as it stands is obviously too weak for satisfaction. We want to know if Christianity stands. MacKay tells us, "maybe," a less than reassuring response.

A final difficulty with the discussion of "nothing-buttery" is more subtle. I am uncertain of how MacKay would categorize "nothing-buttery" but it seems, to me, that "nothing-buttery" is a scientism which (as scientisms typically do) purports to have an explanation for everything. It is, of course, a severely truncated world-view; positivistic world-views always are truncated. If I am right, then Christianity and "nothing-buttery" stand to each other as homologous levels of explanation for they claim to explain everything to some extent. Occam's razor then properly enters the picture here and "nothing-buttery," on the face of it, seems to be the winner. The only tactic that appears to offer hope would be an attack on the *adequacy* of the explanations presented by "nothing-buttery."

Apparently, MacKay views his examples as just that sort of attack because he insists they are counter-examples.[17] That is, he means to show the inadequacy of "nothing-buttery" with his examples. I heartily approve of efforts at generating counter-examples but when we are lacking criteria for deciding when debunking occurs and to which account it occurs, no example can be regarded as an unambiguous counter-example. The criteria for deciding when debunking occurs are among the criteria we need to recognize counter-examples!

In addition to the above general problem, there is a specific problem with MacKay's examples. I have already shown that examples are irrelevant unless they deal directly with the case in hand. MacKay's prime example, an electric sign conveying an advertising message, just does not seem to involve "nothing-buttery."[18] MacKay notes that, "no advertiser in his senses would imagine that he must deny the completeness of the electrician's account in order to defend the real presence of his message."[19] MacKay is right. The reason the advertiser never thinks of attacking the electrician's account is that it (the electrician's account) is a lower level explanation of the sign which is compatible with the advertiser's account. The two accounts do not contradict and appear to stand to each other as overlapping levels of explanation. If this is correct, the example has no relevance to "nothing-buttery."

We find then, that we are not really presented counter-examples, firstly, because MacKay has no criteria for identifying them and, secondly, because the examples we *are* offered do not fit the category. Thus, we are forced to conclude that MacKay's tactics against "nothing-buttery" are largely unsuccessful.

Complementariness and Complementarity

Nested and overlapping levels of explanation frequently complement each other. Science, purged of scientism, presumably nests within or overlaps Christianity for the compatibilist and it is very natural to see science and Christianity as complementary from within this perspective. In fact, this view seems almost *mandatory*. MacKay extends rather than breaks this compatibilist pattern, raising the idea of "complementary" to the status of a new logical category which he calls "complementarity."

Fifty years ago, the word "complementary" used of ideas simply suggested the ideas completed or rounded-out each other. Bohr's use of the term to describe the wave-particle duality of quantum physics introduced new connotations. Especially when the word "complementarity" is used, these new connotations are unavoidable.

Attempting to explicitly state the new connotations, it is surprising to find that Bohr never defined "complementarity."[20] Unfortunately, the lack did not prevent him and others[21] from applying the word outside of physics. To be sure, Bohr had a problem. The intense drive toward unity so characteristic of science since the Greeks was pushing him to see the new pattern as no unique thing but as a general *modus operandi* for the universe. The drive that has produced the great unifying principles in science is exactly the same as that which leads to reductionism and scientisms. Therefore, *it may well be that scientisms and science cannot be separated in terms of motivation and intent*. Bohr felt a need to show the new principle was not peculiar but sensible and necessary. He has, however, left us with an unfortunate precedent.

"Complementarity" in quantum physics shares with "complementary" the basic denotation of "necessary for completion." The wave picture and the particle picture are both necessary to understanding the full range of behaviors. Together, they explain the whole range. Paradox is unique to complementarity. The two pictures cannot be simultaneously true but what is the sense in seeing one as true at one time and the other as true another time? Nevertheless, we are apparently compelled by repeatedly confirmed experience to accept the paradoxical situation as true. Note that the use of two paradoxical pictures is *empirically* necessitated.

MacKay uses both "complementary"[9] and "complementarity"[22] as terms relating science and Christianity. His use of the latter is very much his own[23] and those who are familiar with the word only in the context of the physical sciences will be confused unless they are aware of the alteration it has undergone in his hands. Unfortunately, it is no easier to decide what differences MacKay sees between the two words than it was with Bohr. This much is clear. For MacKay, "Complementarity stands . . . for a particular kind of logical relation distinct from and additional to traditional ones like contradiction, synonymy, or independence; it demands to be considered along with others whenever there is doubt as to the connection between two statements. . . ."[24] Differences in *viewpoint* and *standpoint* lead respectively to what MacKay terms "hierarchic" and "non-hierarchic" complementarity where the wave-particle duality is non-hierarchic and the relation of science to Christianity is hierarchic. There does not appear to be an obvious relation between these categories and the types of levels of explanation.

Might "nothing-buttery" and Christianity be complementary in this sense of logical complementarity? As for Bohr, so for MacKay, complementarity is to be invoked when empirical necessity arises. Since we surely want to insist there is more to the story than "nothing-buttery" allows, do we then have the right to bring in Christianity to complete the incomplete picture painted by "nothing-buttery"?

To his credit, MacKay does not use complementarity this way. This tactic must be rejected if only because the two views are contradictory.

John W. Haas, Jr., has nicely evaluated MacKay's use of complementarity[23] so I will make only one further remark. The proposal of a new logical category is very brave and radical. As such, it is bound to draw fire and cause confusion. If in use, however, the new relationship can hardly be distinguished from an old one even to the point where the proposer uses the two interchangeably, surely there is room for doubt that anything new is really in use. The advantages of "complementarity" over "complementariness" are elusive.

Conclusions

To what extent do the ideas we have examined accomplish the three tasks (of defending the three propositions) and what can we do given these accomplishments? The first proposition, that science is distinct from scientism, is well established.

As to the second proposition, to drive a wedge between science and scientism, we have one argument of dubious import. If its problems can be overcome, we have a way of logically separating science from scientism. As I have noted, we need more than *logical* wedges but without *some* form of logical wedge, no other type of wedge will provide permanent separation of science and scientism.

The third task of showing that Christianity and science are distinct but compatible might be more fully carried out. The distinction between science and Christianity is well established with MacKay's five distinctions. However, MacKay's tactics for showing compatibility are confusing (if not confused) at times because of ambiguity in the use of the terms "levels of explanation" and "complementarity."

The idea of levels of explanation is a valuable one for viewing the relationship between science and Christianity. The challenge is to show compatibility between the two and to maintain it without unduly restricting the operation of either one. A great deal of effort has been expended in this direction but it is a continuing task. The complementary nature of views must be an important part of our thinking about Christianity and science but it does not seem necessary to claim to be using a new category of logic in order to do such thinking.

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Categorical Complementarity and the Creationomic Perspective

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Through the spectacles of scriptural exegesis and through the spectroscopes of natural science we obtain differing perceptions of the physical universe. These two views, we believe, are neither contradictory nor concordant, but they are categorically complementary; that is, each view provides answers to questions drawn from mutually exclusive categories. When the two views are properly integrated, we achieve the "creationomic perspective"—we perceive the cosmos as God's Creation, which is dependent on him not only for its inception, but also for its continuing existence and its lawfully governed behavior. From this perspective, the creation/evolution debate may be recognized as a tragic blunder proceeding from a failure to distinguish among complementary categories of questions.

I. INTRODUCING THE QUESTION

A. One Cosmos; Two Views

As Christians who are trained in the natural sciences, many of us are engaged in a systematic study of the material world, the corporeal cosmos. Though we seek a unified and all-encompassing understanding of that cosmos, our perceptions of it are drawn from two sources which differ significantly. We view the physical universe both through the "spectacles" of Scripture (to borrow a metaphor from John Calvin) and through the spectroscopes and other instruments of natural science.

Through the spectacles of scriptural exegesis we perceive the cosmos as God's Creation. From the Bible we learn that the cosmos is neither a collection of deities (as ancient polytheism thought) nor an autonomous substitute for deity (as modern Western naturalism asserts). Contrary to the claims of both ancient and modern forms of paganism, the Bible proclaims that the entire universe is God's Creation. As Creation, the cosmos is wholly dependent upon divine action for its very existence—for its preservation no less than for its inception. As Creation, the cosmos is governed by the power of its Creator; it stands under God as his servant. Because the cosmos is Creation, it has value by virtue of its relationship to God. And because the cosmos is God's Creation, cosmic history exhibits purpose and direction.

Through the spectroscopes of natural science we see the cosmos differently. We observe a universe whose physical properties, material behavior, and temporal development are coherently interrelated. Though the cosmos is incomprehensibly vast in its dimensional scale, it appears to be constructed of just one kind of substance assembled in a hierarchy of structures—from miniscule atomic nuclei to gigantic spiral galaxies. Whether in terrestrial laboratories or in celestial luminaries, the behavior of matter and material systems is

characterized by the same orderly patterns. Furthermore, this patterned material behavior is governed in such a way that it is related to material properties through proximate cause-effect relationships. Cosmic history—the cumulative consequence of material behavior—can be reliably inferred from the physical record left by past events and processes. From multiple sources of evidence, there results a remarkably coherent picture of cosmic history as a continuous sequence of causally related events and processes beginning billions of years ago with a constructive episode of rapid expansion known as the "big-bang."

B. The Question of Relationship

Presented with these two views of the cosmos—that is, two perceptions, each drawn from a different source—the 20th-century Christian must inevitably ask the question concerning their relationship. A number of diverse opionions have been offered; we review here just a few of those which are contending for our attention.

Contradictory?

The scenario of cosmic history provided by mainstream natural science is formed from a continuous stream of coherently patterned processes and causally related events spanning a multibillion year period of time. However, when the Bible, particularly in its creation narratives, is perceived as providing a chronicle of specific events in the history of God's creative activity, a very different chronology and sequence of events can be derived—a sequence characterized by a set of divine acts which, during a 6-day period a few thousand years ago, brought about the instantaneous inception of a mature and fully functioning universe whose structure and appearance were nearly identical to that which we observe today.

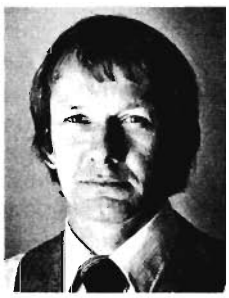
Both of the major contenders in the contemporary creation/evolution debate—modern Western naturalism and recent special creationism—judge that these two views of the cosmos and its history are contradictory. Because they provide conflicting answers to questions concerning the character and chronology of natural history, an either/or choice is being demanded. Hence the debate.

Modern Western naturalism claims that the biblical view is obsolete and must be replaced by the scientific perspective. According to naturalism, the ultimate reality is matter itself; the material world, it is claimed, is self-existent and self-governing. Any view, therefore, which speaks of a deity upon which the material world is dependent must be discarded. The claim is made that the view of the cosmos through the spectroscopes of natural science is not only *valid,* but also *complete.* It is, according to the presuppositions of naturalism, the whole picture.

Contrary to the naturalistic perspective, recent special creationism asserts that the results of mainstream natural science are not binding and that they must yield to the literal, chronological interpretation of the biblical creation narratives. Even those creationists who have gained an appreciation for the integrity of the several chronometric procedures of natural science can still adhere to a recent creation chronology by advancing the apparent-age hypothesis.[1] According to this view, God created the cosmos just a few thousand years ago with the appearance of antiquity. Though it may superficially appear to be 15 billion years old, the actual age of the cosmos is only about 10,000 years. The perceived biblical chronology is given precedence over the chronology derived from empirical data as it is interpreted within the generally accepted framework of contemporary natural science.

Concordant?

While many Christians appear to be unperturbed by a disparity between the results of natural science and biblical exegesis, others cannot rest comfortably with such a discord. Therefore, large segments of the Chris-



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tian community are seeking to demonstrate that the "true biblical view" and the "true scientific view" of the cosmos and its history are concordant—that they are fundamentally in agreement with one another, that they tell the same story in different languages, that they answer common questions in a consistent way.

But how can one achieve agreement between two views which many persons judge to be irreconciliably disparate? Let me identify two rather different concordistic approaches. Each seeks to accomplish a unification of the biblical and the scientific views of the cosmos, particularly in regard to the character and chronology of its temporal development. In essence, one approach shapes the interpretation of Scripture to fit the prevailing scientific view, while the other seeks to reinterpret empirical data to fit the perceived biblical chronology.

The first approach may be illustrated by the "day-age" interpetation of Genesis One.[2] This concept is based on the postulate that each of the days in the creation week narrative may be understood as a lengthy period of time. In this way, the biblical description of cosmic history can be assigned a temporal duration concordant with the results of mainstream natural science. Those who propose such an interpretation are generally in agreement with the multibillion year scenario for the temporal development of the universe and they earnestly desire to demonstrate that the Bible can be interpreted in such a way that it supports, or at least does not directly contradict, that scenario.

What its proponents call "scientific creationism" seeks to establish a concord between the biblical and scientific views of cosmic history in an entirely different manner. This brand of concordism postulates that Genesis One is a straightforward chronicle of events. Its chronology is to be taken literally; a day is a day, and a week is a week. But mainstream natural science, claim the "scientific creationists," has trapped itself by unwarranted presuppositions and circular argumentation into the construction of the "billion year myth." Rejecting both the assumptions and the interpretive framework which lead to the conclusion that cosmic history is evolutionary in character and billions of years in duration, "scientific creationism" claims that it is possible to reinterpret the empirical data in such a way as to prove that the earth, along with the rest of the Creation, is only about 10,000 years old.[3]

In both of the examples cited above, an agreement, or concord, between biblical exegesis and natural science is asserted. In one case, the day-age interpretation of Genesis One is held to be in agreement with the results of mainstream natural science. In the other, the results of "creation-science" are proclaimed to be in agreement with a particular chronological interpretation of the biblical creation narratives. In each case, the goal of concord is reached; but, for obvious reasons, it is not possible for both the day-age interpretation and the young universe hypothesis to be correct. It is possible, however, that both are wrong.

. . . it is not possible for both the day-age interpretation and the young universe hypothesis to be correct. It is possible, however, that both are wrong.

Complementary?

Thus far in our brief overview, two very different judgments concerning the relationship of the biblical and the empirical views of the cosmos have been presented. In spite of their differences, however, those who claim contradiction and those who claim concord do adopt a similar attitude concerning the *scope* of the two views. Each group judges that both biblical exegesis and natural science offer answers to questions concerning the specific events and chronology of cosmic history prior to the appearance of human observers. The two views, as perceived by both concordists and confrontationists, provide answers to many of the same questions. If one were to make lists of all questions to which each view provided answers, one would find, it is claimed, a large area of overlap; a large number of questions would appear on both lists.

In my judgment, however, that is not the case. I am convinced that the list of questions about the material world which may legitimately be addressed to Scripture is very different from the list of questions which natural science may rightfully address to the cosmos itself. Like Donald MacKay, I believe that the two views that we are here considering are views from different standpoints. From two vastly differing vantage points we see entirely different aspects or dimensions of the same reality—the cosmos, which is God's Creation. MacKay has argued that the two views are hierarchically complementary, dealing with questions at different logical *levels*.[4] I prefer to call the two views "categorically complementary" because they differ in the *categories* of questions which they address. Each view is blind to those dimensions of the material world that are visible in the other. Either view must be complemented by the other in order to obtain the

unified and all-encompassing understanding of the cosmos that we seek.

In the remainder of this paper I shall outline what I call the "categorical complementarist" approach and give a brief sketch of the perspective on the material universe that results from adopting this approach. I call it the "creationomic perspective."

II. THE PRINCIPLES OF CATEGORICAL COMPLEMENTARITY

A. Categorize the Questions That We Ask Concerning the Material World

One cosmos; two views, we said. And if the two views result from looking at the cosmos from fundamentally differing standpoints, they are complementary views. The questions before us, then, are, 'Do the biblical and empirical views of the cosmos differ in standpoint?' and 'If so, what is the character of each standpoint?'

However, before we attempt to formulate answers to these questions, I believe we must make an inquiry into the kinds, or *categories*, of questions that arise in our search for a unified and comprehensive understanding of the cosmos. When we ask questions concerning the nature of the material world, into what categories do these questions fall?

Following is a list of categories which I believe will accommodate all (or at least the vast majority) of our questions. The list has eight categories organized under two principal headings. Under the heading of *internal affairs* we list those categories of questions which pertain to the nature of the material world irrespective of its relationship to any external, non-material powers or persons which may exist. Under the heading of *external relationships* we list those categories which pertain specifically to the matter of the relationship of the cosmos to external forces or beings. (Note: it is extremely important to keep in mind that these are categories of questions about the material world as such—about *things* insofar as they can be defined in material (physical) terms alone. Human behavior, human thought, and human history clearly extend beyond the boundaries of the purely physical realm. While questions concerning the wholly physical aspects of human beings lie within the scope of our classification scheme, those questions which pertain to uniquely human *personal* phenomena fall outside of its domain.)

The internal affairs of the cosmos

1. Questions concerning *properties*: What discernible physical properties do matter and material systems possess? For example, what is the chemical composition of the sun? What is the surface temperature of the star Betelgeuse?

2. Questions concerning *behavior*: What patterns of behavior do material systems exhibit? In what fashion does one material system dynamically interact with another? What physical process, for example, is responsible for energy generation in the sun?

3. Questions concerning cosmic *history*: What sequence of events and processes has preceded the present state of affairs in the material world? What is the character and chronology of the temporal development of the universe and of material systems within it?

Even these categories are not entirely independent of one another. Properties and behavior appear to be intimately related to one another by statements of immanent cause/effect relationship. Furthermore, history and temporal development may be seen as the cumulative product of the individual processes and events which constitute material behavior. Nonetheless, I find it helpful to distinguish among these three aspects of the internal affairs of the material world.

Because we believe that the Bible is inspired by divine revelation, we are confident that it will provide trustworthy answers to appropriate questions about the cosmos.

The external relationships of the cosmos

1. Questions concerning *status*: In addition to the material world, does there exist any other, non-material entity, power, or person? If so, where does the material world stand in relationship to it? Where, for example, does the cosmos stand relative to deity? Does it stand as an equal among other members of a divine pantheon? Does it stand alone as a machine-like substitute for deity? Does it stand under God as his responsible servant?

The question of the status of the cosmos is, I believe, the most profound and fundamental question that we can ask concerning the material world. The answer given to this question will determine the character of the answers given to the remaining categories of questions in this list—questions concerning the various

consequences of status.

2. Questions concerning *origin*: What is the ultimate cause or source of the existence of the cosmos? What, or Who, causes something to exist in place of nothing? What, or Who, serves as the origin for the very existence of the physical universe at any instant in time—past, present, or future?

Because the term 'origin' is used in so many different ways, let me clarify my use of that word in this context. Sometimes we use 'origin' in a temporal sense to indicate the beginning or inception of something. In the present context, however, I wish to identify questions concerning the *cause* for both the beginning and the continuation of existence. Sometimes we use 'origin' to mean the giving of specific form to matter already existing. In this context, however, questions of formation would be placed into the categories of *behavior* and *history*, not *origin*. In summary, we are here using the term 'origin' in the ontic sense, not merely the temporal or the formal sense.

3. Questions concerning *governance*: We observe matter and material systems to behave in particular ways. What agent causes that action? What is the ultimate cause for the patterned material behavior that occurs in the cosmos? Is matter itself the governor of its own behavior? Or is material behavior governed by some external, non-material agent?

It is important here to note the profound difference between questions of *behavior* and questions of *governance*. Questions of behavior deal with the discernible actions exhibited by material systems. Questions of governance deal with the ultimate *cause* for those actions. The science of meteorology, for example, studies the behavior of matter in the processes of cloud formation, precipitation, and wind. Psalm 135:7, on the other hand, provides us with a perspective on the governance of those same phenomena.

> He (God) makes clouds rise from
> the ends of the earth;
> He sends lightning with the rain and
> brings out the wind from his storehouses. (NIV)

4. Questions concerning *value*: Do material entities have value? If so, by what criteria is that value established? Is the value of a material entity inherent in its substance, or its structure, or its behavioral capabilities? Or, on the other hand, is the value of a material system derived from its relationship to external, non-material beings?

5. Questions concerning *purpose*: Does the cosmos exist for some purpose? If so, what purpose? Does cosmic history display purposeful development? If so, what is the source of that purpose? To what end or goal is cosmic history moving?

B. Recognize Two Sources of Answers

For many centuries, the Christian community has recognized two distinct sources of answers to its questions: the Bible, God's written Word, and the Creation, God's handiwork. I certainly have no reason to quarrel with that perception. Neither do I see a need at this time to demonstrate by lengthy argumentation that these are indeed both legitimate sources of answers to questions about the material world. Because we believe that the Bible is inspired by divine revelation, we are confident that it will provide trustworthy answers to appropriate questions about the cosmos. And because we believe the cosmos to be God's Creation, we are confident that our empirical study of it will provide us with reliable answers to numerous questions about its physical nature.

And because we believe the cosmos to be God's Creation, we are confident that our empirical study of it will provide us with reliable answers to numerous questions about its physical nature.

C. Direct Questions to the Appropriate Source

So far in our discussion, we have developed a list of the categories of our questions about the material world and have identified the two sources of answers. Now we must direct the questions to the sources. But how is that to be done? Must we direct all of the questions to both sources? Or should we divide the questions, directing some to one source, some to the other?

When we first presented the list of categories, we divided that list into two major classes: *internal affairs* and *external relationships*. I am convinced that each of these two classes of questions may be appropriately directed to only one of the sources for answers. (There may be exceptions, but I have not yet uncovered any.)

To be specific, I am persuaded that only those questions which deal with the *internal affairs* of the material universe may legitimately be directed to the universe itself and investigated by the tools of natural science. Natural science is powerless to deal with any other categories of questions, and good, honest natural

science is carried out in the awareness of that limitation. Theists and atheists alike must come to this same awareness. Therefore, when scientists make statements or conjectures concerning matters of the status, origin, governance, value, or purpose of the cosmos, they are necessarily drawing from their philosophical or religious perspectives, *not* from the results of scientific investigation. Any question which requires the consideration of extra-material realities will consequently require that the questioner go beyond the boundaries of the scientific domain in order to formulate answers. The failure to perceive or to admit this requirement forms one of the streams of confusion which feeds that sea of turmoil known as the creation/evolution debate.

Similarly, I am persuaded that only those questions which deal with the *relationship* of the cosmos to the Creator may legitimately be directed to the Scriptures for exegetically derived answers. The Bible as covenantal canon[5] was never intended to provide answers to questions concerning the physical properties, the material behavior, or the temporal development of the corporeal world. In its emphasis on covenantal relationships, the Bible was written in such a way as to carefully avoid questions regarding the internal affairs of the universe, and good, honest exegesis is carried out within the awareness of that divinely guided restraint. Theists and atheists alike must come to that awareness. While it appears allowable to infer some features pertaining to the general character of the Creation (e.g., its orderliness, its coherence, and its intelligibility), it makes no sense whatsoever to address to Scripture questions about the physical properties of matter, or about the mathematical laws describing patterns of material behavior, or about the temporal measure of cosmic chronology. Therefore, when theologians or other persons claim to make statements concerning the specifics of cosmic structure or cosmic history on the basis of scriptural exegesis, they are displaying the results of a grossly unwise attempt to force the Bible to answer inappropriate questions. The failure to distinguish among distinct categories of questions and the refusal to select only appropriate questions to address to Scripture forms a second stream of confusion which flows into that fog-shrouded ocean of bewilderment known as the creation/evolution debate.

Table 1, "Treatment of Question Categories," following, provides a convenient summary of our list of question categories, their division into two major classes, and their direction to appropriate sources only.

D. The Relationship of the Two Views

Having considered the matter of distinguishable categories of questions and appropriate sources for answers, I believe we are now in a better position to understand the relationship of the two views of the cosmos—the views through spectacles and spectroscopes.

The view of the cosmos through the spectacles of scriptural exegesis provides us with answers to the fundamental questions of *status* and its consequences for *origin*, *governance*, *value* and *purpose*. From Scripture we learn that the cosmos is God's Creation, that it is dependent on him for its existence, that it is governed by his power, that it has value in its covenant relationship to the Creator, and that its purpose is to manifest the love of God.

Through the spectroscopes of natural science, however, we obtain a very different view. The empirical study of the cosmos provides us with answers to a host of questions concerning the specific *properties*, *behavior*, and *history* of the material aspects of the Creation. We learn, for example, about the chemical composition of the sun, about the processes of stellar energy generation, and about the chronology of cosmic evolution.

Because these two views of the cosmos provide answers to questions drawn from entirely different categories, we fully expect the views to differ. But they need not be contradictory. In fact, I am convinced that they *are not* contradictory. I find nothing in either view that conflicts with an answer provided by the other. Each view, I believe, provides me with a valid, though incomplete, perspective on the created cosmos.

Furthermore, because the two views of the cosmos do not deal with the same questions, it would be inaccurate to speak of them as concordant. It is not the case that each view provides partial and concordant answers to a common set of questions. Rather, each provides potentially complete answers to questions drawn from different categories. Each view is incomplete not because it yields only partial answers to questions, but because it provides answers only to a partial list of questions.

What, then, is the proper term to denote the relationship between the two views? Provided that each view respects its categorical boundaries, they cannot be contradictory. And because the two views deal with mutually exclusive categories of questions, the term 'concordant' is not applicable. In my judgment, the term which most accurately denotes the relationship that we have described is the term "categorical complementarity."

The views of the cosmos through the spectacles of scriptural exegesis and the spectroscopes of natural science are categorically complementary views because they provide answers to categorically complementary

Table 1. Treatment of Question Categories

Categories of Questions about the Material World	*Appropriate Sources of Answers for the Christian*
INTERNAL AFFAIRS	
1. Properties 2. Behavior 3. History	The created cosmos itself, which is constituted and governed in such a way that is amenable to empirical investigation and is intelligible to the human mind.
EXTERNAL RELATIONSHIPS	
1. Status 2. Origin 3. Governance 4. Value 5. Purpose	The Bible, the covenantal canon, which was written principally for the purposes of revealing the divinely established convenantal relationship among God, mankind, and the rest of Creation, and of providing a witness of past human experience with the Creator-Redeemer.

sets of questions. Our full list of question categories was divided into two groups: *internal affairs* and *external relationships*. Each group is the complement of the other; together they comprise the whole. The two groups of questions, we say, are categorically complementary. The views of the cosmos formed by answers to these two groups of questions are categorically complementary views, comprising views from distinctly differing vantage points. Each is an authentic, though incomplete, view. Both are required for a unified and all-encompassing perspective on the cosmos, which is God's Creation. Both biblical scholars and natural scientists are needed in our quest to know ourselves, our place in the Creation and its history, and our relationship to the Creator of all.

III. THE CREATIONOMIC PERSPECTIVE

A. Definition

Using the principles of categorical complementarity, we seek now to unite the two views of the cosmos into a single comprehensive perspective on the material world. That unified and all-encompassing perspective on the cosmos which is gained by doing natural science in the context of a commitment to biblical theism I call the "creationomic perspective."

The peculiar name that I have chosen to denote this concept requires a brief explanation. The word 'creation' appears in the name because I wish to draw attention to the fact that the foundation of the creationomic perspective is the biblical teaching that the cosmos has the status of Creation. The suffix 'nomic' (from the Greek *nomos*, meaning "law") is attached as a reminder that it is because God governs his Creation in a rational, lawful manner that the empirical study of its properties, behavior, and history is possible. (The term 'creationistic' was rejected for its association with a particular concept of the character and duration of cosmic history which is at odds with empirical evidence.)

B. Methodology

The principles of categorical complementarity provide the methodological framework for achieving the creationomic perspective. Following these principles, we must: (1) Categorize all of our questions concerning the material world under two headings: *external relationships* and *internal affairs*. (2) Direct all external relationship questions to the Bible, and seek answers by faithfully and diligently applying the rules for biblical exegesis. (3) Direct all internal affairs questions to the Creation, and search for answers by honestly and carefully applying the methods of natural science. (4) Recognize the views of the cosmos seen through the spectacles of biblical exegesis and through the spectroscopes of natural science as being complementary, and integrate them to form a unified and comprehensive perspective.

C. Taking the Bible Seriously

There are numerous biblical passages that provide a powerful polemic against the naturalistic polytheism

commonly found in the Ancient Near East. Ancient polytheism viewed the cosmos as having the status of deity itself: the sun, moon, and stars were gods; the mountains were gods; the rivers were gods; the storms were gods. The cosmos was filled with material manifestations of deities to be feared, or placated, or worshiped. To these ancient pagan beliefs the Bible boldly declared 'No, the cosmos is not deity; the cosmos is God's Creation. It does not stand as an equal in a populous pantheon of deities; it stands under the one sovereign and loving God as his created servant.'

The Christian takes the Creation seriously by doing excellent natural science in the context of a commitment to God, who is revealed to be the Creator of the cosmos.

This same biblical teaching also provides an effective antidote to the world-view of modern Western naturalism. The naturalistic perspective is based on the premise that the material world is all there is, that there is no external, non-material power or person to whom the cosmos is related. The cosmos, according to naturalism, has the status of an independent, autonomous entity called Nature (with a capital **N**) which stands in place of deity.

To take the Bible seriously and to perceive the cosmos as Creation rather than Nature has profound consequences for one's concepts of its origin, governance, value, and purpose. As Creation, the cosmos is dependent upon God for both the inception and preservation of its existence; God is the Originator of Creation. Conceived as Nature, however, the cosmos is assumed to be self-existent; Nature is its own originator. As Creation, the cosmos is governed by divine power; God is the Governor of Creation. As Nature, the cosmos is conceived of as being autonomous; Nature is self-governed. As Creation, the cosmos has value by virtue of its covenant relationship to God the Creator. As Nature, the cosmos has no value beyond itself; if value is to be found in Nature, it must be inherent within material structure and behavior alone. As Creation, the cosmos follows a historical development that manifests the plans and purposes of its Creator. As Nature, however, the cosmos drifts aimlessly on an uncharted sea of eternity. The history of Nature is an undirected succession of accidental events, blindly going nowhere. The history of the Creation, on the other hand, is a divinely directed continuity of meaningful events proceeding toward the goal that the Creator has established for it.

When we take the Bible seriously and accept its answers to questions concerning the status, origin, governance, value and purpose of the material world, we have the foundation on which the creationomic perspective is built.

D. Taking the Creation Seriously

The Bible was not written for the purpose of providing answers to questions concerning the details of material properties, physical processes, or cosmic chronology. But it does, I believe, provide us with sound reasons to expect that empirical natural science will yield authentic answers to those questions. For example, because God is revealed to be the Governor of material behavior, I believe that I have a right to expect that matter and material systems will behave in an orderly and patterned manner. And I expect the behavior of the cosmos to exhibit coherence and integrity. I expect the behavior of the universe to be rational and intelligible to the human mind. I expect the behavior and properties of matter to be correlated so that material behavior will exhibit proximate cause/effect relationships. And because the Bible teaches that cosmic history is divinely directed, I expect the cumulative effect of material phenomena to display evidence of purposeful, directed development.

But these expectations, drawn from the character of divine governance, are the very aspects of material behavior which make natural science possible. The empirical investigation of the material world is possible because the cosmos is God's divinely governed Creation. The results of honest and careful scientific investigation, therefore, may never be dismissed. The Creation must be taken seriously. When performed within the boundaries of its domain, natural science is a vital contributor to the creationomic perspective. We seek no substitute or alternative to mainstream natural science. The Christian takes the Creation seriously by doing excellent natural science in the context of a commitment to God, who is revealed to be the Creator of the cosmos.

E. When Categorical Complementarity Is Violated

A Lesson from History

Early in the 17th century, Galileo became embroiled in a dispute with the Church hierarchy concerning the

structure of the cosmos. The Church, following traditional belief, presumed that the Bible provided final answers to questions of cosmic structure. Furthermore, it was argued that the Bible clearly taught a geocentric cosmos, such as the one proposed by Ptolemy in the 2nd century. Galileo, on the other hand, appealed to empirical evidence which he judged to support the Copernican heliocentric model. Galileo's argumentation failed to convince the powers of the day, and he was eventually forced to recant.

One of the chief issues in that dispute was the matter of question categories and answer sources. To which source do we take questions concerning cosmic structure? The Church held that Scripture, as traditionally interpreted by the Church Fathers, provided the answer; Galileo urged that the question be directed to the Creation itself. Galileo was advocating what I have called the categorical complementarist approach. History vividly demonstrates the soundness of his advice.

The Error Repeated

Today, we are once again caught up in a debate which has arisen as a consequence of addressing questions to the wrong sources. Those who call themselves "scientific creationists" have directed questions concerning material behavior and cosmic chronology to the Bible. Naturalistic evolutionists, on the other hand, have boldly claimed that questions concerning external relationships can be answered by scientific investigation. Both, I believe, are in error.

As I understand it, the biblical concept of creation provides a vivid picture of the relationship of the material world to God, but does not entail a particular specification concerning the patterns of material behavior or the duration of cosmic history. Creation is a theological concept regarding the relationship of the cosmos to God, not a scientific concept regarding cosmic chronology.

The scientific concept of evolution, on the other hand, provides a panoramic view of the patterns of material behavior that have contributed to the temporal development of the universe and material systems within it. Like all other concepts in natural science, it is blind to matters of status and its consequences for origin, governance, value and purpose.

The concepts of creation and evolution, therefore, are not contradictory or competing answers to the same question. Rather, they are complementary concepts which are concerned with entirely different and mutually exclusive categories of questions. The biblical doctrine of creation deals with questions of *external relationship,* while the scientific concept of evolution is concerned only with the *internal affairs* of the material world. When that distinction is recognized and when properly categorized questions are addressed only to appropriate sources, perhaps that tragic blunder known as the creation/evolution debate may be put to rest forever.

May the creationomic perspective prevail. May we see clearly through the spectacles of Scripture that the cosmos is God's Creation. And, without removing those spectacles, may we see through the spectroscopes of natural science that the dependably stable properties of matter, the coherent behavior of material systems, and the purposeful history of the cosmos are declaring daily the glory of their faithful Creator.

REFERENCES

[1]Henry M. Morris has frequently asserted that the biblical concept of creation necessarily entails the appearance of age. For example, in *The Remarkable Birth of Planet Earth* (Minneapolis: Dimension Books, 1972), p. 62, he says, "Actually, real creation necessarily involves creation of 'apparent age.' Whatever is truly created—that is, called instantly into existence out of nothing—must certainly look as though it had been there prior to its creation. Thus it has an appearance of age." In more recent publications, however, Morris insists that the proper application of "creation-science" provides empirical support for a youthful earth concept—that the earth not only *is* young, but also *looks* young. In an article entitled "Recent Creation Is a Vital Doctrine" (*Impact* No. 132, Institute for Creation Research, June 1984), Morris says, "For that matter, the earth does not really look old anyway . . . . Furthermore, there are many times more geological processes and systems that yield a young age for the earth than the handful of radiometric methods that can be forced (through an extreme application of uniformitarianism) to yield an old age."

[2]See, for example, John L. Wiester, *The Genesis Connection* (Nashville: Thomas Nelson Publishers, 1983), p. 199, and Robert B. Fischer, *God Did It, But How?* (Grand Rapids: Zondervan Publishing House, 1981), pp. 43,44. See also Robert C. Newman and Herman J. Eckelmann, Jr., *Genesis One and the Origin of the Earth* (1977; rpt. Grand Rapids: Baker Book House, 1981), pp. 83–88, for a summary of their "Modified Intermittent-Day View" of the Genesis One chronology.

[3]For an illustration of this approach, see Thomas G. Barnes, "Earth's Magnetic Age: The Achilles Heel of Evolution," (*Impact* No. 122, Institute for Creation Research, August 1983).

[4]D.M. MacKay, "'Complementarity' in Scientific and Theological Thinking," (*Zygon*, vol. 9, no. 3, September, 1974).

[5]For a development of the concept of the Bible as covenantal canon, see Meredith G. Kline, *The Structure of Biblical Authority,* 2nd ed., (1972; rpt. Grand Rapids: Eerdmans Publishing Company, 1975).

"As iron sharpens iron, so one man sharpens another."

Proverbs 27:17

The Roots of the Scientific Revolution: Reformed Theology

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It has been generally accepted that the Reformed tradition had an influence on the development of science in the sixteenth and seventeenth centuries. What the nature of that influence was is less well understood. This study examines Calvin's theology of nature and proposes that both the rationale for, and the methodologies of, the study of nature characteristic of the scientific revolution can best be understood as growing from these theological roots.

It has been attested by a variety of sources in the history of science that Protestantism in general, and the Reformed tradition in particular, played a crucial role in the Scientific Revolution of the 17th century. Historians of science such as Charles Coulston Gillispie[1] and Robert K. Merton[2] explain the involvement in terms of sociological factors, though, not theological ones. Gillispie is very specific in this regard, stating:

> The correlation of Calvinist behavior patterns . . . is a very general feature of Western cultural history. There can simply be no doubt that protestant and bourgeois milieux have encouraged talent and ambition to rise through science, and that catholic and aristocratic milieux have inhibited the development of scientists. Scotsmen and Dutchmen flock through the history of science; Irishmen and Spaniards are scarcely to be found. But the forces are sociological, not doctrinal.[3]

Attempts by Christian historians and philosophers to explain the relationship of science and religion have, on the other hand, been more in the realm of Christian apologetics than history of science. R. Hooykaas, for example, shows that men of intelligence can also be men of faith and tries to articulate why science and faith are compatible.[4] But I believe that this does not go far enough in explaining the relationship. Gillispie is wrong: the forces were indeed doctrinal. Hooykaas is too restrained: Calvin's theology of nature was the intellectual roots of the tree which we call the scientific revolution. Biologically, the purposes of a root system are to provide anchorage for the plant in the soil and to absorb from the soil those materials which can be used by the plant as it grows. Calvin's theology of nature served those functions for science in the sixteenth and seventeenth centuries. The focus of this study, therefore, will be *Calvin's* writings, *Calvin's* theology, and not the developmental changes of *Calvinist* theology. In the examination of his works, I will

(1) delineate elements of Calvinism which were factors in the developing philosophy of nature within the reformed tradition;

(2) contrast, at times, certain elements with other views known or held at that time; and

(3) describe the impetus Calvinism had on science in terms of the combination of factors discussed, a combination which was unique to Calvinism, although individual elements could be found elsewhere.

Such a study should help both the theologian and the scientist to recognize the importance of the scientist's over-all world view to the science which is produced. In a subsequent paper I hope to examine Lutheran theology and the type of science which resulted in that theological milieu.

I. Calvin's Basic Presuppositions and Principles

Some background comments are necessary before an analysis of Calvin's theology of nature can be made. A starting point might be the first two questions in Calvin's Geneva Catechism of 1541 (and the parallel question and answer which opens the Westminster Shorter Catechism of 1647). In the Geneva Catechism, one begins as follows:

Question: What is the chief end of human life?

Answer: To know God.

Question: Why do you say that?

Answer: Because He created us and placed us in this world to be glorified in us. And it is indeed right that our life, of which He Himself is the beginning, should be devoted to His glory.

The introductory question and answer of the Westminster Shorter Catechism is this:

Question: What is the chief end of man?

Answer: To glorify God and enjoy Him forever.

There is a degree to which these questions summarize the essence of all of Calvin's teachings, for the rest of his writings is an exposition on this theme. In his commentary on Jeremiah 9:24 he states: "Today, all sorts of subjects are eagerly pursued; but the knowledge of God is neglected. . . . Yet to know God is man's chief end, and justifies his existence. Even if a hundred lives were ours, this one aim would be sufficient for them all."[5]

Yet it is not just man which exists to glorify God. All of creation attests to its creatureliness by glorifying its Creator. The commentary on Psalm 19:1 portrays clearly Calvin's view:

> [The Psalmist] introduces the heavens as witnesses and preachers of the glory of God, attributing to the dumb creature a quality which, strictly speaking, does not belong to it, in order the more severely to upbraid men for their ingratitude, if they should pass over so clear a testimony with unheeding ears. This manner of speaking more powerfully moves and affects us than if he had said, The heavens *show* or *manifest* the glory of God.[6]

Calvin emphasizes the effect which Creation's glorifying of God should have on men as he continues to explain this Psalm:

> David shows how it is that the heavens proclaim to us the glory of God, namely, by openly bearing testimony that they have not been put together by chance, but were wonderfully created by the supreme Architect. When we behold the heavens, we cannot but be elevated, by the contemplation of them, to Him who is their great Creator; and the beautiful arrangement and wonderful variety which distinguish the courses and station of the heavenly bodies, together with the beauty and splendour which are manifest in them, cannot but furnish us with an evident proof of his providence. Scripture, indeed, makes known to us the time and manner of the creation; but the heavens themselves, although God should say nothing on the subject, proclaim loudly and distinctly enough that they have been fashioned by his hands: and this of itself abundantly suffices to bear testimony to men of his glory. As soon as we acknowledge God to be the supreme Architect, who has erected the beauteous fabric of the universe, our minds must necessarily be ravished with wonder at his infinite goodness, wisdom, and power.[7]

Implicit in this commentary are Calvin's views on God as Creator, on man's capacity to know God post-fall, and the ways God still speaks to man in order to restore him to sonship. Let us look at each of these in more detail.

For Calvin, the fact that God was Creator of the Universe was linked closely with his views of God's Providence and the doctrine of Predestination. He discusses in the *Institutes* the fact that creation was not a momentary, instantaneous event but that God's creative work took six days to complete.[8] This fact is important to Calvin for two reasons: (1) "that we might not find it irksome to occupy our whole life in contemplating it," and (2) that "we ought in the very order of things diligently to contemplate God's fatherly love toward mankind, in that he did not create Adam until he had lavished upon the universe all manner of good things."[9] He continues this theme in the sixteenth

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chapter of Book 1, which is entitled "God by His Power Nourishes and Maintains the World Created by Him, and Rules Its Several Parts by His Providence," with the first subsection being "Creation and providence inseparably joined."[10] In the editions published between 1539 and 1554, Calvin included both the ideas of providence and predestination in this chapter, but in the final edition he separated them. This was not because he no longer considered them related, but because he saw the latter to be more related to the redemptive work of the Holy Spirit. Nevertheless, the close relationship is still seen in this section in comments such as this:

> But faith ought to penetrate more deeply, namely, having found him Creator of all, forthwith to conclude he is also everlasting Governor and Preserver—not only in that he drives the celestial frame as well as its several parts by a universal motion, but also in that he sustains, nourishes, and cares for, everything he has made, even to the least sparrow.[11]

In the next section Calvin contrasts the concepts of Providence and fortune or chance, and the section title summarizes his conclusion: "There is no such thing as fortune or chance." For Calvin, the fact that God was Creator required a God who was still actively involved in His creation and a cosmos which was submitted to His will in all of its activities.

One can summarize this section by noting that Calvin's doctrine of God as Creator of the universe requires a sharp cleavage between Creator and Creation (hence denying pantheism and various forms of monism), insists on the continued involvement in and sustaining of the creation by the Creator (refuting deism), and affirms the orderliness and stability of the natural world as a result of Divine Will (rejecting both fatalism and chance). The Creator is also Lord, and, as a part of creation, man is called to acknowledge the Creator's Lordship: "Let us therefore remember . . . that there is one God who so governs all natures that he would have us look unto him, direct our faith to him, and worship and call upon him."[12]

A second concept which must be dealt with prior to a discussion of Calvin's theology of nature concerns his doctrine of man. With Calvin, this meant a study of man before the sin of Adam and a study of man in his fallen state. The latter was, in addition, divided into unregenerate man and regenerate man. One thus begins with an understanding of what it meant for man to have been created in the image of God. Calvin rejected the Lutheran pastor Andreas Osiander's claim that the image of God was both physical and spiritual. Calvin retained the view that this pertained to the spiritual realm, and indeed "located" the image in the soul.[13] To be created in God's image meant, first of all, that man's nature was different qualitatively from all other living creatures. In his commentary of Genesis 1:26 he says, concerning the meaning of "image of God" the following: "But here the question is respecting that glory of God which peculiarly shines forth in human nature, where the mind, the will, and all the senses, represent the Divine Order."[14] Yet the spiritual nature of the image did not keep man from physically and mentally demonstrating his difference with the rest of creation.

> [T]he integrity with which Adam was endowed is expressed by this word [image], when he had full possession of right understanding, when he had his affections kept within the bounds of reason, all his senses tempered in right order, and he truly referred his excellence to exceptional gifts bestowed upon him by his Maker. And although the primary seat of the divine image was in the mind and heart, or in the soul and its powers, yet there was no part of man, not even the body itself, in which some sparks did not glow. . . . From this we may gather that when his image is placed in man a tacit antithesis is introduced which raises man above all other creatures and, as it were, separates him from the common mass.[15]

The true nature of this image, according to Calvin, is best seen by discovering what redemption through Christ does. His conclusion is that the renewed man in Christ acquires first knowledge, and then righteousness and holiness. "From this we infer that, to begin with, God's image was visible in the light of the mind, in the uprightness of the heart, and in the soundness of all the parts."[16] The knowledge of which he speaks is the knowledge of God (as Redeemer and Creator), but, as we shall see later, it is related to and includes a knowledge of creation.

For Calvin, the fact that God was Creator required a God who was still actively involved in His creation and a cosmos which was submitted to His will in all of its activities.

Adam's fall and man's sin mean that the image is marred. Calvin saw this as meaning that all supernatural gifts were taken from him, but he agreed with Augustine that the natural gifts were only corrupted. By the former he meant such things as faith, love of God, desire for holiness, and love of neighbor. But he also includes soundness of mind and uprightness of heart. This results in a corruption of the natural gifts which remain, including human reasoning and understanding. Several passages in Book II, chapter ii, section 12 discuss this subject, and Calvin's views may be best illustrated in the following:

> When we so condemn human understanding for its perpetual blindness as to leave it no perception of any object whatever, we not only go against God's Word, but also run counter to the experience of common sense. For we see implanted in human nature some sort of desire to search out the truth to which man would not at all aspire if he had not already savored it. Human understanding then possesses some power of perception, since it is by nature captivated by love of truth. . . . Yet this longing for truth, such as it is, languishes before it enters upon its race because it soon falls into vanity. Indeed, man's mind, because of dullness, cannot hold to the right path, but wanders through various errors and stumbles repeatedly, as if it were groping in darkness, until it strays away and finally disappears. Thus it betrays how incapable it is of seeking and finding truth.[17]

The point at which we see the corruption most clearly is as man seeks to know God and heavenly things. However, when reason and human understanding are applied to earthly things, such as government, household management, mechanical skills, and the liberal arts, man's efforts are neither worthless nor ineffective. Even the unregenerate man may display wisdom in civil law, dexterity in mechanical skills, or insight in the realm of science. This point is emphasized by Calvin in the section entitled "Science as God's gift:"

> Whenever we come upon these matters in secular writers, let that admirable light of truth shining in them teach us that the mind of man, though fallen and perverted from its wholeness, is nevertheless clothed and ornamented with God's excellent gifts. If we regard the Spirit of God as the sole fountain of truth, we shall neither reject the truth itself, nor despise it wherever it shall appear, unless we wish to dishonor the Spirit of God. . . . . Shall we say that the philosophers were blind in their fine observation and artful description of nature? . . . Shall we say that they are insane who developed medicine, devoting their labor to our benefit? What shall we say of all the mathematical sciences? Shall we consider them the ravings of madmen? No, we cannot read the writings of the ancients on these subjects without great admiration . . . . But shall we count anything praiseworthy or noble without recognizing at the same time that it comes from God?[18]

Calvin thus affirms that human reasoning and understanding, as natural gifts of God, still operate in both the regenerate and unregenerate man, but because of the fall, they are inadequate and inaccurate in leading man to knowledge and understanding of God, nature, or himself. and whereas some have discovered aspects of truth, more often they have promoted error, superstition, and human traditions. Calvin was especially distraught by the error taught by both Plato and Aristotle that reason, if it takes command, is able to lead to a good and blessed life, but that the senses may lead to error (cf. Calvin's discussion in *Institutes* II.ii.2–3). This false reliance on reason leads to "self-sufficient intellectualism," to use John T. McNeill's term,[19] and was to be seen soon after Calvin in the resurgence of natural theology. Calvin would not elevate reason to that lofty position because of the fall. Instead, he declared that man's ability to know, enjoy, and glorify God by looking at nature and using his reason was futile for two reasons: first, man seeks to know God in the wrong way; and, second, he obscures the truth of creation in tradition and superstition. Since man can no longer know God as He reveals Himself through His works, and since reason does not lead us to God, Calvin concludes that God has revealed Himself in a new way—His Word (both Christ and the Scriptures).

Thus the Word leads to faith, and faith, according to Calvin, is superior to all opinion. Scripture is the sole means of avoiding error and correcting faulty reasoning.

Calvin's epistemology becomes clear in Book I, chapter vi, which he titles "Scripture Is Needed as Guide and Teacher for Anyone Who Would Come to God the Creator." God is known only by revelation, and He reveals Himself in two ways. T.H.L. Parker has an extended discussion of this subject in his interesting book *Calvin's Doctrine of the Knowledge of God*,[20] and he calls the two ways the *oracula Dei* and the *opera Dei*. Calvin introduces the subject in this manner:

> That brightness which is borne in upon the eyes of all men both in heaven and on earth is more than enough to withdraw all support from men's ingratitude—just as God, to involve the human race in the same guilt, sets forth to all without exception his presence portrayed in his creatures. Despite this, it is needful that another and better help be added to direct us aright to the very Creator of the universe. It was not in vain, then, that he added the light of his Word by which to become known unto salvation . . . . Just as old or bleary-eyed men and those with weak vision, if you thrust before them a most beautiful volume, even if they recognize it to be some sort of writing, yet can scarcely construe two words, but with the aid of spectacles will begin to read distinctly; so Scripture, gathering up the otherwise confused knowledge of God in our minds, having dispersed our dullness, clearly shows us the true God.[21]

The title of this chapter and the passage just quoted from that chapter illustrate what has been called the "formal principle" of the Reformation: the Holy Scriptures are the standard by which all things are to be judged. Their function is to teach man who God, the Creator, is, now that he can not know Him by His works. Calvin declares that we should be able to "learn from Scripture that God, the Creator of the universe, can by sure marks be distinguished from all the throng of feigned gods."[22] Thus the Word leads to faith, and faith, according to Calvin, is superior to all opinion. Scripture is the sole means of avoiding error and

correcting faulty reasoning. Moreover, Scripture is the means by which we can make sense of the world in which we live. Parker summarizes Calvin's views in these words:

> The Scripture is a thread, guiding us through the labyrinth, the enigma of the universe in which we live. The revelation which was frustrated by man's blindness becomes, objectively as well as subjectively, revelation by the illumination of the Holy Spirit. The universe is now perceived to be, not an unmeaning or accidental system, but the *opus Dei*. World history and personal experience of life is no longer regarded tragically, comically or satirically as a chaotic or cosmic sequence of events, but as the *opera Dei*. The Creator, executing His eternal purpose by His sovereign power, upholds and orders all things. That revelation which our sin vitiated into a condemnation, the Word of God restores to a source of knowledge of the Creator. If we begin with the Scriptures and learn to know God from them, we find that the same thing is said by God in His works[23]

For the regenerate man, therefore, nature as a part of the *opera Dei* becomes a true source of knowledge of God, when it is interpreted by the *oracula Dei*. Moreover, as a potential source of knowledge, it is a legitimate and necessary object of study. Calvin emphasizes this point in his commentary on Psalm 40:6:

> [H]owever diligently a man may set himself to meditate upon the works of God, he can only attain to the extremities or borders of them. Although, then, so great a height be far above our reach, we must nevertheless endeavour, as much as in us lies, to approach it more and more by continual advances; as we see also the hand of God stretched forth to disclose to us, so far as it is expedient, those wonders which we are unable of ourselves to discover.[24]

Calvin insists that the *opera Dei* are not an independent source of knowledge of God, and the *oracula Dei* are the spectacles by which chaos is transformed into cosmos. But the *oracula Dei* are not independent either, for they are confirmed by the creation around man. In both God reveals Himself to man who is unable to know Him correctly apart from His initiating revelation.

II. The Study of Nature: A Means of Knowing God

With this background, what conclusions can we draw with regard to Calvin's theology of nature? And how does that thinking provide a stimulus for the development of science? In answer to the first question, it would seem that for Calvin and his followers, the study of nature has two functions: it is a means of knowing God and it is a means of glorifying God. Let us examine each of these elements. First, Calvin was concerned about the false ideas about God which were current in his time. He asserted that a study of nature and creation would correct these errors, for it required that man ask the right questions:

> What is God? Men who pose this question are merely toying with idle speculations. It is far better for us to inquire, "What is his nature?" and to know what is consistent with his nature. What good is it to profess with Epicurus some sort of God who has cast aside the care of the world only to amuse himself in idleness? What help is it, to know a God with whom we have nothing to do?[25]

The "right questions" help us avoid the erroneous speculations of philosophers and lead us to a proper understanding of the doctrine of Creation, one which requires a God who is both a Provider and a Planner. Unregenerate men and men without Scripture as a guide fail to see God as Creator, and the result is superstition. Rather than apprehending God as He offers Himself, they "measure him by the yardstick of their own carnal stupidity, and neglect sound investigation; thus out of curiosity they fly off into empty speculations."[26] If regenerate man, on the other hand, investigates nature using the spectacles of the Scriptures, then knowledge concerning the nature of God can be deduced. Such knowledge edifies the church and the believer, and it corrects error which has developed through superstition and tradition. These points are made repeatedly by Calvin, including in his commentary on Isaiah 40:2–22, and his *Institutes*, I.v.9, which he titles "We ought not to rack our brains about God; but rather, we should contemplate him in his works." In this latter source he says:

It is clear, therefore, that nature is a gift of God, providing the believer with a means of knowing better the nature of God. But to say that Creation is a gift of God has further implications. It means that it has an intrinsic value.

> Consequently, we know the most perfect way of seeking God, and the most suitable order, is not for us to attempt with bold curiosity to penetrate to the investigation of his essence, which we ought more to adore than meticulously to search out, but for us to contemplate him in his works whereby he renders himself near and familiar to us, and in some manner communicates himself. . . . It is also fitting, therefore, for us to pursue this particular search for God, which may so hold our mental powers, suspended in wonderment as at the same time to stir us deeply.[27]

And in *Institutes* I.xiv.1, he says:

> Since the notion of God as the mind of the universe (in the philosophers' eyes, a most acceptable description) is ephemeral, it is important for us to know him more intimately, lest we always waver in doubt. Therefore it was his will that the history

> of Creation be made manifest, in order that the faith of the church, resting upon this, might seek no other God but him who was put forth by Moses as the Maker and Founder of the universe.[28]

It is clear, therefore, that nature is a gift of God, providing the believer with a means of knowing better the nature of God. But to say that Creation is a gift of God has further implications. It means that it has an intrinsic value. On the one hand such a view distinguishes itself from Luther's by insisting on the constancy of creation, and on the other hand it places a positive value on this world. Luther followed the more pessimistic views of Chrysostom, who held that nature was implicated in man's sin. George Huntson Williams compares in detail the Lutheran and Calvinist positions regarding nature in his "Christian Attitudes Toward Nature" and quotes Luther as saying: "The whole world degenerates and grows worse every day. All creatures, yea, even the sun and the moon, have put on sack cloth."[29] The nature of a science which investigated a degenerating, unstable cosmos would be different from that of one which viewed its subject as constant, stable, and orderly. A. Kuyper maintains that in the absence of this latter viewpoint,

> Science is unable to go beyond mere conjectures, and only when there is faith in the organic interconnection of the Universe will there be also a possibility for science to ascend from the empirical investigation of the special phenomena to the general, and from the general to the law which rules over it, and from that law to the principle, which is dominant over all. The data, which are absolutely indispensable for all higher science, are at hand only under this supposition.[30]

Calvin, according to Williams, held to the Augustinian view of nature. Nature must retain its essential goodness if it is to be a revelation of God and evidence of God's goodness. Moreover, if God's nature does not change, creation must remain constant. Calvin's conclusion after examining the alternative tradition is "Notwithstanding I say that it is the same earth which was created in the beginning."[31] Moreover, in addition to viewing the character of creation positively, Calvin taught that it was both acceptable and expedient for men to be actively involved in the study of this world. In his commentary on Genesis 2:8 he says:

> For Moses has no other design than to teach man that he was formed by God, with this condition, that he should have dominion over the earth, from which he might gather fruit, and thus learn by daily experience that the world was subject unto

> him. . . . But some one may say, that to interpret this of celestial bliss is more skilful. I answer, since the eternal inheritance of man is in heaven, it is truly right that we should tend thither; yet must we fix our foot on earth long enough to enable us to consider the abode which God requires man to use for a time.[32]

And in the *Institutes* he states similarly:

> If we must simply pass through this world, there is no doubt we ought to use its good things in so far as they help rather than hinder our course . . . .
>
> Let this be our principle: that the use of God's gifts is not wrongly directed when it is referred to that end to which the Author himself created and destined them for us, since he created them for our good, not for our ruin. Accordingly, no one will hold to a straighter path than he who diligently looks to this end.[33]

While the context of this passage implies the use of elements within Creation, the overall thrust would allow the interpretation that all of Creation, which is meant to reveal God, should be studied carefully, since that is in part the end to which God destined it for man. The implications of such a view are many, but they will be examined in more detail when we discuss the study of nature as a means of glorifying God.

One final point should be made with regard to man's seeking to know God through the study of nature, and this point has already been alluded to before. Reason has its limits, and, as Ernst Troeltsch says so well, for "Calvin, God is irrational in the sense that He is not to be measured by the standards of human reason and logic."[34] Specifically Calvin says:

> For even though our eyes, in whatever direction they may turn, are compelled to gaze upon God's works, yet we see how changeable is our attention, and how swiftly are dissipated any godly thoughts that may touch us. Here also, *until human reason is subjected to the obedience of faith* and learns to cultivate that quiet to which the sanctification of the seventh day invites us, it grumbles, as if such proceedings were foreign to God's power.[35] [Italics added]

The God Who revealed Himself in His Word is the same God Who revealed Himself in His Works, and the God Who is discovered by reason and a study of His Works must be consistent with the God Who has spoken clearly in His Word.

It is clear that for Calvin, reason should serve faith. It becomes a means of understanding what faith reveals, and hence in practical terms it must be subjected to the authority of Scripture. Methodologically, therefore, that data of experience and the conclusions of reason are never isolated from knowledge gained through the *oracula Dei*. The God Who revealed Himself in His Word is the same God Who revealed Himself in His Works, and the God Who is discovered by reason and a study of His Works must be consistent with the God Who has spoken clearly in His Word. If one's senses or reason lead to contrary conclusions, then the Word remains the authority, and senses and reason must be corrected. On the other hand, senses and reason can illuminate and confirm the Word by increasing man's understanding of Creation and hence his knowledge of the Creator.

III. The Study of Nature: A Means of Glorifying God.

Thus far we have looked at the study of nature as a means of knowing God. Let us now turn our attention to the second function which the study of nature has in reformed theology, namely as a means of glorifying God. If the first task of man is to know God, then the second task is to glorify Him. Calvin emphasizes this point when he states: "Now the great thing is this: we are consecrated and dedicated to God in order that we may thereafter think, speak, meditate, and do, nothing except to his glory. For a sacred thing may not be applied to profane uses without marked injury to him."[36]

It is at this point that another element of Calvin's teachings converges with his doctrine of Creation, namely his view of the Church and its function. Troeltsch says, on this point, the following:

> To Calvin the Church is not merely an organ of salvation which provides the objective means of grace, from which everything else should develop as a logical result, and from the standpoint of which the ungodliness of the world must be supported in patience and humility. The organ of salvation ought rather at the same time provide the means of sanctification; it ought to prove itself effective in the Christianizing of the community, *by placing the whole range of life under the control of Christian regulations and Christian purposes.*[37] [Italics added]

Troeltsch goes on to say that Calvin regarded "everything as commanded and permitted which can serve the glory of God—and by that he means that the Church is to be set up, maintained, and kept pure as a community of saints closely connected with the State and with Society."[38] Such a viewpoint requires an active involvement in this world on the part of believers, and it also breaks down the historic distinction between sacred and secular, doctrine and deed, piety and practicality. Two passages in Troeltsch are particu-

larly relevant at this point:

> He . . . rejects a faith that is based merely on dogma and authority, and discards all ideas of sacramentarian magic; he also teaches that the new life must spring from faith. But since to him the central point of religion is not the blessedness of the creature, but the Glory of God, so also the glorification of God in action is the real test of individual personal reality in religion . . . . In conflict and in labour the individual takes up the task of sanctification of the world, always with the certainty, however, that he will not lose himself in the life of the world; . . . he is free to give all his attention to the effort to mould the world and society according to the Will of God. His duty . . . is not to preserve the "new creation" in its intimacy with God, but to reveal it.[39]

A little further on, Troeltsch continues:

> In Calvin's mind God cannot reveal Himself solely in purity of doctrine; He must also manifest His active and creative nature as an energy of will. . . . The "pure doctrine" is not an end in itself, but, just as faith is the presupposition of right action, so also pure doctrine is only a presupposition and a means to some further end . . . . This explains why Calvinism, with its severe logic and its acceptance of the culture of Western Europe, maintains a far higher intellectual standard than Lutheranism, and yet lays far less emphasis on doctrine and on system . . . . God, he teaches, gave us reason to aid us in our work in the world, and for the glory of God. Thus the keenest and the most cultivated intellect, and the clearest formulation of doctrine, are only of use as tools for purposes which are above the grasp of the intellect and as a preparation for action.[40]

Such activity, since done to manifest God's glory, is a divine task, no matter what the nature of the work. Farming, for example, was called "celestial agriculture," and provided, according to Charles Webster, "an ideal opportunity to work with God and to abide by the apostle's admonition to take the fullest advantage of the power of grace (2 Cor. 6:1)."[41] Moreover, the study of nature provided man with increased capacity to subdue it, to have dominion over it, and thus to extend the Scriptural mandate. By doing that, the believer validated the Word and brought glory to the Redeemer-Creator. No matter what one's vocation, therefore, one is called to glorify God through it, and the study of nature is as glorifying to Him as is the preaching of His Word.

Another way in which the study of nature leads to the glory of God is in the discovery of how to use the gifts God has given to men. Calvin taught that the natural qualities of things "demonstrate sufficiently to what end and extent we may enjoy them."[42] He amplifies this point by stating:

> Let this be our principle: that the use of God's gifts is not wrongly directed when it is referred to that end to which the Author himself created and destined them for us, since he created them for our good, not for our ruin. Accordingly, no one will hold to a straighter path than he who diligently looks to this end.[43]

Calvin then laid the groundwork for a stewardship of Creation by discussing the proper use of it—avoiding narrow-minded frugality and immoderate indulgence. The study of nature teaches the purpose of the elements of Creation and thus their proper utilization. Webster comments on how such a view was incorporated into early English Puritan science and concludes with these words: "[I]nvestigations conducted into secondary causes, and with utilitarian ends in mind, would incur no risk of transgression, but instead glorify God, and restore man's dominion over nature."[44] The utilitarian character of Calvinism is a well documented and accepted point, but it must be made clear that it differs from the utilitarian philosophies of the Enlightenment. The study of nature takes a very pragmatic, utilitarian bent, but all is for the glory of God. Moreover, not only does the study of nature lead to a stewardship, or proper use, of it, but also the study of nature allows men to use the differing gifts God has given them in their vocations, thus glorifying Him. Indeed, Calvin's major section on men's callings, or vocations, is the final portion of the chapter dealing with the proper use of God's gifts of nature (Book III.x.1-6). He says there, "It is enough if we know that the Lord's calling is in everything the beginning and foundation of well-doing."[45] Such a view of vocation further breaks down the distinction between sacred and secular activities, for the laborer who follows his calling is glorifying God as much as is the man who preaches or who pastors the congregation. Stewardship begins with using rightly God's gifts to the individual through his calling, continues by discovering the proper use of His gifts of Creation, and is motivated by "the sense of responsibility and of the obligation to render personal service under the Lordship of Christ."[46] That is the essential character of glorifying God in a practical way.

Calvin then laid the groundwork for a stewardship of Creation by discussing the proper use of it—avoiding narrow-minded frugality and immoderate indulgence.

What is not mentioned as much in studies of Calvinism, however, is that man can glorify God in non-practical ways. The study of nature, by increasing man's understanding of the way in which it functions, increases his appreciation of the Creator and builds faith (cf. *Institutes* I.xiv.1). But while such a study may increase one's knowledge of God, it is inadequate if it does not lead to the aesthetic enjoyment of both the

Creator and His Creation. Accompanying the instructions cited above to use God's gifts for the purposes for which they were created are the following comments:

> Now if we ponder to what end God created food, we shall find that he meant not only to provide for necessity but also for delight and good cheer . . . . In grasses, trees, and fruits, apart from their various uses, there is beauty of appearance and pleasantness of odor [cf. Gen. 2:9]. For if this were not true, the prophet would not have reckoned them among the benefits of God, "that wine gladdens the heart of man, and oil makes his face shine" [Ps. 104:15p.]. Scripture would not have reminded us repeatedly, in commending his kindness, that he gave all such things to men. And the natural qualities themselves of things demonstrate sufficiently to what end and extent we may enjoy them. Has the Lord clothed the flowers with the great beauty that greets our eyes, the sweetness of smell that is wafted upon our nostrils,and yet will it be unlawful for our eyes to be affected by that beauty, or our senses of smell by the sweetness of that odor? What? Did he not so distinguish colors as to make some more lovely than others? What? Did he not endow gold and silver, ivory and marble, with a loveliness that renders them more precious than other metals or stones. Did he not, in short, render many things attractive to us, apart from their necessary use?[47]

If this passage is not sufficient proof of Calvin's recognition of the value of the aesthetic component of life, the following sentence which introduces the next section should dispel all doubts: "Away, then, with that inhuman philosophy which, while conceding only a necessary use of creatures, not only malignantly deprives us of the lawful fruit of God's beneficence but cannot be practiced unless it robs a man of all his senses and degrades him to a block.[48] The study of nature should expand man's awareness of Creation, and increased understanding should produce an appreciation of the intricacies of the work and an awe of the Maker. Moreover, it should provide the observer with more data to enjoy and to marvel at. These in turn should provoke greater adoration of the Creator, and hence direct man to glorify the One Who made all things for man's benefit and pleasure.

IV. The Character of the Science Based on Calvin's Thought

Thus far we have tried to show that Calvin's theology required an approach to nature which favored its disciplined investigation. We have seen that Creation is a means of God's self-revelation to the man of faith, and through its study, man is able to know God better and thus glorify Him as He should be praised and enjoyed. If the analysis thus far is valid, then we should be able to see certain results in the science which proceeded from this base. Let us therefore turn to some of those results and see how they were an outgrowth of Calvin's theology of nature.

First, the introduction of the Scriptures as the standard by which all propositions were to be judged produced a changed view as to the authority of classical writers. Leroy Nixon in his *John Calvin's Teachings on Human Reason* points out that

> There are two stock phrases which occur dozens of times in Calvin's commentaries and sermons. In the phrase "Philosophers say" the P is always capitalized. "The philosophers" is a standard medieval expression for Aristotle and his followers. It was used by Maimonides as early as 1175. When Maimonides thoroughly agreed, he used the name, "Aristotle;" when he disagreed, he dubbed the Aristotelians with the epithet "the philosophers." Calvin adopted this mannerism, occasionally even in the *Institutes*. In Calvin's other epithet, "all the Sophists of the Sorbonne," the initial S in "Sophists" is likewise always capitalized. Kidd has noted that during this period the scholastics were commonly referred to as sophists.[49]

Nature must retain its essential goodness if it is to be a revelation of God and evidence of God's goodness. Moreover, if God's nature does not change, creation must remain constant.

Calvin's doctrine of the Fall requires that he hold in question the opinions of all men and measure their reasoning against revelation. Aristotle, the philosophers, and the scholastics might be correct in some things, but they were to be judged on the basis of Scriptural truth, and that which was false was to be rejected. This meant, in part, that learning was moved from the classroom and textbooks to a direct study of nature. Hooykaas discusses this point in terms of the "priesthood of all believers" concept, and says this:

> This [the priesthood of all believers] implied the right, and even the duty, for those who had the talents, to study Scripture without depending on the authority of tradition and hierarchy, together with the right and the duty to study the other book written by God, the book of nature, without regard to the authority of the fathers of natural philosophy. The Huguenot Palissy was derided because he, a man "without letters" (that is, ignorant of Greek and Latin), had dared to contradict the view of the ancients, who held that minerals grow like plants. A scholar, introduced under the name of "Theorique", asks him in which book he has read his new opinion, and he retorts that he got his knowledge through the anatomy of nature and not by reading books: "I have had no other book but heaven and earth, which is known to everybody, and it has been given to *everyman* to know and to read this beautiful book."[50]

Yet the authority of Scripture did not create a "Biblical Science" as it did a "Biblical Theology." Again, Hooykaas clarifies this point when he writes:

> There was, of course, the temptation, especially for those who wanted to substitute a purely biblical theology for a theology based on Aristotelian principles, to found science too on a biblical instead of an Aristotelian basis. And this biblical foundation often meant that not only a general evaluation of the world was sought in the Bible but also concrete data about its structure . . . .
>
> However, the idea of setting up a "biblical" natural science found no general acceptance among the adherents of the Reformation. The idea was rejected by such influential writers as Ramus and Francis Bacon, Kepler and Wilkins . . . . In general, the "biblicism" of the Reformed Christians was not concerned with scientific topics, and in seeking the data of science solely in the book of *creation*, they followed the examples of one of their main teachers, John Calvin.[51]

The result was a return to the study of nature, by direct observation and manipulation (or experimentation). At the same time, it was expected that the Holy Spirit would lead the student of nature to recognize truth which had been formerly discovered. The student was thus allowed to observe, freed of the shackles of tradition, but at the same time permitted to utilize those "truths" which were consistent with Scriptural revelation. Moreover, as Hooykaas indicated, the concept of the priesthood of all believers implied a duty for all who had the talent to observe and to learn from nature to exegete its text in the same manner as those who had the ability to explain the Word were obligated to perform their services—both for God's glory and for the sake of the community of believers.

The rejection of tradition as authority and the egalitarian character of Calvinism as exhibited in the doctrine of the priesthood of all believers had an impact on a very important philosophical concept which had strongly influenced science, namely the concept of the Great Chain of Being.[52] Based upon classical Greek ontology, especially Aristotle's, and developed by Anselm and Thomas Aquinas, all of creation was ranged in a hierarchy of being ranging from divine, angelic, and human, on down to the simplest matter. Eugene M. Klaaren claims that Calvin rejected this view, and supports that claim in various ways.[53] First of all, Calvin did not maintain the essence-existence distinction of Aquinas, and so the Thomistic distinction between primary and secondary causation and a scale of causes was absent in Calvin. But more central to Calvin's rejection of the chain of being was his "conviction that all creation was egalitarian because of its ultimate dependence upon God's power."[54] Several passages in the *Institutes* show that Calvin did not view the angels as intermediaries between God and man (e.g., II.12.1), and because they were dependent upon the Creator for their existence in the same way as man, they were no higher (nor lower) than humans. Similar logic forced the rejection of the total hierarchical system. By freeing the student of nature from the confines of this pattern of thinking, reformed theology created an atmosphere in which physical or biological, not ontological, relationships could be explored.

But if it is true, as we said earlier, that all who had talent had a duty to serve the community, then the community in turn had a duty to help all develop their talents. The result was a move toward universal education. Webster describes the view and priority given education in this way:

> Pre-occupation with the deficiencies of the senses and reason, awareness of the inherent defects of the cultural inheritance, and appreciation of the degree of labour required for correction induced a sharpened awareness of the difficulties of education. At the same time it was realised that childhood and youth were God's gift to each generation, constituting a perpetual challenge to man to redeem his state of corruption. Each new mind was a *tabula rasa*; every child was as impressionable as wax . . . . Education was seen as a battleground, on which society's education mechanisms were tested against the impinging forces of evil. Through education, the Kingdom of God came within the reach of each generation, but failure to exploit its potentialities had perpetuated man's ruinous condition. Education was accordingly both a source of hope and a reminder of human inadequacy. . . .
>
> Belief in the impending millennium prompted the Puritans to redouble their educational efforts, so that the ground might be prepared for the Great Instauration. In the final age the barriers to knowledge would be removed, but only after dedicated individual effort, and the total utilisation of human resources, would God grant his full Light of Wisdom.[55]

Practically, this resulted in a drastic revision of education, and by the middle of the 17th century, new educational objectives were to be found among many of the Puritans in England. Sciences were to be founded on Baconian axioms; ideas and systems were to be evaluated according to merit, not authority; manual experience and laboratory experimentation were to be preferred over disputational and library learning, with chemistry serving as the model for the empirical sciences; and Galenic medicine was to be rejected and Paracelsian medicine incorporated, since the latter would promote a more systematic study of diseases.[56] Moreover, this education was to be in the vernacular, reducing even more the authoritive influence of the ancients and promoting the dispersal of knowledge throughout the community. In this regard, Webster says:

The study of nature should expand man's awareness of Creation, and increased understanding should produce an appreciation of the intricacies of the work and an awe of the Maker.

> By a reversal of the priorities of traditional education, languages would be acquired only where relevant to an increased understanding of the natural world. The foundation of knowledge would be the solid learning of science and mathematics, conducted in the vernacular . . . . Thus the process of education would lead naturally into vocational life, each member of the community being equipped for public service conducted out of a sense of religious obligation.[57]

Hence the benefits of the increased educational emphasis within the Reformed tradition were quickly appropriated by society at large.

The emphasis on practical public service, even in the sciences, can be seen in the outline of science subjects taught at the highest level in the Reformed Schools in England in the early 1700's. The students learned agriculture (building on earlier studies in husbandry); natural history, and the histories of meteors and minerals; architecture, engineering, fortification, fireworks, weapons, military discipline, and navigation; mathematics, including optics and accounting; medicine, including chemistry and pharmacy; and surgery, including dressings and ointments.[58] Such a curriculum illustrates the active this-world emphasis of Reformed pietism, which contrasts greatly with the more aesthetic, passive, other-world pietism of both the Catholic and the Lutheran traditions. It also demonstrates the emphasis placed on observationally based sciences rather than the more speculative ones.

The final result which can be seen in the sciences built upon Calvin's theology of nature occurred when a philosophy developed which was divorced from the theology. The orderliness and stability of nature demanded a Creator, but without the theology which insisted upon the providential character of the Maker, there was a shift to deism and mechanism. The value which Calvin placed on the creation as a gift of God led, with the theology removed, to materialism. And whereas Calvin required that reason be submitted to the revelation of Scripture, those who rejected the theological roots elevated reason, with the resulting forms of rationalism as the outcome. The scientific study of nature was no longer a duty of men who sought to know the Creator and to glorify and enjoy Him, but it was now the pursuit of those who sought knowledge for its own sake, or who wished to control and subdue nature for their own benefit. The philosophy which was to predominate by the end of the 17th century was indeed an outgrowth of Reformed theology, but it was cut off from those roots, and it would therefore have been viewed by Calvin as a heresy in need of reform.

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The View from a Censored Corner

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The following is a personal account of the withdrawal from circulation of Brave New People. *Originally published in the United States by IVP/USA, a new edition has been published by Eerdmans. References to IVP are to IVP/USA and not IVP/UK, the publishers of the book in Britain.*

At 5 a.m. on Wednesday, 6 June 1984, my world changed. It was then that I was awoken from a deep sleep by the telephone at the side of my bed. Much to my somnolent astonishment it was Jim Sire phoning from the InterVarsity Press (IVP) headquarters in Downers Grove. His calculation of the enormous time difference between the Mid-West of the United States and New Zealand was two hours out—it was not 7 a.m. New Zealand time but 5 a.m.

I was not in a particularly receptive frame of mind at that hour; nevertheless, I was sufficiently awake to be aghast at what he told me. My book, *Brave New People,* had been very severely criticized by an anonymous writer (later to be identified as Douglas Badger) in *Action Line*, the newsletter of the Christian Action Council (CAC). Letters were also arriving at IVP objecting to its publication, a move advocated by the CAC.

This was to be the first of a number of trans-Pacific phone calls. Later ones were to recount the material distributed by the CAC and the "open letter" circulated by Franky Schaeffer outside the Christian Booksellers' Convention in Anaheim, California; the picketting outside the IVP offices; the flow of critical letters (largely in response to calls by certain groups for the book to be withdrawn from circulation); the boycotting of all IVP publications by some booksellers, and the replies formulated by IVP to the critics of *Brave New People* and of IVP as a publisher of evangelical literature. And finally came the phone call announcing the end (as it then seemed) of the whole episode—the withdrawal of the book from the American market by James McLeish, the director of Inter-Varsity Christian Fellowship (IVCF).

What had given rise to such unprecedented reaction? This was the first occasion in the 43-year history of IVP that a book had been withdrawn from circulation. My reason for writing *Brave New People* had been to inform Christians and others about the major technological developments in reproductive biology. My focus of attention, therefore, had been *in vitro* fertilization, artificial insemination, cloning, amniocentesis, genetic counselling and the whole technological environment responsible for these developments. I had also attempted to view these procedures within a biblical and Christian framework.

The furore, however, was not over my treatment of these issues. My crime—I do not think that is too strong a word—lay in the chapter on therapeutic abortion. It was in that chapter that I had apparently transgressed all the principles of evangelicalism, by allowing for abortion under certain circumstances. A few of my critics even contended that I wrote the book in order to promulgate a liberal view of abortion.

The lines of battle all too quickly fell into place. I was depicted as the arch-proponent of abortion on demand with my critics representing the forces of anti-abortion-

ism. Completely unawares, and certainly against my own desires, I found myself cast as a leader of the pro-abortion forces within evangelicalism. No justification, it seemed, was required to support this assignation, in spite of the fact that *Brave New People* only incidentally dealt with therapeutic abortion and hardly dealt at all with abortion in general terms.

I found that my "heretical" views had earned me notoriety within evangelical circles. Not only this, but, in the eyes of some, my views were so dangerous that they had to be censored. And they were—for quite a few months anyway—since *Brave New People* was withdrawn from the American market by IVCF. The censorship was carried out by a few self-appointed guardians of evangelical morality, who conducted a vociferous and concerted campaign against the book, myself, and the publishers.

Headlines and Labels

The Christian media, like the secular media, feeds on headlines and one-liners. Hence, *Action Line* described *Brave New People* as lending Christian respectability to the "pro-choice" position.[1] Joseph Scheidler of the Pro-Life Action League described it as "one of the most blatant pro-abortion books I've ever seen"[2]. For Curtis Young, Executive Director of the CAC, it represents the pro-abortion arguments of the 1960's baptized in Christian terminology".[2]

The *Christian Courier* in a headline described it simply as a "controversial abortion book," and an editorial in that magazine thought it was "on the garbage edge of evangelicalism".[3] For one writer of a letter to *Christianity Today* I had "advocated [the] murder of unborn children,"[4] while another considered that *Brave New People* "opens the doors for abortion on demand."[5] According to this latter writer *Brave New People* can be compared to books promoting "incest, rape, pornography, and child abuse." When the IVP offices were picketted by members of the Pro-Life Action League the banners included slogans such as "IVP revives eugenics," "Let the handicapped live," "Abortion the ultimate child abuse," and "Abortion kills babies."

The publishers have also been depicted in stark terms. IVP, for instance, was described as "a company which promotes therapeutic abortion;"[6] while another claim was that "therapeutic abortion is backed by 'evangelical' publisher [Eerdmans]."[3] One reviewer concluded that "Every secular publisher in the country has stuff like this."[6]

Vitriolic Reviews

Beyond these headlines and graphic labels, a number of writers have fulminated over what they view as the thrust and basic stance of *Brave New People,* of myself, and of IVP and its editorial staff.

Franky Schaeffer[7] described the book as an "amalgam of dishonesty," containing "coercive, leftist, and pro-abortion ideas." He saw it as a "noxious dish of reviving the eugenics movement of death as a solution to social problems," employing "seductive liberal jargon." It was, he asserted, "a vehicle for the propaganda of the therapeutic abortion industry, dressed now in evangelical robes." On the basis of such an assessment, Franky Schaeffer suggested that it was time for IVP "to shut their doors," and that Christian booksellers should "re-evaluate [their] reason for stocking IVP books."

According to Gary North[8] *Brave New People* is a "monstrous book" in that "it imposes the satanic ethics of abortion on Christian consciences in the name of autonomous medical technology." It is claimed by North that I am guilty of writing "gibberish about complex moral issues," since God says "no" to abortion. I am said to espouse the ethics of sentimentality, the source of which is humanism. Moreover, he contends that my arguments lead to euthanasia, a senile person being—according to his interpretation of my analysis—

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"an expendable elderly fetus." North also refers to my "incomparable hypocrisy" and queries my Christian position with the words, "He claims he is a Christian." North also suggests that I am destined for hell: ". . . the heat that he will face approximately ten seconds after his death."

Douglas Badger[9] places considerable emphasis on my use of the concept of personhood, arguing that it is not found in Scripture and that it was devised to "create two classes of human beings: those whose lives have value and those whose lives may be ended with impunity." I am also said to have argued that "God cares little for babies who are spontaneously or intentionally aborted," and he implies that I would support all abortions performed on women whose pregnancy threatens their physical or mental health. Quite specifically, he interprets my stance as suggesting that "abortion . . . is morally justifiable under *many* circumstances," and that I believe "that the destruction of unborn individuals is *often* the best solution to the problems of individuals who have been born."[10] (Italics mine.)

Badger further proposes that my arguments are indistinguishable from those used to support abortion on demand and infanticide. The implication appears to be that I also support abortion on demand and infanticide. My approach is, according to him, "the standard fare of pro-choice apologists" and my defence of therapeutic abortion is the same as that of organizations such as National Abortion Rights Action League and Planned Parenthood.

Badger also contends that I do not regard "unborn children as being the image of God," and that I "would deny that many handicapped individuals are persons." He argues that my treatment of the biblical texts relevant to the legitimacy of abortion is "dismal," and that I fail to come to terms with the biblical admonitions against violence—admonitions that in his view rule out abortion.

The theme of a number of my critics is that someone with my position on therapeutic abortion cannot be an evangelical. Jan Dennis,[11] for instance, states this, and also contends that my whole view of human biotechnology is open to condemnation. According to his assessment of *Brave New People*, I "blithely endorse" a whole range of technological procedures, and espouse "quality of life" concepts as did Hitler's eugenicists. According to Dennis, I wish "to sanction the manipulation of a certain class of human beings (embryos and fetuses) in various unpleasant ways." I accomplish this, he continues, by declaring "fetuses non-persons;" in this I am compared to Hitler's eugenicists and to slaveowners in the South. Dennis describes me as being "pro-choice" and states that my "position inevitably leads to abortion on demand." I am an example, he says, of those who have "accommodated themselves to the world" and "given themselves over to a reprobate mind." In short, I have jumped "on a bandwagon bound for hell."

My Christianity comes in for censure by Shelley Nicholson,[12] who describes it as "pure, unregenerate, existential humanism." She interprets my discussion as leading to a view of God as "too old-fashioned to have addressed these issues [abortion and eugenics] in His word." She concludes her review of *Brave New People* by stating that it is "an excellent example of justice perverted . . . . God's Law replaced by man's."

A Personal Response

These are exceedingly strongly held viewpoints. When looked at *en masse*, they question almost everything I stand for. Some question my Christianity, others my evangelicalism; some inform me I am bound for hell, others that I am dishonest and hypocritical. What I have written is described as garbage; it is a product of unregenerate humanism. My views are blithely compared to those of Hitler's eugenicists, and what I have written is placed in the same category as books favouring rape and incest. I am regarded as a pedlar of abortion, with a leaning towards infanticide and euthanasia, and with a very low view of human life in general.

I have no wish to escape the force of these criticisms, since they may be true. If they are true though, I have to examine myself very seriously to see where I stand before the One I have long considered to be my Lord and my God. *Brave New People* was written as a Christian contribution to thinking on the implications of some of the new developments in biomedicine. When I am severely indicted by Christians, I must question whether I have been deceived, and whether my efforts to speak Christianly on issues within society have been of any avail.

These are possibilities I dare not shun. My critics may be right; there is no place for me or those like me within evangelicalism. On the other hand, those critics who have castigated my contribution to the bioethical debate may themselves be wrong. In saying this, I am not suggesting that my views on the range of bioethical issues discussed in *Brave New People* are correct down to the last detail, nor that the stance of my critics on abortion does not have merit. Rather, the condemnatory tone of their criticism, the assurance that their views are the only tenable ones within evangelicalism, the personal abuse hurled at me, and the selective reading of *Brave New People* in which most of them

have indulged, together amount to actions and attitudes that are foreign to Christian conduct.

As the person at the centre of this controversy, I have found it impossible to escape from the logic of this confrontation. Either my own position and my attitudes are anathema to true Christianity, or the attitudes of my most belligerent critics are impossible to reconcile with the standards of Christ.

It may be objected that I am too emotionally involved in the controversy, and hence my analysis is an unduly extreme one. After all, many Christians have been hurt by the criticisms of other Christians, and there have been many bitter controversies within the Church. And yet with hindsight we recognize the strengths and weaknesses of the respective antagonists. All this is, of course, true; and if it was the case in this instance, I would have no problem. In the preface to the first edition of *Brave New People*, I expressed the hope that my arguments would be used as the *basis* of urgent and serious debate. I have never suggested that any of my views should be regarded as the last word on any subject. My aim was to inform, so that others might come to their own conclusions and formulate their own opinions.

Unfortunately, my critics have not allowed me this privilege. They have argued that *Brave New People* does not represent a legitimate contribution to bioethical debate within evangelicalism. This is especially true of the discussion on therapeutic abortion, although it probably extends beyond the narrow confines of abortion. In their eyes there is no place within evangelicalism and evangelical literature for my contribution. They are sure that they are right, and they know equally well that I am wrong. This is their assessment, and it is an extreme one—as manifested by their campaign to have *Brave New People* removed from the American market. My arguments are considered to be so dangerous that ordinary Christians must be shielded from them. There is no room for informed opinion or dialogue.

It is not my intention to argue this issue through in this article. I leave readers of *Brave New People* to weigh up the arguments set out there for themselves. That is both their privilege and their duty. What concerns me here is the nature of the confrontation foisted on me. The arguments of my critics are exclusive ones—they are the representatives of true Christianity, whereas I am a threat to true Christianity and a false teacher.

This is a possibility I have considered repeatedly over the past months. I have examined numerous biblical passages dealing with false teachers and false teaching, and I have also studied some of the confrontations experienced in the early church. Am I a false teacher, or do some of my critics fall into this category? I am deeply disturbed even at the possibility of such an antithesis, since I regard my critics as brothers and sisters in Christ. They are as much Christ's representatives as I am. If they deny my standing in Christ, that is their judgment and it is a matter between themselves and their Lord. Nevertheless, if they are prepared to divide the body of Christ over these matters, the question of false teaching cannot be completely overlooked.

My plea is that we all examine ourselves regarding the biblical mandate we have for our views and beliefs, and the extent to which our attitudes reflect the work of the Spirit. Are our cherished beliefs as firmly based upon biblical principles as we like to think, or do they subtly reflect many cultural and nationalistic pretensions? As we advocate our own position, do we do so with patience, kindness, gentleness and self-control?

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Abortion and Absolute Beliefs

I sympathize with all those who are appalled at the immense tragedy of abortion on demand as currently practised in many countries.[13] The tragedy is perhaps illustrated most starkly in the United States, and some of the consequences of the present legislative situation in the United States following the *Roe* v. *Wade* decision in 1973 are horrific. I understand the intensity of feeling expressed by those with a high regard for fetal life, and I share it (however difficult it may be for some of my critics to accept this).

What I must object to though, are the procedures adopted by some of my critics. Ignoring the tone of my writing and also quite explicit statements about my stance on abortion-on-demand, sentences and phrases have been interpreted to mean what my critics think they should mean and not what I take them to mean. Further, on quite a number of occasions, my descriptions of other people's opinions have been interpreted as though they are my opinions. Even my attempts to show that fetuses and handicapped children should be

treated with dignity and respect have been interpreted negatively, as though I believe that all fetuses and handicapped children are of no value and can be killed.

The difficulty appears to be that my critics recognize only two positions on abortion: the absolute protection of all fetal life, or abortion-on-demand. Since my position does not fit into the former category it must, it appears, fit into the latter. Hence, the attempts to demonstrate that I am a typical example of a pro-choice, abortion-on-demand advocate. When I contend that this is not my position, I am accused of being superficial, inconsistent, or devious.

Underlying all attempts to establish this simple dichotomy is the belief that a final solution to the abortion question must be a legislative one. My critics would, I imagine, contend that abortion should be legally prohibited since it amounts to murder. Any less-than-absolute position on abortion is seen, therefore, as a threat on these two counts—it undermines the belief that the evangelical community is politically united in its absolute anti-abortion position, and it questions the assertion that abortion under every conceivable circumstance amounts to homicide.

A repeated criticism of my position on abortion has been that many will stretch it and use it as an argument in favour of abortion for reasons of convenience. This, it is stated, is what makes my position and the book so dangerous; the effect of my views will be to support abortion-on-demand. Probably any rational response by me will not placate those who believe this. It should be noted, however, that my position differs from that adopted by the Supreme Court in its *Roe* v. *Wade* decision; it is misleading, therefore, to move directly from the consequences of that decision to the perceived consequences of my position. Further, my remarks are primarily addressed to Christians, who stand before God for all their actions. My critics appear to believe that Christians (and the public-at-large) only need someone to suggest that abortions may sometimes be permissible, for them to clamour for abortions for any reason whatsoever. It is my hope that a careful reading of *Brave New People as a whole* will convince my readers that it is my firm belief that the decision by a woman (Christian or otherwise) to have an abortion is one of the most serious decisions she could ever take, and it is a decision that should not even be contemplated except in the most dire of circumstances. For a Christian it is a decision that should always be made before God, and after much prayer and soul-searching. To have an abortion under any other circumstances is to fail in one's duty as a Christian and human being.

The absolute stance adopted by my critics would appear to mean that there are never any grounds whatsoever for an abortion, even when the mother's life is in danger. Whether this is the case I am not clear, except that criticisms of my position have not hinted at any exceptions to the absolute inviolability of the fetus. It has to be asked whether this stark absolutism has a biblical mandate, and also why such absolutism is not invoked by many evangelicals when it comes to divorce (on which there is ample explicit biblical teaching), or to the taking of human life under other circumstances—at an individual level in self-defence or at a national level in both offensive and defensive wars.

Modern societies appear to thrive on labels. They are the easiest way we know of placing people and ideas in compartments. Once we have done this we can laud them or ignore them as we wish.

The fallenness of the human condition introduces conflict and strife into our world, and ensures that an absolute stance is *sometimes* impossible to maintain. This is the argument generally adopted when opposing pacificism as an option for Christians. It is argued that utopian schemes bring tragedy, and that the Bible is never utopian. Although we are on dangerous territory when arguing in favour of *any* killing, it is difficult to see why an *absolute* anti-killing stance holds in some situations but not in others; or why utopianism is acceptable in some areas but not in others.

The Danger of Labels

Modern societies appear to thrive on labels. They are the easiest way we know of placing people and ideas in compartments. Once we have done this we can laud them or ignore them as we wish. And so we have right-wing or left-wing, pro-life or pro-choice, pro-abortion or anti-abortion, creationist or evolutionist, capitalist or communist. Everything and everyone can be labelled; it is simplicity itself. Unfortunately, it does not allow for exceptions to a general rule or for any middle-ground or intermediate position. Labels acknowledge the legitimacy of extremes and of nothing else.

A book such as *Brave New People* must be labelled and, as we have already seen, it becomes a "pro-abortion" or "pro-choice" book. The fact that it is not primarily about abortion becomes irrelevant, as does

the fact that it is neither pro-abortion nor pro-choice in the way in which society-at-large uses those labels. Such labels, therefore, are highly misleading and give to the book a false reputation.

One way in which this can be illustrated is by the extremely diverse reactions to *Brave New People*—from outright hostility on account of its allegedly pro-abortion stance, to appreciation of its balanced treatment of all the bioethical issues dealt with, including therapeutic abortion. In general, the former response is that of those who have labelled it in a particular way, while the latter represents the response of many of those who have not attempted to see it in terms of one particular viewpoint.

Labels circumscribe what a person or book stands for. They also tell others more about the perspective of the labellers than of those being labelled. What is so sad about labelling is that important contributions to an issue are lost. We do not read the writings of theological "liberals" or "charismatics;" we refuse to listen to "conservatives" or "premillenialists." No matter what our choice of labels to espouse or detest, we automatically shut ourselves off from the contributions of many devout, biblical Christians when we allow ourselves to be guided by labels alone. This is not to say that all books are of equal value, nor that certain theological contributions have not proved of greater value than others. What it does mean is that labels can be very misleading and may sometimes quench the work of the Holy Spirit.

To suggest that *Brave New People* sets out to advocate abortion is untrue, and yet this is the message of so many of the labels that have been appended to it. They detract from the thrust of the book as a whole, and smother its Christian perspective on biomedical technology and the reproductive revolution. This, I contend, is a great disservice to the cause of Christ, and impugns the integrity of those who have been misleadingly and unhelpfully labelled.

Scope of Evangelicalism

For many of my critics I cannot be regarded as an evangelical, since I cannot state categorically that personal life commences at day one of gestation. This, it seems, is being made a basic affirmation of evangelicalism, from which there can be no deviation. To adopt a position that deviates from the view that the embryo is anything less than a person demanding *complete* protection under *every conceivable circumstance*, is to exclude one automatically from the domain of evangelicalism. According to some of my critics there is no room even for discussion of this point.

In our ardent desire to be thoroughly biblical on some peripheral issue (no matter how important in its own right), we ignore the plain teaching of Christ on the unity of his church.

Differences are still allowed within evangelicalism on issues such as baptism, the charismata, nuclear warfare, the role of women in the church, divorce; on a vast range of social questions, and even on the inerrancy of the Bible. But there are to be no differences on the precise nature of the personhood of the embryo. To deviate on this matter is to court spiritual and moral disaster. No longer is it sufficient to hold to classic evangelical affirmations on the nature of the biblical revelation, the person and work of Christ, or justification by faith alone. In order to be labelled an evangelical, it is now essential to hold to a particular view of the status of the embryo and fetus. Were this approach to be generally accepted it would have profound repercussions for the nature of evangelicalism. I leave it to others better qualified than I to pursue this matter further. The question confronting us is 'Do we have adequate grounds for making this issue a *theological* watershed?'

A somewhat different attack on my evangelicalism is provided by those who accuse me of having accommodated the thinking of a secular technological society. The essence of this criticism is that I do not take Scripture seriously. My principles have been moulded by technology; and I use Scripture to back up decisions already reached on humanist grounds.

Such a criticism has a spiritual veneer, since it advocates absolute standards. Any position recognizing exceptions to such absolute standards, no matter how rare, is condemned as less-than-biblical. This critique, however, takes no account of the theological principles outlined in some detail in *Brave New People*, and of their stress on the significance of people in their wholeness. It is also based on a variety of assumptions about the status of the fetus.

But is the absolutism promulgated in the area of prenatal life as faithful a manifestation of the biblical ethos as is often assumed? Is it maintained in other ethical areas, and can it be successfully translated from a general principle to the individual situation where the results of our fallenness may be all too evident?

A temptation to which evangelicals are prone when discussing ethical issues is to think that generalizations can suffice in the real world. It is easy to contend that the Christian position is *always* to preserve prenatal life, and to aver that any deviation from this viewpoint is sub-Christian. It has to be asked, however, what meaning this has in the midst of some of the horrendous dilemmas which doctors and families have to face. Christianity must speak a message of reconciliation and forgiveness to those in the midst of such dilemmas, and this is where a less-than-absolute stance on prenatal life may occasionally have to be contemplated.

All too easily we shun what we regard as *compromise* in these conflict situations. Generalizations about the *inviolability* of fetal life under every conceivable circumstance cannot cope, and yet many decry *compromise* and *accommodation*. In *Brave New People* I took seriously these conflict situations and I was castigated for it. Nevertheless, the challenge remains: 'Do our generalizations suffice when faced by these predicaments;' and 'Do we know how to show compassion and ethical discernment while continuing to be thoroughly biblical in our outlook?'

Evangelicalism remains very uneasy about technology. While we accept some aspects of it with hardly a whimper, we continue to fight a rearguard action against other forms of technology. Evangelicals are as dependent upon electronic and other forms of technological gadgetry as anyone else in our communities. We have also been very willing to utilize it in the proclamation of the gospel, and only a few voices have been raised against the dangers of an over-dependence upon technology. There have been few serious evangelical critiques of modern medicine, much of which we accept with gratitude and sometimes with adulation. And yet modern reproductive technology is viewed with fear and deep concern. Even here though, there is ambivalence. While contraception has gained widespread acceptance within evangelicalism, genetic engineering, *in vitro* fertilization and artificial insemination leave us fearful and unhappy that humans may be playing at being God.

Some of these fears are justified, as I pointed out in *Brave New People*. What we have not accepted is that there is a legitimate place within evangelicalism for professionally-trained scientists and doctors to explore these realms honestly and openly. Without such exploration, the responses of evangelicals will continue to owe far more to conservative attitudes than to a seriously thought-out biblical assessment.

Freedom of Expression

One of the major features of the *Brave New People* episode is our inability to cope with differences of opinion within evangelicalism. The reaction to an opinion considered unacceptable is to muffle that opinion and to ostracize its holder. It has to be asked whether we, as evangelicals, believe in freedom of thought.

Many evangelicals and fundamentalists complain bitterly about the humanist bias of the media in America and also of the difficulty of getting a fair hearing for the evangelical point-of-view. Unfortunately, these same people do not appear to be worried about stifling freedom of expression when it suits their own purposes. Neither do they worry about unfair bias when it works in favour of their cause. It should not surprise us then, that those outside evangelicalism look with suspicion on our claims to revere freedom of expression and opinion.

Allied with this is the readiness with which Christians will hurl personal abuse at other Christians. The lesson seems not to have been learnt that criticism of ideas and criticism of the people holding those ideas need to be clearly distinguished. I have no objection to people criticizing what I write—that is their prerogative. However, when this is accompanied by a questioning of my motives and an assault upon my character and reputation, the criticism has entered quite a different realm. And the question is 'Should this be a realm Christians enter?'

The result is that no distinction is made between public polemic and serious ethical debate, and evangelicals are not allowed to discuss in public controversial topics that have public implications.

In this regard, one is tempted to say that the standards of some Christian groups are lower than those of secular organizations. For instance, one medical research funding body gives this advice to referees of research proposals: "In your scientific assessment of the application, you should attempt to avoid subjective criticisms or statements that are personally damaging." Oh, that Christians would adhere to the same standards when disagreeing with their brothers and sisters in Christ!

We need to learn how to disagree with each other in a positive and helpful way. We need to beware of turning friends into enemies, simply because we do not see eye-to-eye on everything. In my experience, fellowship has been completely broken with other Christians because we cannot agree on some matter peripheral to the essentials of our faith in Christ. This surely is schism; it is a tearing-in-two of the body of Christ. What issues are *that* important? In our ardent desire to be thoroughly biblical on some peripheral issue (no matter how important in its own right), we ignore the plain teaching of Christ on the unity of his church. This is to our shame, and it should make us re-examine whether our overall attitudes are as biblical as we may like to think.

Within Christian circles the principle of dialogue based on respect for each other's position and integrity should always be present. When this is lost, it is replaced by an unyielding harsh legalism that is prepared to destroy people and institutions in order to win a political battle. In the biomedical area we can be assured of one thing, and this is that the ethical dilemmas of modern medicine will not go away; they will only increase. The nagging question which remains is whether evangelicalism will provide constructive ways forward or simply piously-packaged solutions that ordinary evangelicals will ignore when confronted by difficult choices. Debate is essential. Some of it will be hard-hitting. But debate there must be within evangelicalism. Otherwise, we shall be left fighting old battles that have already been lost, and the loners fighting the contemporary battles will, for all practical purposes, be denied the name of evangelical.

Debate over complex ethical issues (and there *are* complex issues, despite what some of my detractors contend) has a place, therefore, within evangelicalism. More than this, debate is *essential* when tackling issues over which no evangelical consensus has been reached. The presentation of representative evangelical views is the essence of any community based upon belief in the priesthood of all believers. This right of presentation must, therefore, be safeguarded in the Christian community. Without this we shall soon succumb to dictatorship, and the end-result will be a totalitarian society and not one based upon the freedom and responsibility that are found in Christ alone.

A healthy Christian community is a debating community. Intellectual honesty and spiritual integrity demand this when the issues at stake are complex and difficult to unravel. This is not a call for cowardice, mediocrity or a blurring of ethical guidelines, but for an honest assessment of the moral burden placed upon us as Christ's representatives.

Public Polemic and Serious Debate

Issues of public concern have long posed difficulties for evangelicals. After many years of neglect evangelicals have more recently realized the importance of a Christian voice in political and social matters. This is all to the good, and is a return to the realization that we are to exercise our ministry as salt and light within society. Nevertheless, social involvement has its dangers and one that is evident at present is the drive for a "unified evangelical voice" on certain issues within society. One of these issues is abortion.

No matter what the rights and wrongs of this evangelical concern, it has led to a pressure group mentality according to which there is only one stance on abortion that can be tolerated within evangelicalism. Any deviation from this rigid position is considered a betrayal of the evangelical cause. The result is that no distinction is made between public polemic and serious ethical debate, and evangelicals are not allowed to discuss in public controversial topics that have public implications.

A book such as *Brave New People*, which was written to explore complex and, in many instances, unresolved ethical quandaries is treated as though it was a political pamphlet aimed at advocating one particular viewpoint. The vicious criticisms of it are criticisms of it as a political polemic. Since it was not written in this form, its arguments are oversimplified, the bulk of the issues are ignored, and sentences or phrases are repeatedly taken out of context to mean something other than I intended them to mean. My views are treated as though they were written from a pro-abortion standpoint; they are then criticized within that context, rather than on their own merit. The end-result is that the glib descriptions of the book and the treatment afforded it are a travesty.

Having seen numerous criticisms of *Brave New People*, I have been left wondering how anything could be so misread, and how arguments could be so misunderstood. Plain statements are misinterpreted, and often become the opposite of what was intended. While I am sure I could have expressed myself more clearly, I am equally certain that educated people should be able to read what is written and to follow arguments even though they may disagree with them or consider them to be fallacious. The major stumbling block appears to be that complex arguments and open-ended positions are not acceptable in some bioethical areas—everything must be cut-and-dried and must conform to a precise political platform. Unfortunately, the dilemmas of life and death frequently do not conform to the niceties of black-and-white political debate, and Christians should be the first to realize this.

The Way Forward

It would be quite wrong of me to end this article on a negative note. That should never be the conclusion to disagreement amongst Christians. As evangelicals we should be sketching out the common ground there is between us, and then with this as our basis we can begin the task of serious dialogue on those issues that divide us. For me, and I trust for evangelicalism at large, the only reliable framework is biblical authority; our only base is God—his character, standards and faithfulness; the Lord and Master is Jesus Christ whose totally unconventional directives provide us with important clues for the decisions we have to make in life; the Holy Spirit is our source of power and comfort. We should be characterized by an openness to Scripture, by new initiatives, by hope, and by a meaningful response to the real world in which we all find ourselves.

These are generalizations, and they may seem a long way from the controversies surrounding *Brave New People*. And yet they are not. Repeatedly throughout the pages of *Brave New People* it is these principles that surface as I discuss topics from amniocentesis to zygotes. By all means let others disagree with my views on anything from amniocentesis to zygotes, but if they are arguing from a Christian perspective it is also their duty to demonstrate the faithfulness of their stance to the principles of evangelicalism. This is the obligation placed on all of us.

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Communications

Reductionism, Preductionism and Hierarchical Emergence

One of the philosophical puzzles that lies close to the heart of many considerations of science and religion is the question, "How does novelty arise?" Of particular interest, of course, are such major novelties as the beginning of the universe, the origin of life, and the origin of human personality. But in its more detailed aspects, this puzzle is not limited to these major qualitative changes, but applies to many smaller changes as well.

Within the context of secular scientism, the question of the origin of novelty has received a single answer: chance, purposeless and meaningless chance. Within the context of historic Christianity, this question has received two types of answers: (1) novelty arises from the direct and instantaneous creative activity of God, without process and without the possibility of continuous scientific description; and (2) novelty arises from the midst of continuous process in which God's activity can be discerned through the eyes of faith.

The first Christian answer is that of *fiat* creation, in which God's intervention into the natural order is seen as essential for the beginning of the universe, of life, or of human personality. Historically, such an approach has frequently become a case of the God-of-the-gaps: a Christian apologetic which is based on the argument that there is no natural way for these beginnings to have occurred. Since they have occurred, it may be concluded that God exists. Since a scientific description of these origins in terms of continuous process is still in the realm of hypothesis rather than in the realm of established evidence, many Christians continue to hold to these origins of novelty as fundamental evidence for the existence and mode of activity of God in a world increasingly described by science. For such an apologetic to have force, however, it is necessary to maintain both that God did act historically by *fiat* (the fact that God might have acted by *fiat* is insufficient), and that no non-*fiat* description is possible. It is precisely these contentions that seem to be receiving increasingly suggestive answers.

As we learn more about the structure of created reality, it seems more and more likely that indeed it is possible to provide a scientific process description of these origins—whether or not they actually did occur by process or by *fiat*. That being alive does not require the presence of some entity, a vital essence, but can most probably be correctly regarded as a property of the patterned interaction of the created matter become alive, appears to be the consensus of biological scientists, both non-Christian and Christian alike.[1] That being human does not require the presence of some entity, a soul and/or spirit, but can most probably be correctly regarded as a property of the patterned interaction of the living creature become human, appears to be a growing consensus from both scientific and biblical perspectives.[2] Even the origin of the universe from nothing, considered as the one absolute scientifically indescribable event, can now be at least theoretically treated in terms of the new "inflationary universe theory" in which the origin of the universe from nothing can be considered within the context of natural processes.[3]

Although the segment of the Christian community that still holds to *fiat* acts of God as a necessary perspective is large, it is becoming more and more out of touch with the realities of present understanding. Christians who are involved both with the understanding of the biblical revelation and with a scientific description of this world's processes are turning toward some way of synthesis between these two inputs; i.e., they are turning toward the second answer given above and are seeking ways of integrating it into their theological and scientific world views.

Three types of explanatory contexts have been advanced to deal with the origin of novelty in the world if that origin is indeed in principle describable by continuous process. The first of these is *reductionism*, the position of secular scientism, and the principal target of Christian apologists because of its materialistic and essentially atheistic perspective. In reaction against reductionism, many Christians have been tempted to the opposite pole to what I have called *preductionism*. In this communication, I discuss briefly these two antithetical possibilities and advocate a third, *hierarchical emergence*.

Reductionism

Reductionism deals with novelty by demystifying it completely. All novelty is believed to be the inevitable consequence of the laws of nature as these are applied to situations brought into being by uncaused chance. Since both the laws of nature and chance operate ultimately on the particles and quasi-particles of atomic and nuclear structure, then all events, properties, or phenomena displaying novelty may be properly and completely described in terms of the behavior and properties of matter. Thus all phenomena, whether conventionally described in terms of biology, psychology, sociology, anthropology, or theology, find their only true and complete description in the physical and chemical description of the behavior of matter. All attempts to describe and explain the world, whether dealing with love, faith, beauty, or courage, are reduced to attempts to express the properties and behavior of the material reactions that are the *real* source of events to which these illusory labels have been given. Theology must be reduced to anthropology, psychology must be reduced to biology, and biology must be reduced to physics and chemistry. Only physics and chemistry are *real;* all other terms and concepts are only "shadow" constructions to cover ignorance.

Reductionism advocates the position that the whole is no more than the sum of its parts. If the parts are known, then the whole is known. The properties of the whole that seem to transcend the properties of the parts do not really do so, but merely seem that way to us because of their complexity. Not only is a human being a complex organic machine, but a human being is nothing more than a complex organic machine. Not content with providing an authentic scientific description of reality, reductionism presses further and insists that a scientific description is the only meaningful description of reality that can be given.

Preductionism

With a play upon words, I have coined the term "preductionism" to indicate that perspective that takes complete issue with reductionism by effectively standing reductionism "on its head." If reductionism claims that the properties of the whole are only illusory because they are not explicit in the parts, preductionism claims that the properties of the whole are authentic because they are indeed implicit in the parts. If reductionism claims that there is no such thing as "spirit" because that is not a category used in physical and chemical description, preductionism claims that the reality of "spirit" is made known by its presence in all of matter. If reductionism deals with novelty by demystifying it completely, preductionism deals with novelty by mystifying it completely.

Preductionism may seem to the Christian like an effective antidote to reductionism, like a wholistic answer to the disintegrating tendencies of reductionism. It may seem like a positive step forward to affirm that aspects of spirit, mind, feeling, and choice are present in some embryonic form in the rocks and trees, even in the electrons and protons, which come to full flower in the higher forms of life. If one wishes to affirm the reality of these properties of higher life, and if one feels unable to demand that they come into existence wholly apart from matter through *fiat* creationism for both scientific and biblical reasons, is it not a happy solution to solve the problem by asserting their presence in all of matter? To the *fiat* creationist's challenge, "If spirit and mind are real aspects of personal life, how could they have arisen in an impersonal world from impersonal matter?" it is appealing to respond that there is no real problem because the essence of spirit and mind are present in all dimensions of created reality. In this way many claim to have arrived at an integration of religious truth with modern scientific understanding.

Perhaps a principal difficulty with this perspective is that there is no real evidence in its favor. It is an *ad hoc*, semi-poetic construction of a mind in search of a solution for a perceived dilemma. Furthermore, it requires only the subtlest of shifts to become identified with a modern form of animism, with some type of pantheism, or with the character-

istic monism of Eastern religions. Preductionists tend to emphasize the single organic unity of the universe so that necessary distinctions between properties of different configurations of matter (rocks, animals, humans) tend to become blurred. It is common to be told that we are all part of one another; it is only a small step from a mystical interpretation of such a statement to the affirmation that we are all part of God, or that we are all in some sense God.

If reductionism dehumanizes the human being by insisting that the human person is no more than the matter from which the person is composed, preductionism dehumanizes the human being by insisting that all of matter shares the attributes of human personhood. Both perspectives agree in dehumanizing the human person by insisting that the person has no more value than the matter present in the person; reductionism reduces the person to matter, while preductionism elevates matter to personhood.

Hierarchical Emergence

Full faithfulness to both the understanding of modern science and the biblical revelation, without subjecting one to the other, appears to demand that the answer to our question concerning the origin of novelty must maintain the following perspectives on the relationship between matter and personhood: (1) both matter and the characteristic properties of personhood are created; (2) matter is matter and is not characterized by personhood; (3) the attributes characteristic of personhood are real and not an illusion; (4) in the earthly world of our experience a person does not exist without the matter that composes him/her. Perspective (1) affirms the fundamental Christian doctrine of Creation. Perspective (2) negates preductionism, and perspective (3) negates reductionism. Perspective (4) states the existential reality with which any model must deal.

An approach that deals faithfully with the problem within these boundary conditions is the one that may be called hierarchical emergence. The elements of the world are viewed as being described by a hierarchical model, of which the most obvious levels correspond to material but not living; material and living but not human; material, living and human. Such a hierarchical structure, of which further details might be spelled out at considerably greater length,[4] consists of parts and wholes, such that wholes at a higher level depend upon and yet transcend the parts at a lower level (e.g., biological life and physical "particles") in such a way that the unique properties of the wholes are not present even implicitly in the parts but emerge when the parts participate in a particular, suitable pattern of interaction. It is the pattern of interaction that is responsible for the real properties of the whole, a pattern that is not demanded by the properties of the parts but shapes and focusses their interaction in the way that boundary conditions shape and focus the solutions to a differential equation. To be alive is a systems property of a particular type of material system composed of suitable parts arranged in a suitable pattern of interactions. To be human is a systems property of a particular type of living material system composed of suitable parts arranged in a suitable pattern of interactions.

If the pattern of interaction of the parts does not arise from or is not caused by the parts themselves, where does it come from? From within the framework of a scientific description, we can give no other answer than to say, "By chance." But we should not draw the mistaken conclusion that this is a non-teleological statement. Within the scientific context, any description must be either regular and deterministic—and hence devoid of the possibility of introducing novelty, or it must be a chance description—and hence capable of introducing novelty. From the perspective of scientific description, the appearance of novelty requires the presence of a scientific chance description. But this is to speak from within the level confines of the scientific approach. It leaves open the appropriate answer to the same question when viewed from the far deeper resources of the higher level of theological description. Here we can with consistency affirm the theological insight that God is Creator of the novelty.

Summary

Reductionism affirms that the whole is no more than the sum of its parts. Preductionism affirms that the properties of the whole are already implicitly present in the parts. Hierarchical emergence affirms that the properties of the whole emerge from the patterned interaction of suitable parts: the whole is more than the sum of its parts.

Reductionism demystifies the origin of novelty. Preductionism completely mystifies the origin of novelty. Hierarchical emergence affirms the degree of mystery that is present in reality through the emergence of new properties from the patterned interaction of parts without these properties, but does not demand more mystery than is actually present.

Reductionism dehumanizes by reducing the person to matter. Preductionism dehumanizes by elevating matter to personhood. Hierarchical emergence maintains both the dependence of personhood on matter and the transcendence of personhood over matter.

A Christian perspective on the origin of novelty that is open to continuous scientifically describable process can be consistently developed using the model of hierarchical emergence. This same model is totally consistent with the biblical teaching on Creation.

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How Introductory Psychology Textbooks Treat Religion

The idea for this paper came to me as the result of reading an article entitled "How Sociology Texts Treat Religion," by David Claerbaut (April 1974, p. 3). I have taught introductory psychology since 1964 and have used six different textbooks. As a Christian teaching in an evangelical college, I am particularly interested in what message is conveyed about religion by the reading material which I assign to my students.

Textbook publishing is a fiercely competitive business. Since the introductory psychology course is one of the most popular on campus, the demands for textbooks are high. Consequently, the teacher has well over a hundred textbooks from which to choose. Some textbooks sell so well they make their authors wealthy while others never get past the first edition. The dominance of the market by one book, as was the case with Floyd Ruch's *Psychology and Life* in the 1960's, seems to be a thing of the past.

Each spring, I find my desk piled high with complimentary copies of new or revised editions which are advertised as being the solution to all the problems the teacher faces in the introductory psychology course. Many of them are superb productions with professional layout, graphics, expensive paper, and lots of white space. In addition, they include student workbooks, personalized instructional materials, slides, overhead transparencies, teachers' manuals, and computer disks containing test questions. The writing is frequently simplified with a slant toward readability and human interest.

Claerbaut's article offers some useful insights concerning religion and sociology textbooks. He points out that one problem in dealing with this topic is ambiguity over the definition of religion; he objects to the term being defined as a set of behavior patterns dealing with the ultimate issues of life. The problem with this definition, says Claerbaut, is the absence of a personal commitment to a belief system.

Claerbaut found that sociology textbooks treat religion as rigid, exclusive, irrelevant to real life, and a cultural element which is a divisive force that tears social groups apart. Religiosity therefore becomes "churchiosity" studied in terms of denominations and sects. A considerable bulk of the material in sociology textbooks is concerned with the social values of religion. Public worship is looked at as a way to reduce anonymity and alienation. Sociology regards religion as having no universal validity but offering only subjective interpretations of the meaning of life. Sociology, concludes Claerbaut, regards religion as a dependent variable rather than as an independent variable, an effect rather than a cause.

It might be hypothesized that sociology would be more likely than psychology to include religion in its topics since religion is a social phenomenon, the area of concern for sociology. On the other hand, religion also has a personal and unique aspect for each individual, and psychology is interested in this.

How do introductory psychology textbooks treat religion? To answer this question, I consulted the following twelve introductory psychology textbooks published during the last ten years: *Psychology: An Introduction to Human Behavior* (Holland, 1974), *Elements of Psychology* (Krech, 1974), *Psychology: Its Principles and Meanings* (Bourne, 1976), *Psychology* (Liebert, 1977), *The Psychology of Being Human* (McNeil, 1977), *Psychology: An Introduction* (Mussen, 1977), *Understanding Human Behavior* (McConnell, 1977), *Psychology: Understanding Behavior* (Baron, 1980), *Psychology: An Introduction* (Lahey, 1983), *Mastering Psychology* (Lefton, 1983), *Psychology* (Roediger III, 1984), *Psychology: The Science of Behavior* (Carlson, 1984).

My procedure was to check in the indices of these textbooks for words which had religious connections. The terms I looked for were Bible, believer, Catholic, Christian, Christianity, Jesus, religion, salvation, and Scripture. Six of the twelve textbooks had none of these words. The remaining six presented the following information on religious topics: (1) The main world religions teach that men are superior to women (McNeil, 1977, p. 406; Holland, 1974, p. 316); (2) Some churches are more liberal than others (Holland, 1974, p. 129); (3) The Bible does not each evolution (McNeil, 1977, p. 323); (4) Roman Catholics have a lower suicide rate than Jews or Protestants (Mussen, 1977, p. 196); (5) An individual's belief system determines behavior (Carlson, 1984, p. 705); (6) Religious beliefs slowed down the development of the scientific psychology (Roediger III, 1984, p. 7); (7) Religious feelings in the Middle Ages led to a moral wickedness view of bizarre behavior (Roediger III, 1984, p. 500); (8) Auditory and visual hallucinations were important components of nascent religion (Roediger, 1984, p. 500); (9) The religious personality is a separate type (Krech, 1974, p. 515).

That was all I could find out about religion by checking the indices of these textbooks. Based on a cursory examination of many other introductory psychology textbooks, it is apparent that religious topics are scarce in their pages. The comments mentioned above always occurred in connection with the development of nonreligious themes. They tend to be references to research or generally accepted opinions. I found no support for Carl F.H. Henry's claim that "Psychology texts usually introduce God only as a psychic aberration" (1984, p. 8).

I found no extended reference in any of these texts to religious topics. This is not to say that psychology is not concerned with these issues or that they are not discussed in other kinds of books. However, it appears that introductory psychology textbooks would prefer to keep a safe distance from religious topics.

Of course, introductory psychology textbooks do take positions which have religious significance. It has been pointed out that contemporary psychology is built on empiricism, determinism, relativism, reductionism, and naturalism (Collins, 1977, p. 77). Each of these topics is related to epistemology and is of particular interest to theists. Empiricism denies revelation; determinism denies free will; relativism denies moral absolutes; reductionism denies complexity, and naturalism denies God. Obviously religion, especially Christianity, takes a different view on these issues. Whereas psychology does not "seek divine revelation" (Kagan, 1968, p. 20), Christianity believes that God has spoken through the written Word and the incarnate Word.

How justifiable is the treatment of religion by the introductory psychology textbooks which I have just described? From the publishers' viewpoint, it is at least defensible. They are in the business of selling textbooks and they want to make them as attractive as possible to potential customers. Adding a strong religious emphasis is patently considered a liability.

Textbook publishers can lose customers if they produce books which offend a teacher's sense of propriety. Here is an example. Several years ago, a teacher of child psychology in an evangelical college was looking for a new text. He found one he liked, but it had on the cover a young mother breast-feeding a baby. The teacher inquired of the publisher whether the book was available with a different cover. It was, and the book was adopted. When additional copies came to the bookstore in subsequent semesters, they came with the exposed-bosom cover. Consequently, the book was dropped as a text. Because a publisher took a risk with a controversial cover, it lost some sales.

Publishers of introductory psychology textbooks are careful to avoid taking stands on such controversial topics as sex, politics and religion. These are divisive subjects and likely to arouse emotions which might lead to textbook rejection, an unhappy state of affairs for a commercial enterprise.

Since textbooks are generally chosen by the teacher, publishers must pander to the teacher's taste. In academia, psychologists are divided almost equally between atheistic and theistic positions (Scully, 1977). This means that textbooks must be careful to avoid making statements which will alienate either persuasion.

Is the publisher's position justified? I think so. After all, publishers are not trying to reform the world; they are trying to stay in business and make a reasonable profit. It is the profit motive which will determine what is offered for sale in the arena of introductory psychology textbooks.

Another reason why religion plays such a minor role in introductory psychology textbooks is because most psychologists do not consider it a proper subject to include. Psychology teachers are frequently polled as to the appropriate topics to include in introductory psychology textbooks. It might be concluded that they are not demanding that religion be included. Anyone who has examined textbooks knows that they are expensive and large already and to include new topics ultimately means dropping old ones. The best-selling textbook by Ruch (1963, p. 11) expresses this exclusionary idea: "Since psychology limits itself to the study of observable phenomena, it cannot concern itself with problems of the soul and immortality. On the other hand, psychology does not pretend to deny the existence of an immortal soul. It merely leaves this important inquiry to religion." With this disclaimer, Ruch excludes the soul and religion from the remaining 674 pages of his text. Most of his colleagues do the same in their texts.

How should Christians react to the virtual absence of religious topics in introductory psychology texts? Some colleges may prefer that the perspective conveyed to the student in an introductory psychology textbook be strictly psychological with religion left out. For them the current state of affairs is acceptable. However, most evangelical Christian colleges stress that every course, including psychology, should be taught from a Christian viewpoint. This is accomplished through integration of faith and learning which may take several avenues.

A possible approach is to use a textbook for introductory psychology written from a Christian viewpoint like the one produced in 1952 by Zondervan Publishing Company. Written by Hildreth Cross, it was entitled *An Introduction to Psychology*. It sold only 10,000 copies. It is not difficult to understand why this book failed to capture the imagination of the evangelical psychology teacher. It was poorly illustrated, incomplete, cheaply produced, and somewhat preachy.

A potential entry into the field of introductory psychology textbooks written from a Christian perspective is *Introduction to Psychology and Counseling*, a 1982 production by Paul D. Meier, Frank B. Minirth, and Frank B. Wichern. A cursory examination of this book reveals that it is not an appropriate choice for an introductory psychology textbook for a college course. The authors intend the book for "students who expect to become counselors" (Meier, *et al.*, 1982, p. 22). Thus the contents are short on material typically covered in introductory psychology and long on topics usually covered in a counseling course. For instance, an introductory psychology textbook like *Psychology* by James Geiwitz devotes over 100 pages to sensation and perception whereas this book covers these subjects in just eight pages. This is in keeping with the announced plan of the book to present a sketchy review of modern psychology. Further, this book is not packaged in a competitive format and is inferior in graphics to other introductory psychology textbooks I have seen. I do not think the audience for whom it was intended is well served; certainly it is not a good choice for an introductory psychology textbook from a Christian viewpoint.

With the exception of Cross's *An Introduction to Psychology* and Meier's *Introduction to Psychology and Counseling*,

I do not know of other introductory psychology textbooks which incorporate a Christian view. Thus, to integrate psychology and Christianity by selection of this kind of textbook does not seem at present to be a valid option.

A good way to integrate faith into the introductory psychology course is to choose some parallel readings which present a Christian world view. For several years, my students used a reader which contained 28 articles written from a Christian perspective (Ruble, 1975). It was available in the bookstore at nominal costs. Also, with permission of the publisher, articles from current magazines and journals can be reproduced for distribution.

Books available which bring a Christian perspective to psychology include works by Bufford, Carter and Narramore, Collins, Fleck and Carter, Jeeves, Kilpatrick, and Koteskey. (Bibliographic information for these books occurs at the end of this article.) These books can be placed on reserve in the library and thus save the student the expense of purchase. In addition, three journals which provide material on psychology with a religious dimension include *The Journal of the American Scientific Affiliation*, *The Journal of Psychology and Theology*, and *The Journal of Psychology and Christianity*. Occasionally, articles relevant to psychology appear in *Eternity* magazine and *Christianity Today*.

Another way to make up for the lack of biblical perspective in introductory psychology textbooks is via lectures. The Christian teacher can present appropriate biblical material along with the textbook information and thus give the student an opportunity to integrate. On occasion, a guest speaker or a film may be useful for this purpose. Term papers and classroom discussions can play a role in getting students to think about how psychology relates to Christian truth. Students can also be encouraged to join and participate in such organizations as the Christian Association for Psychological Studies and the American Scientific Affiliation.

Christian teachers are the crucial element in making a college experience in introductory psychology distinctly Christian. Even if good evangelical textbooks were available, they would still take a secondary place to the teacher in terms of potential for impact. Ultimately the teacher is the one who determines the elements to be used in teaching a course. Textbook selection, lecture content, use of films, speakers and field trips all fall under the teacher's control.

Many teachers in Christian colleges have been trained in secular institutions and have no training in the Bible. For such teachers, a program of faculty development is definitely needed if they are to lead students into an understanding of psychology from a Christian vantage point. Some further training in a seminary or Christian graduate school may be appropriate.

In some Christian colleges, introductory pscyhology is a required course. In some, psychology is the major that attracts the largest number of students. In some, an introductory psychology course is part of the general education requirement. All of this produces a lot of students who are getting their first exposure to psychology through the introductory course. It is important that this exposure have a Christian perspective. In order for it to be so, the teacher must go beyond just assigning a secular textbook for the student to read. The teacher must engage the students in the difficult but essential task of integration.

The teacher has ready allies because most Christian college students desire to get involved in this process. Research has shown that students choose a Christian college for this very reason; *i.e.*, they want a biblical perspective that they cannot get on a secular campus. There will be some disagreement as to how integration is best achieved. The reach will probably always exceed the grasp. But it is essential that an attempt be made if the Christian college is to live up to its name and to its Lord.

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Boyle, Christian Gentleman

Robert Boyle (1627–1691) and Christopher Wren (1632–1723) in their early thirties were regarded by their British contemporaries as "the wonders of the age." Boyle was cited in the poetry of James Thomson and William Cowper. Although called the father of chemistry he was truly an amateur and owed his reputation largely to his social position and personal character.

His industrious father, the first Earl of Cork, said to be the richest man in Great Britain and the most influential in Ireland, had married the daughter of a wealthy landowner. Robert, their fourteenth child, was their seventh son; his mother died when he was two. Studious and truthful, he was tutored at home until eight, when he was sent to Eton; there he developed a passion for reading to acquire knowledge. At twelve he and an older brother Francis were sent with a tutor to study on the continent. At fifteen he was introduced to natural philosophy and mechanics. When his father died the following year, he inherited some estates, including Stalbridge Manor, Dorsetshire. Three years later he spent six years there reading (*e.g.*, F. Bacon, Descartes, Gassendi) and writing (theological concerns).

At twenty-seven through John Wilkins, Warden of Wadham College, Oxford, he settled in a house on High Street (where the Shelley Memorial of University College now stands). There he set up a laboratory and secured a staff including assistants (*e.g.*, Robert Hooke), secretaries (he had weak eyes), *et al.*; he collected various items such as gems. He himself attended the weekly meetings of the so-called "invisible college," where the new experimental philosophy was discussed. (At thirty he was given an honorary Dr. Phys. by Oxford University.) Three years later he went to live with his older sister Katherine, Lady Ranelagh, in her house on Pall Mall, London (he never married). (His oldest brother, then Earl of Burlington and Cork, built the elaborate Burlington House, which has become the headquarters of the Royal Society of London.) Their home became a focus of London society. After some paralytic strokes he died at sixty-one and was buried in the chancel of St. Martin-in-the-Fields, London—without pomp.

Boyle's life was a model of piety and humility. To his insatiable curiosity and indomitable persistence, he added integrity of mind. To his shrewd business ability and scrupulous honesty, he joined a broad generosity. He refused various honors and appointments, *e.g.*, in the church, a peerage, Provost of Eton, President of the Royal Society (1680). He gave one-third of his Irish income for the propagation of the gospel among the North American Indians (*e.g.*, support of the missionary John Eliot) and the other two-thirds for the poor and ministers in Ireland. In his will he bequeathed the income from his unentailed property for Irish poor, preachers and their wives, and, in general, for good, pious purposes.

Boyle made no epoch-making scientific discoveries. He was more of a laboratory director than an individual researcher. For example, his best known work, Boyle's Law, was largely due to the manipulative skill of Hooke, who produced in 1659 an air pump (now in the Royal Society Library) like that invented five years earlier by Otto von Guericke. Their observations were published in Boyle's first scientific paper "On the Spring and Weight of the Air" (1660). Two years later in a reply to Franciscus Linus he added an appendix which contained the law relating pressure and volume at constant temperature.

Boyle did not continue his work in physics, but concentrated on chemistry; he was always an enthusiast for alchemy. His most famous writing was "The Sceptical Chemist" (1661), in which he criticized the ancients' four elements (earth, water, air, fire) and the medievalists' three principles (mercury, salt, sulfur). In the appendix to the second edition (1680) he defined an element as a substance that cannot be further decomposed by experiment—thus emphasizing empirical analysis.

In 1662 Charles II chartered the Royal Society (patron, St. Andrew). Boyle was a founding member and on its first Council (Hooke was made Curator). Prior to Isaac Newton he was its chief glory; all in all, he had 35 articles in its Transactions. Between 1660 and 1673 he published rapidly. He popularized science by demonstrating his experiments and by expounding the new philosophy simply.

Boyle was not just a teacher and propagandist; above all, he was a lay preacher and, through his writings, a prolific author of religious topics. Only one, however, was devoted to dogmatic theology, *viz.*, "Protestant and Papist;" he was opposed to the papacy with its claims of catholicity and infallibility. He was, moreover, unsympathetic with all sectarianism; he preferred the *via media* of Anglicanism. He hated bitterly all religious strife over creeds and ceremonies. Although a regular church attendant, to him Christianity meant essentially the practice of holy living; its fruits, peace and charity.

Throughout his life he had a conviction of personal Divine Guidance. A turning point occurred when he was thirteen during a night thunderstorm in Geneva; he made a vow of piety; four years later his faith was established. A second crisis occurred when he perceived in science "a means of discovering the nature and purpose of God;" he realized, of course, that revelations about the Creator in the book of nature are not as significant as those about the Saviour in the Scriptures. All his work and thought became saturated with religion, composed in an atmosphere of humility. He definitely eschewed Holy Orders so that he might pursue theology freely—and hence more effectively. In 1661, at the request of Lord Broghill, a brother, he published "Some Considerations Touching the Style of the Scriptures," noting

the usual problems of translation associated with when, by whom, to whom, for what purpose. He himself believed in miracles, *e.g.*, Jesus walking on the sea.

He believed the study of nature and the attributes of God were the noblest aim of life. In "The Excellency of Theology, Compared with Natural Philosophy" (1674, written 1665), he noted, "The vastness, beauty, orderliness of heavenly bodies; the excellent structure of animals and plants; and other phenomena of nature justly induce an intelligent, unprejudiced observer to conclude a supreme, powerful, just, and good author."

Boyle had a lifelong passion to educate and Christianize the native populations of Ireland, America, and the Orient. Accordingly, he subsidized various translations of the New Testament, *e.g.*, Arabic, Turkish, *et al.* In his will, moreover, he left funds for eight annual lectures in a London parish "for proving the Christian religion against notorious infidels." The first Boyle Lecture (1662) on "A Confutation of Atheism," was given by Richard Bentley, then Chaplain to Bishop Stillingfleet (later Master, Trinity College, Cambridge), at St. Martin-in-the-Fields (the remaining at St. Mary-le-Bow's). The author submitted drafts to Newton, who replied in four celebrated letters, generally approving, but adding some additional arguments in support. The last lecture argued in favor of a Divine Providence from the constitution of the universe as demonstrated in the *Principia*.

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This is the fourteenth in a series on scientists and their religion.

Book Reviews

A REASON TO HOPE: A SYNTHESIS OF TEILHARD DE CHARDIN'S VISION AND SYSTEMS THINKING by R. Wayne Kraft, Intersystems Publications, Seaside, California (1983). Paperback. 274 pages.

This is the third book by Professor Kraft, Department of Metallurgy and Materials Engineering at Lehigh University, on the theme of Teilhardian thought as a guide to an integration of science and Christianity [Cf. *Relevance of Teilhard* (1968), and *Symbols, Systems, Science & Survival* (1975)]. The books show a progressive attempt to generalize and extend the perspectives of Teilhard and of systems theory to this task of integration. The purpose of the author is both to "bridge the gap between the secular and the sacred," and to "give a reason to hope" so that we might work together to "transform our world into one in which peace, justice and unity prevail."

The book is divided into seven major sections. In the first Kraft touches briefly on "The Mystery of Time," arguing that we can be sure that time progresses because of the First Law of Evolution and the Second Law of Thermodynamics. This is followed by a more extended review of "Evolution, Convergence and Teilhard's Vision." Of course this approach not only accepts evolution, but is based on the assured truth of evolution: "No educated and rational person in the latter part of the 20th century can deny that *Homo Sapiens* is the product of some sort of evolution." Many of these ideas are very helpful to the Christian; others may be taken with some caution. Although Teilhard himself has passed through a maximum of popularity so that the present generation is usually unaware of his contributions, it is important not to lose the main thrust of his perspective, even if its details must be revised.

The following four chapters deal with four major scientific topics relevant to the central theme of the book: "Entropy, Thermodynamics and Divergence," "Systems Thinking—Coping with Complexity," "Communication—the Foundation of All," and "Energy." These chapters provide long popularized excursions into technical areas, the relevance of the details of which is not always evident as far as the main theme of the book is concerned. More troublesome is the usual difficulty of popularized science: it remains beyond the grasp of those readers for whom it is popularized, and it does not offer enough for those readers who are technically prepared to read it. With this warning, however, Christian readers trained in science may find a variety of useful and challeng-

ing thoughts in these chapters.

The final chapter is entitled "Christogenesis," the final stage in the Teilhardian scheme that moves from cosmogenesis, to biogenesis, to noogenesis, and finally to Christogenesis, "the process of changing the world into the image of God . . . the process of transforming the fire of God's love into tangible reality."

In spite of its technical sections much of the book is written in quite an informal style, with the author's perspective ranging back and forth from the technical details of scientific description to the Teilhardian-informed Roman Catholic perspective on Christian doctrine. One admires the fervor and commitment of the author, his desire to bring all things under the Lordship of Christ, and his dedicated hope for the future.

Kraft provides ringing affirmation of Christian faith and truth. He affirms that "the person of Christ must be at the center of any theory if it is to be completely valid in a Christian context. . . . The minute one departs from Jesus, in however small a way, one can easily fall into error." Many more such affirmations ring out through the pages of the book. How frustrating and shattering it is, therefore, to have the clear statement, "Jesus came to save the world from sin and death. He is the capstone, as it were, of God's saving plan for His people," footnoted with the incredible words, "Let me hasten to add that I do *not* regard Christianity in an exclusionist sense which belittles and denigrates authentic values and genuine truths of other religions. Ample evidence can be found which shows that all the major religions of the world are converging on Omega." On the very next page he writes, "The plain truth is that the good news of Jesus Christ is the only power capable of saving us from our own folly." And, a few pages later, he says, "Its worship will become enriched as it incorporates authentic truths about the Lord of Creation from the other great religions of the world. The other religions, too, will grow in holiness as they learn something about their God from Christianity, because, after all, there is only One God." In spite of all the valuable insights provided by Teilhard and his followers, the author seems to indicate that he is still trapped in some of Teilhard's fundamental dilemmas. The particularity of Christ, although ringingly endorsed by Kraft on one page, remains a stumbling block on another.

For an honest, sincere effort to integrate evolution, systems theory and Christianity, the book can be recommended for its insights, even though it leaves many unanswered questions.

Reviewed by Richard H. Bube, Department of Materials Science and Engineering, Stanford University, Stanford, California 94305.

DEVELOPING A CHRISTIAN MIND by Oliver R. Barclay. Inter-Varsity Press, Leicester, England (1984). 207 pages.

On the back cover, the publisher summarizes this book as follows: "The Christian mind is not just a set of opinions, but the attitude that should pervade everything we do and makes us what we are." Barclay's views on the Christian mind emanate from the commandment that we are to love the Lord our God with all our heart, soul, and mind. In the Introduction he sets the tone:

> We must not be misled, either by those who, on the one hand, despise a Christian mind and regard it as merely an optional extra for those so inclined, or by those who, on the other hand, make it a highly rarefied affair for academics only. In the Bible it is for everybody: fishermen, soldiers, farmers, tax collectors, philosophers and religious leaders alike. It applies as much to the uneducated slave as to his educated master, to the Greek philosopher as to the Jewish peasant.

Having given us this pervasive scope of the Christian mind, Barclay uses eight chapters to tell us how we develop it.

In the first chapter, as he answers the question, "What Is a Christian Mind?," he defines it as an outlook that controls our life and our thinking. Furthermore, "A Christian mind is . . . seen to start with humility and a desire to serve rather than to be important or comfortable." He emphasizes the present-day urgency as he reminds us that the Christian values of the Sermon on the Mount are no longer generally accepted and that unchristian values such as marital infidelity and cheating are taken for granted.

In Chapter two he discusses the importance of the Christian mind for practical living. He stresses the need to avoid the extremes of an ethical legalism and a "love God and do what you like" antinomianism. In Chapter three he warns against striving for "complete systems" of doctrine. He views biblical teaching, here as in Chapter two regarding ethics, more as a net or framework than as a rigid presentation of all truth.

In discussing a "Christian philosophy" in Chapter four, he reminds us that often we don't get the right answers through our philosophical systems because we are asking the wrong questions. A "world-and-life-view" can be helpful but it is never superior to constant application of biblical truths to each day. In Chapter five he emphasizes the difference between biblical wisdom on the one hand and the extremes of

Books Received and Available for Review

(Please contact the Book Review Editor if you would like to review one of these books.)

J. Beversluis, *C.S. Lewis and the Search for Rational Religion*, Eerdman's

G. Clark, *The Trinity*, Trinity

C.S. Evans, *Philosophy of Religion: Thinking about Faith*, IVP

G. Fackre, *The Christian Story* (revised), Eerdman's

J. Nelson, *Human Life (A Biblical Perspective for Bioethics)*, Fortress

Prophet without Honor, *Saint's Revelation*, Vantage

P. Snyder, *A Life Styled by God (Spiritual Discipline for Weight Control)*, Lamplighter

G. Sweeting, *You Can Climb Higher: The Christian's Pursuit of Excellence*, Nelson

T. Torrance, *The Christian Frame of Mind*, Handsel Press

intellectualism and anti-intellectualism on the other. Biblical wisdom depends on understanding, but it is practical rather than academic. Furthermore, we need to remember that through "common grace" God has allowed some nonchristians to be wise in many areas in which they can be of help to us. (*E.g.*, Abraham accepted moral reproof from pagan kings.)

Chapter six introduces us to Christian anthropology and sociology as Barclay points out some of the biblical teachings regarding human nature, the role of the state, education, marriage, and family. In Chapter seven he presents an excellent summary of the biblical nature of work and job. He warns us that the "Protestant Work Ethic" is not necessarily biblical. Work should not be treated as an idol nor denigrated to a necessary evil. (This chapter alone would be worth the cost of the book.)

Chapter eight covers a "Christian View of Culture." Here he outlines three emphases held by various Christian groups: "love not the world" pietism/asceticism, "good creation" involvement, and the liberal self-improving society. He considers the good-creation/Calvinist view to have had the best track record. (This reviewer is a bit puzzled, however, by his inclusion of Ron Sider, a leader in Evangelicals for Social Action, as an example of the ascetic tradition.)

Chapter nine is a brief summary and conclusion in which the author reminds us of, among other things, the fact that God wants our whole-hearted love, including our thinking; that we are new creations but not perfect; that we must fill our minds with the revealed truth of God—not just Bible verses; and that on many subjects the Bible is not rigidly specific. Near the end he reminds us that "a church that is married to the culture of one generation will be a widow in the next."

This is a book that obviously has a lot in it. I have found it profitable to go back over it several times, and I am sure I'm not finished with it yet. I highly recommend this book to every literate Christian.

Reviewed by Wilbur L. Bullock, Durham, New Hampshire.

CREATION AND EVOLUTION edited by Derek Burke. Inter-Varsity Press, Leicester, Great Britain (1985). 288 pages.

Seven prominent Christians debate today's issues. "All the contributors seek to be ruled by Scripture. Since they do not agree between themselves, the crucial issue is whether one view or another is more consistent with the teaching of the Bible." After listing eleven opening theses to which all agree, such as "the New Testament regards Adam and Eve as the first parents of the whole human race (*Homo sapiens*)," the authors state their views and reply to their opponents' beliefs.

The age of the earth is discussed by A.G. Fraser, using sedimentary rocks, the Law of Superposition, igneous rocks, fossils, and radiometric dating to indicate that the "earth is extremely old." He evaluates flood geology and the "apparent age" view as inadequate explanations of scientific observations. E.H. Andrews replies from his own heat flow calculations and other evidence that "refinements of the 'flood' model can account for a recently created earth." Then Andrews gives his chapter on the age of the earth using scientific arguments against uniformitarianism: "processes can vary in rate by orders of magnitude depending on the temperature at which they occur," sedimentation rates near land, a volcanic eruption forming a mature island called Surtsey, and defects in radiometric dating; and he concludes that "the Bible testifies for a mature creation some thousands of years ago." Commentator Fraser replies to this in detail and concludes that "the view that the earth's great age is only apparent is tantamount to an admission that the case in favour of an orthodox interpretation of the geological record is a very good one."

"I believe in God . . . Maker of heaven and earth," by R.J. Berry, discusses God's activity and natural processes, evolution as a scientific theory, the mechanism of evolution, and man and evolution, accepting the common evolutionary views. He reminds us that Cuffey in the *Journal of the American Scientific Affiliation* had listed "several hundred transitional forms, including many 'crossing from one higher taxon into another.'" Adam was a historical figure, created by God's inbreathing, and "it is quite possible that, at some time after God had created Adam, he then conferred his image on all members of the same biological species alive at the time."

But in his reply, V. Wright says Cuffey's list consists of much speculation and of some examples since abandoned. Following other responses, Wright's chapter begins by referring to the Creation Research Society of the U.S.A. and the Newton Scientific Society in the U.K., whose extensive membership questions the evolutionary model of the origin of man. The evolution of the eye "was clearly impossible." Reconstructions of man "owe more to the preconceived ideas of the authors than to the scientific observations." Man is considered unique because he can communicate and is a worshipping being. Because the opening chapters of Genesis are not allegorical or poetic, the author believes in a six-day creation. R.J. Berry differs with Wright's evaluation of the eye, man's upright posture, missing links, vestigal organs, and so-called Precambrian human footprints; and comments, "there can be no conflict between 'why' God created (which we find in the Bible, Heb. 11:3) and 'how' he created (which is an aim of science to discover)."

"A consistent biblical and scientific view of origins" is considered non-evolutionary by D.T. Gish. "Evolution would certainly constitute the most wasteful, inefficient, cruel method God could have used to create." Amplifying his views on probability, the second law of thermodynamics and the fossil record, he concludes, "I am convinced that the facts of science declare special creation to be the only logical and rational explanation of origins." D.C. Burke replies that Dr. Gish "confuses several different ideas in his argument from thermodynamics" and "does less than justice to the huge body of evidence that paleontology has assembled." So Burke in the next chapter tells "why some Christians believe in evolution."

The Bible in his view "leaves entirely open the method of creation." So he considers the evidence for the evolutionary process in variation, selection and geographical isolation, and says that the earth appears to be very old, that fossils are found widely, and that there is overwhelming evidence for the unity of all cellular processes. Then Burke lists some difficulties of the "young earth theory"—*e.g.*, stars being X years away—and comments that most of the flood geology writers "have to accept apparent age up to a point in areas outside paleontology; since their theory simply is not adequate by itself." He concludes that "as a scientific theory, evolution is the best so far." Gish replies that "Neither creation nor evolution is a scientific theory," and that "No consistent evolutionist can believe in a mechanism much more;" but finishes with "To say that there is no evidence to support evolution would be foolish indeed. The overwhelming weight of the scientific evidence is, however, solidly in support of special creation."

Issues and dilemmas in the creation/evolution debate are presented by D.G. Jones and responded to by E.H. Andrews who then writes a lengthy chapter on the biblical and philosophical case for special creation. The former says "Biblical knowledge and scientific knowledge represent different levels of appreciating reality. At best the two levels are complementary; at worst they may be contradictory." It is important that man has a proper estimate of himself. Andrews concludes in his detailed analysis of conflicts between evolution and the Bible, "If we were more robustly scriptural in our evaluation of science, we would be less inclined to be mesmerized by the tenuous logic, circular reasoning and leaps of faith which characterize the general theory of evolution."

The book ends with a summary and conclusion by O.R. Barclay and a statement of the professional connections of each of the contributors. You will wish to read this volume to compare what you now believe with the reasoned disagreements of those differing from you. Remember each author believes this thesis "In the beginning God created the heavens and the earth (Gen. 1:1). God's creation is a sovereign act of his power, love, and wisdom and depends on no other being or created substance. It was *ex nihilo*."

Reviewed by Russell Mixter, Professor Emeritus of Biology, Wheaton College.

HISTORY OF MODERN CREATIONISM by Henry M. Morris. Master Book Publishers, San Diego, CA 12115. 382 pages with index. Paper $9.95; cloth $12.95.

This is the first full length history of the so-called modern creation movement. It was written by one of its founders and the most well known American creationist. This eminently readable and flowing account has a wealth of information about the various individuals involved. It is partly autobiographical, including many personal anecdotes and experiences of the author, Henry Morris. Although admittedly biased in favor of a particular creation position, this bias, for the most part, does not mar the book. Ironically many of the creationists the author discusses, as well as many of the creationist organizations and the most prominent creationists such as Douglas Dewar of England, were not so-called fiat or short-age creationists, but could accept the dates generally assumed in the science community as being accurate.

Of particular note to this reviewer were the many incidences of blatant discrimination against creationists, even if they manifested a high level of competence in their area of teaching or research expertise not related to creationism. And this discrimination was not necessarily limited to conservative creationists, but included those who would more accurately be described as progressive creationists and who accept most of what is in vogue in orthodox science. Morris himself experienced difficulties although he was a theistic evolutionist during most of his undergraduate and graduate training. This pattern is true of many if not most prominent fiat creationists, and seems to be a major reason that many avoided serious discrimination in the early part of their career.

Morris's introduction to the science and Christianity conflict (or attempts to interface, whichever perspective one takes) was Henry Riemer's work, which Morris encountered after beginning to teach at Rice University in the fall of 1942. Enthused about Riemer's work, Morris tried to have him on campus. His request was flatly turned down; and Dr. Morris, an evolutionist at the time, was himself grilled regarding his view of creation, miracles, the Bible, *etc.* Although Riemer was not allowed to speak on campus, Morris was able to arrange for him to address about 60 students at the Rice Christian Fellowship. Morris concluded, "I was happy with the turn-out, because it had been an uphill battle to get such a group going . . . in the first place" (p. 91).

One of the more interesting aspects that Morris noted is that not only Morris, but many of the leading creationists, were at one time atheistic or theistic evolutionists. It is a common assumption that their creationist beliefs were part of their upbringing and that they simply continued to persist in the mold in which they were raised. Although many creationists had a religious upbringing, they accepted evolution rather uncritically. For one reason or another, intense discussions with creationists caused a reevaluation of their belief structure and led to an essentially creationist world view. They claim that they rejected the evolution position because of their research and study which caused them to reject or question various key aspects of this paradigm. To what degree this is the case is not easy to determine; nonetheless the book serves as a basis from which to explore the psychological and sociological aspects of this modern social movement which can only be understood in terms of social movement theory.

A major problem in the book (as well as in this review) is specifically defining the term *creationism*. Creationists differ in many areas. Some of the leading ones, Morris states, still believe in a "mysterious form of quantum theistic evolution." Many of the organizations and individuals that Morris discusses are not creationists in the sense that the Institute for Creation Research uses the term today. Many reject flood geology, the literal 24-hour interpretation of the creation days in Genesis; and accept the gap theory, progressive creationism, or even evolution in a major sense. Using the term

scientific creationist as opposed to *Biblical creationist* may be helpful, but only to a limited extent. Many of those individuals involved in the creation movement object to the term "scientific creationism" and terminology remains one of the major areas of concern in any discussion of creationism.

A major problem creationists continually have had is getting their works published. Concern as to whether the discrimination is based on valid criteria needs to be addressed. Obviously colleges and universities are forced to make faculty decisions, and they must be based on some criteria. Likewise, journals must make decisions relative to the merits of an article. Further, one would expect difficulty in publishing an article that utilizes assumptions that are contrary to those generally accepted in the scientific community. On the other hand advocates of numerous other beliefs, for which there is clearly questionable evidence, are able to hold their positions, evidently without problems. The concern should be, 'Does a belief which is unpopular, or may not even be scientifically tenable, justify discrimination?'

Even if one holds controversial views which are directly related to one's teaching or occupational assignment, it is generally conceded that if one can accurately articulate the opposing position (such as a young earth creationist who can accurately explain and present the data, reasoning, *etc.*, used to support the old earth position), then one cannot charge incompetence, and discrimination should not take place. It is interesting that Morris notes that many leading creationists have been quite successful in publishing non-creationist material, including textbooks. For example, Morris, among his other books, published *Applied Hydraulics and Engineering* (John Wiley & Sons) which he claims is the "standard textbook, still widely used in many colleges and universities around the world . . . altogether at least 100 colleges and universities have used this as a textbook at one time or another" (pp. 152–153).

A number of excellent discussions are included relative to creationist movements in different parts of the world. One of the main groups is the Evolution Protest Movement, most of whose members never took a short-age position, and many did not accept universal deluge geology. Nonetheless, they still encountered what Morris claims is censorship. They further endeavored to react to what they felt was blatant atheistic evolutionism presented in the British Museum and by the British Broadcasting Corporation (BBC). Their protests "were generally ignored, and the British schools and other institutions, like those in the United States, came more and more to be utterly dominated by evolution" (p. 209).

In summary, this book is the first major, comprehensive history of the modern creation movement told by one who was intimately involved and personally acquainted with most leading creationists. A prolific letter-writer, Morris has collected a wealth of information relative to creationism as a social movement as well as to the personalities, beliefs and idiosyncracies of its founders, those on the periphery, and even of its opponents. Regardless of one's orientation on this matter, Morris' book is an important source of information.

Reviewed by Jerry Bergman, Bowling Green, Ohio.

DID THE DEVIL MAKE DARWIN DO IT? edited by David B. Wilson. Iowa State University Press (1983). 242 pages. Cloth $25.00; paper $12.95.

The product of careful thinking, this collection of essays by Iowa State University (ISU) professors gives a modern perspective on the controversy created by those scientists who are associated with the various creationist groups and societies. Many of these creationists claim that by taking the Genesis flood literally to be world-wide, one has a catastrophe which so alters the geological records as to allow for a late date for the origin of Earth and man—a "scientific" creationism as opposed to the alleged unscientific standing of evolution.

The book addresses questions about science and faith, and about how science can be rooted in observation and experiment and yet claim to know about the distant past. It helps to explore what both sides of the debate mean by nature being "uniform" and by "catastrophe."

Philosopher David Kline clarifies the use by both parties of such basic terms as *facts*, *data* and *theory*. Of particular interest is what Kline has to say about Karl Popper's falsifiability test of truth: the idea that there must be some observable events such that if they were to occur the theory would be false. Scientific creationists claim that evolution is mere metaphysics and can not pass the test (specifying a way in which it could be proved wrong). Kline points out that Popper's actual claim was that *Darwinism* was a "*metaphysical research programme.*" Some of the scientists contributing to this book argue that evolution is falsifiable but that no one has been able to show that its thesis is indeed false. Indeed, they appeal to empirical evidence which they feel makes sense only on the evolutionary hypothesis. For his part Kline wonders how the creationists' version of supernatural creation could itself pass Popper's test. More important, he argues the questionable character of falsificationism as an adequate "demarcation" of the scientific.

Another argument used by some creationists is that the Second Law of Thermodynamics (that the availability of energy in our universe is decreasing) stands against the evolutionary developmental thesis. Evolutionists counter by reasoning that if one grants a long evolution of life and man, there could have been changes in the chemical nature of the atmosphere which would have facilitated the biological shifts they require—a view which does not violate Newton's Second Law.

Clearly there are issues here of interest to natural and behavioral scientists, and the recent creationists have made them significant for educators and state legislators as well.

Of particular interest is Paul Hollenbach's chapter on "Creation Belief in the Bible and Religions." Hollenbach, a professor of religion, asks the reader to compare the early Genesis chapters (aided by modern biblical scholarship) with the creation accounts in the ancient Babylonian *Enuma Elish* and a more modern sample of cosmology from the Omaha Indians. Many Christians and Jews would have no problem with admitting that all three of these evidence old-world religious reflections on nature and hence are not modern

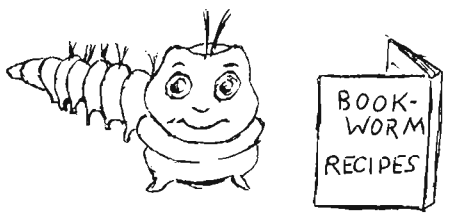
scientific texts. This leaves the question as to what is their import, if not scientific? Hollenbach's answer reflects a sociology of religion viewpoint which sees their significance in what they tell us about the relation between religious beliefs and institutional practices of the people to whom these several accounts were addressed. His presentation is insightful and certainly serves to remind us that Genesis is a religious text. His view could be strengthened by, for example, the supposition that the literary form of Genesis 1, with its stress on the seven days of creation, helps to call attention to the Jewish Sabbath.

But I should think that the primary importance of the Genesis stories of the creation and fall of man is *theological*. In contrast to the stress of many creationists on modern science one would suppose that the way to understand Genesis is to look at the Bible itself, how the concept of creation is used throughout scripture. The doctrine of creation affirms the basic goodness and meaningfulness of the world, mankind and history. It is the beginning of the central narrative about how human goodness can be obtained in spite of fallenness; how redemption, recreation and ultimate fulfillment are essential to the divine purpose for man. Psalm 136, for example, indicates that the religious response to the reality of the Creator-God in the world and in history is one of praise and thanksgiving for his wisdom, goodness and mercy, and for his wondrous works. By faith one affirms that the stars were not made or kept in place apart from the Almighty, and that the same Lord has created and led Israel (Isaiah 40:26, 43:15). Paul claimed that persons of faith are impressed with the fact that behind nature is the "eternal power and deity," and that nature and mankind await a glorious recreation (Romans 1:20, 8:19,39). He saw the gospel as centering in Christ, the second Adam, who makes of men and women a "new creation" (II Cor. 5:17).

Certainly the contents of the early chapters of the Bible throw light upon the nature of being human, male and female; upon the family, upon the nature of sin and evil, and upon the question of our stewardship over nature and its resources.

The committed Jew or Christian who is also a scientist can affirm the fact that if God chose to work through a long process of developmental change, this could not at all alter the theological significance of the reality, power and graciousness of the God of creation and recreation or salvation. The Genesis account, then, offers a strikingly different picture of God, man and the world from that of the polytheistic *Enuma Elish*. Genesis ushers us into a strikingly different faith and theology. It offers a world-view in which science is free to help us achieve understanding. Science also gives us technology—in the abuse of which fallen man may be again tempted to say, "The Devil made me do it!"

Reviewed by William W. Paul, Professor of Philosophy, Central College, Pella, Iowa 50219.



THE MEANING OF CREATION: GENESIS AND MODERN SCIENCE by Conrad Hyers. John Knox Press, Atlanta (1984). 203 pages. Paperback.

Conrad Hyers, Professor and Chairperson of Religion at Gustavus Adolphus College in Minnesota, has provided in this book a major contribution to the creation/evolution debate of recent years. He continues a growing trend toward considering the proper interpretation of the Genesis account in its own integrity, rather than focussing on whether or not these accounts can be in fact harmonized with modern science. Believing that the "real" meaning of these texts has been understandable in part from the beginning, and that this "real" meaning has not been waiting until the present generation to be perceived by today's scientific descriptions, Hyers delves into the purpose and meaning of these sections of Scripture in their own context. He critiques the practice of many conservative Christians in recent years who have been so enamored with the findings of science that they have paid little attention to the biblical text itself and even less to the original meaning and purpose of the text in its historical setting.

The book is organized into eight chapters. The first two chapters discuss general issues in treating the revelation of Genesis; the second two focus on the interpretation of Genesis 1; the fifth deals with the types of literature in Genesis and explores the meaning of "myth" rightly understood; the sixth and seventh chapters deal with the interpretation of Genesis 2 and 3; and the eighth chapter is a kind of appendix in which Hyers integrates revelational perspectives in terms of the order *versus* chance debates of current years.

Hyers is as critical of scientific misreadings of Genesis as he is of theological misreadings. He finds linguistic confusion, failure to appreciate the nature of the literature being interpreted, to be a recurrent source of misunderstanding and conflict in the creation/evolution debate. He makes clear the fallacy of the "Bible science" position that makes the truth, validity and relevance of the Genesis passages depend on whether or not they conform to today's notion of what is an acceptable scientific description. He points out that "quite ironically, those who would dismiss the Bible as contradicting science and those who would defend it as true science find themselves in agreement that these biblical texts are to be interpreted "literally" (pp. 19,20). Indifference to the religious roots of the Genesis accounts makes authentic interpretation impossible.

> Even if evolution is only a scientific theory of interpretation posing as scientific fact, as the creationists argue, creationism is only a religious theory of biblical interpretation posing as biblical fact. . . . It is, therefore, essentially *modernistic* even though claiming to be truly conservative. (p. 27)

Only by recognizing what these scriptural documents actually are, can we hope to understand God's revelation for us in them.

Hyers gives a detailed and persuasive interpretation of the two creation accounts in Genesis 1 and Genesis 2, and clarifies many nuances, far too numerous to be included in this review. His appreciation for the different styles of the two

creation accounts makes it possible to see them as essentially complementary, with Genesis 1 stressing the role of order in creation, and Genesis 2 *ff* stressing the fundamental virtues of pastoral simplicity in contrast to the effects of civilization, urbanization and technology. In appropriate contexts he points out not only the shortcomings of Bible science (which he terms an oxymoron), but also those of anti-religious scientism, progressive creationism, and views that necessitate a God-of-the-gaps.

Hyers elaboration of the meaning and use of "myth" is one of the clearest available. Always readable and attention-holding, his writing at times breaks out into pure prose/poetry, as in the passage on mystery.

> . . . mystery in its ultimate sense . . . is not resolvable, for the greater the knowledge and understanding, the greater the awareness of mystery. Rather than being the absence of knowledge, mystery in this sense surrounds even the most commonplace, obvious, taken-for-granted, and therefore presumably well-known areas of experience. Such a sense of mystery looms not only where knowledge and thought are exhausted and where science has not yet broken through the latest barrier, but also where there is clear light as well as seemingly impenetrable darkness. It comes at the moment when the oddness of the most familiar object overwhelms us. Then even the ephemeral presence of a snowflake confronts us with those primordial questions that are at the heart of myth and religion: the mysteries of life and death, of being and nothing, of origins and destinies, of mind and matter and time, and of the very existence of creatures capable of asking these questions. (p. 111)

He points out that historically science has not superseded religion, but rather science has superseded magic and magical practices. He argues that one need not "demythologize" the Bible to get rid of mythical concepts no longer acceptable to modern man, and then reconstruct the biblical message in categories acceptable to modern man (following the path of Bultmann, for example); nor need one "demythologize" the Bible by taking its statements literally and restating them in terms of modern science and historiography (following the path of Christian fundamentalists, for example). Both of these are forms of modernism. Instead the appropriate approach relative to both these misuses is to "*deliteralize* and *re*mythologize the text to preserve its religious character and richness of meaning." (p. 106)

In view of these extremely timely, relevant and helpful insights, it is unfortunate that Hyers has adopted, essentially without argument or justification, the hypothesis that Genesis 1 is the product of a "Priestly" author while Genesis 2 is the product of a "Yahwist" author, both authors writing in fact considerably after the time of Moses. He speaks of the "Yahwist" account as having been written in the 10th century B.C. in the time of Solomon, when imperial splendor called for the reminder of mankind's humble beginning in the dust of the earth, and for a warning against the subtle evils of civilization. He speaks of the "Priestly" account as having been written in the 6th century B.C. in the time of the Exile when Solomon's kingdom had been divided and conquered, and when the author reminds his readers of the intrinsic dignity of human beings and their origin as created in the image of God. It is true that the use of these historical contexts makes an understanding of some of the nuances of these two accounts surprisingly possible, but their introduction as obvious, true and established will automatically lead many evangelical readers to reject the whole of Hyer's valuable contributions out of hand. It is high time for this question to be dealt with carefully and thoroughly by scholars committed both to a high view of inspiration and the integrity of the Bible, and to a willingness to face whatever facts are really there. In this book Hyers offers only the statement, "If the seven-day account was written in the context of the dark period of exile following the Babylonian conquest of Jerusalem and the deportation of Jews to Babylonia, *as most scholars concur*, . . ." (italics added, p. 51). Surely the dating of these creation accounts, if possible at all, should be undertaken with as much care as possible; it is not a question that can be settled either by dogmatic traditionalism on the one hand or appeal to the consensus of specialists with unknown personal commitments on the other. A very large fraction of the points that Hyers makes are independent of the specific truth or error of these dating assignments. Readers who disagree with Hyers should not take the easy way out of casting suspicion on his major conclusions via his acceptance of datings not universally agreed on in the conservative Christian community.

This is a book of first-rate quality. Its contribution to the Christian community's perception of the creation/evolution debate is sizable. No future discussion of these issues will be complete if the insights given us by Hyers are not considered and included.

Reviewed by Richard H. Bube, Department of Materials Science and Engineering, Stanford University, Stanford, CA 94305.

TWO MEN CALLED ADAM by Arthur C. Custance. Doorway Publications, Brockville, Ontario, Canada (1983). Paperback $10.50. ISBN 0-919857-02-7.

Who was Adam? For many he was the first human being, formed directly by God out of the dust of the earth, and having the breath of life breathed into him by God. For others, even some who profess Christianity, Adam is merely a figure of mankind in general. He is a symbolic man, the result of a long process of evolutionary change from more lowly and primitive creatures. And who was Eve? Was she the product of a supernatural surgical technique or was she also a product of evolutionary processes? And what of the soul or spirit of man, how or when was it introduced? Who was the Second Adam and what was His relationship with the First Adam? These and other questions and topics are discussed in the latest book by Arthur Custance.

Custance, a scientist and prolific writer, is known to Christians for his series of books, the Doorway Papers. *Two Men Called Adam* is somewhat different in style from his previous works. It is less scholarly and much more personal in nature. It might best be described as a devotional type of reading. I felt as though I were engaged in an intimate conversation with the author as he discussed some of his innermost feelings.

The book is, as the subtitle states, "a fresh look at the creation/evolution controversy from a different point of view—the theological." Indeed, most of this controversy is of a scientific nature. Custance, on the other hand, explores this in a different manner—from the Biblical data. He makes it very clear in the book that he approaches Scripture in what would be described as a literal or conservative manner. He readily accepts the Biblical record as historical and accurate. He feels, for example, that Eve was formed from Adam just as described in Genesis.

The book does not seem to be a work of apologetics. If one is having a personal struggle over issues in the creation/evolution controversy, then this may be a useful resource. It would not, I feel, be sufficient in changing the conviction of one who accepts an evolutionary origin of humans. It would, however, certainly provide many thought provoking questions for such a person.

The most positive aspect of the book is that it is interesting and enjoyable to read. The author discusses some fascinating topics related to humans and their origins. He discusses, for example, the origin of man and woman, the origin of the spirit and of consciousness, and the purpose and nature of the human body. The nature of death in animals and humans, the resurrected body, and heavenly existence are also discussed. Much of the book is devoted to the "Second Adam," including such topics as the incarnation, virgin birth, death and resurrection, and nature of His sacrifice.

I did not agree with all of Custance's conclusions, but I did feel that he had spent much time in study and contemplation. It would even seem in reading the book that it represents a lifetime of thought and service.

The only negative aspect of the book is its lack of footnotes and bibliography. The author explains that this was done for style and readability. The book does have extensive indices of Biblical references, names, and subjects.

I recommend this book to all those of Christian belief. It is thought provoking and insightful, and does, in fact, explore a new way of looking at the issues related to creation and evolution.

Reviewed by Phillip Eichman, Muncie, Indiana.

GOD'S FOREIGN POLICY by Miriam Adeney. W.B. Eerdmans Publishing Co., Grand Rapids, MI (1984). 140 pages. Paper $6.95.

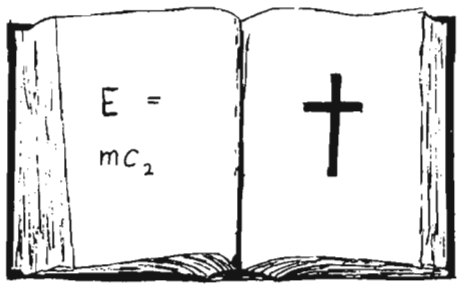
Miriam Adeney grapples with the intractable problems associated with promoting development in the poorer countries of this world. She clearly describes the problems that arise when a wealthy country with its centuries-old culture attempts to raise the living standards of a poor country which has its own centuries-old but vastly different culture.

Her training as an anthropologist (Ph.D.) serves her well as she repeatedly reminds us the donors should look at the entire culture of the recipients and be prepared to spend many years at the job if sustained improvement is to be achieved. Her training as a journalist (M.A.) comes through in a gripping way as she describes some of her experiences in developing countries. For example, having spent two years in the Philippines myself, I found the accounts of her life there caught the flavor and tempo of that beautiful country as clearly as a TV documentary. As a committed Christian she reminds us that no matter how many mistakes have been made in the past or how discouraging the present seems to be, we still have to obey the injunction to "love thy neighbor as thyself," in a practical way. The main thrust of her book is that foreign aid should be given more thoughtfully, more caringly and with greater respect and love for the recipients of that aid.

The first five chapters cite problems and successes in 1) health care, 2) agriculture, 3) business, 4) politics and 5) refugees. Chapter six forcefully points out that every culture has something to offer and that proposed new ways of doing things should be planned so as to disrupt the existing culture as little as possible. The last chapter, "American Alternatives," makes the point that when people in less developed countries accept the gospel, their new-found hope causes their lethargy and sense of powerlessness to be replaced with the energy and determination to improve their own lot. She also calls upon Christian people in developed countries to increase their support for this work in accordance with the theme of James 2:14–17. The final conclusion—"No single approach is the answer. We need a comprehensive view of the world and its needs"—is sound.

A more closely focused title for this book would have been "God's Foreign Aid Policy," because it deals only with the aid component of foreign policy. Read this book if you want a Christian perspective on foreign aid or if you like to hear stories of heroes who dedicate their lives to feed the hungry, heal the sick, bring water to the thirsty, clothing to the naked and shelter to the homeless.

Reviewed by Malcolm Bourne, New York State Agricultural Experiment Station, Geneva, New York 14456.



Not everything is relative

Letters

The Creation/Evolution Controversy . . . More Heat Than Light?†

As an evangelical Christian as well as an anthropologist, I have been watching with interest the Creation/Evolution controversy. Since I am a member of two groups of people, each one of which tends to champion one of the positions in question, I have been in an unusually strategic position to observe the happenings of this debate.

A number of things strike me about this issue and the way that it is being handled by both sides. I find it hard to imagine that many people do not see the source of the problem: widely divergent world views. One of the many insights that anthropology has provided the world is that people base their scientific hypotheses on their understanding of the cosmos and the characteristic(s) of any being(s) in the cosmos. This is, of course, equally true for us in the West. For evangelical Christians, with their central concept of a personal God, Creation is the only rational, logical explanation of the origin of humanity. For those whose metaphysical outlook includes no god or a deistic image of God, Evolution is rational and logical. Yet the debate continues to rage on as if everyone involved shared the same metaphysical outlook. Each side calls the other unscientific (and indeed, each side *is* unscientific when it uses "unacceptable" bases for its science) as if the same set of cosmological constructs were being used. No wonder there is such little agreement!

But this is not my central point. My reason for writing is the tactics used in this ideological battle. On both sides, I see less-than-ethical attacks on the other. Both Evolutionists and Creationists are at fault. Even if some semblance of a truce cannot be called based on the reasoning found in the above paragraph, I would like to suggest that some tactics used in the conflict be eliminated. The rest of this paper will deal primarily with areas where I think that the principals involved have not been as honorable as they might have been.

Evolutionists, your scholarship has not been fair. Very few creationists agree with the 4004 B.C. date anymore, yet one can find this in archaeology texts today. The implication is that one who goes along with the Creationist viewpoint is hopelessly naive and outdated in their thinking. If one is willing to introduce the viewpoint of another for the purpose of critical analysis, the least that one can do is provide their best argument, not their most ridiculous.

This applies to Creationists as well. Today, no Evolutionist takes seriously the theories of early physical anthropologists who suggested that Asians are related to orangutangs, Blacks to apes, and Caucasians to chimpanzees. So why even introduce it? It seems to me that arguing with or denigrating another's weakest point implies that their strongest points are too strong. In this controversy, which is being carried out in a public arena, more honorable tactics should be used.

Perhaps I am reading between the lines too much, but it appears that there is a basic distrust of the other side in this whole imbroglio. I detect implications on the part of Evolutionists that anyone holding the Creationist viewpoint must be illogical, backward, subversive, uneducated, and stubborn. Similarly, Creationists seem to suggest that Evolutionists can be demonic, subversive, atheistic (in the pejorative sense), arrogant, and stubborn. As a member of the general public, as well as having one foot on each of the sides (the American Anthropological Association being a proponent of the Evolutionary viewpoint, and Creationism being a major plank of the traditional evangelical platform), I implore both sides to refrain from mud-slinging—either implicit or explicit.

It seems that one constructive step might be for each side to acknowledge its debt to the other. Here I want to focus on anthropology within the Evolution camp and post-Reformation Christianity within the Creation camp. (Not that these sets of people and ideas elucidate their points any better; it's just that I am more familiar with them.) Historically, the anthropology of today owes a great deal to its antecedents in Christianity. Besides missionaries, who were the world's first ethnographers, anthropology owes a debt to the Christian notion that the world around us (including people) is orderly, having been created by a rational God, and that that order can be discovered. Indeed, the whole corpus of Western science has such a notion as part of its foundation. Christians, what would be the degree of your understanding of Scripture if it were not for the labors of those handling spades, picks, brushes as well as the meticulous sorting and note-taking in the hot sun of the Middle East done by archaeologists?

Creationists, remember that a similar battle has been fought before. Fifteenth-century Christians used to "prove from the Bible" that the sun rotated around the earth. The Bible may be the inspired Word of God, but our theologies based on it can never be. Facts are facts and the best theologies are those that integrate truth (no matter what its source) with Truth.

Evolutionists, beware of becoming too dependent on concepts like uniformitarianism. Most of the cultures of the world have no trouble accepting a supernatural and/or cataclysmic beginning for themselves. Are we in the West like the person in the marching band who looked around and saw that everyone else was out of step? We need to take care lest we fall prey to a subtle ethnocentrism that sees Western science as somehow implicitly superior to other explanations of our existence.

Finally, I suggest that both sides learn to treat other world views with respect—a basic anthropological value. The real issue is a person's understanding of the world, and this is something that many people do not readily change. Both Creationists and Evolutionists have a right to prosyletize, but the issue is a metaphysical one of the existence and/or character of God, not trying to get the other person to see that his or her perspective is flawed in its logic and rationality. One doesn't get hot water out of the cold water faucet unless the plumbing system is changed.

In a controversy which has often generated a disproportionate amount of heat in relation to light, I hope that some changes come about in the way the debate is conducted. I also hope that the changes come soon.

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† *This letter has also been published in* Anthropology Newsletter, *Vol. 25, no. 7 (1984).*

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