JOURNAL OF THE
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Evangelical Perspectives on Science and the Christian Faith

Expanded issue . . .

Selections from Oxford

Christian Objections to Technology

Resource and Environmental Ethics

Christian Approach to Scientific Endeavor

Theological Clues for the Scientific World

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

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Putting Things in Perspective

In July 1985 the annual meeting of the ASA was a historic conference held jointly with our brothers and sisters of the Research Scientists Christian Fellowship. For four days we met at Oxford University in plenary and parallel sessions, as well as in the dining hall and walking around Oxford. We discussed biblical and scientific truth, science as servant and manipulator, and science as a social phenomenon. It was an exciting and mind-expanding time as we shared, on an international basis, the challenges of scientific advances and our concerns for their moral and ethical use. One hopes that groundwork was laid for future cooperation as we face the global problems of the closing years of the twentieth century, problems that cry out for a Christian perspective and for Christian action.

In view of the anticipated increase in the number of papers submitted to the Journal as the result of this conference, we are expanding both the June and September issues by fifty percent. The present issue includes two of the key-note addresses from the Oxford meeting. Donald MacKay, of the University of Keele, sets forth the basic priorities with which we as Christians and scientists need to be concerned. We "are commanded, not merely permitted, to 'subdue the earth'" (Gen. 1:28). However, we are to do this as God's fellow-workers, and we are especially to do whatever we can "to alleviate the lot of our fellow man." As we seek to apply technology in the years ahead we need to have humility and compassion and to recognize that as mere mortals we will make mistakes, a result not only of our sin but also of our creaturely inadequacies. MacKay set the stage for much of the conference with this paper. At the closing session he summed up what had gone on and that summation will appear in our September issue.

Walter Thorson emphasizes the importance of realism in relation to the basic response of the reverence that we need to have toward God. He analyzes the recent advances in several areas of science in the light of the recognition of two levels of thinking: "alpha thinking"—about things, and "beta thinking"—about thinking itself. This can be pretty heady stuff, but certainly the spectacular advances in scientific knowledge have raised many questions that challenge simplistic reductionism and positivism, questions that can lead to a greater appreciation of and reverence for the God who has revealed Himself in Scripture and Creation. It can also lead into a morass of pantheistic mysticism that, as Christians, we believe is just another form of paganism.

Not presented at the Oxford conference, and, indeed, submitted to the editorial process of our Journal well before last July, are several papers on a variety of subjects. David Aycock discusses some of the Christian objections to high technology. While, as MacKay reminds us, "science-bashing" is not limited to Christians, Aycock describes some of the recent alarmist views of technology from extreme conservative sources. We must address the real ethical dilemmas of technology, but we must not forget that investigating and using God's creation is a biblically mandated process.

Laurence Walker analyzes another dimension of human relationships with our God-given environment from the perspective of a resource manager. We need to admit that there have been those who have used the Scriptures to justify reckless and ruthless exploitation. However, natural "resources are to be used, and not abused, to provide for the needs of people." We need to appreciate the biblical description of human nature "which leads all men to exploit," and then seek to be responsible stewards.

T. M. Moore presents a model for a Christian approach to science. His model emphasizes the important interactions among theological science, natural science, and human science. While models and diagrams can sometimes oversimplify or sometimes confuse, they can also provide the basis for further discussion and investigation. Moore describes for us an interesting model and compares it with what he considers to be less desirable alternatives.

Harold Nebelsick gives us an overview—largely of a well organized and readable historic nature—of what the theory of relativity and quantum physics has done to our understanding of the world around us. Certainly

there has been an increased awareness of the need for a better relationship between theology and science, a relationship that can help them to "mutally modify and complement one another." In the first Communication Jim Neidhardt (a physicist) comments on theologian Nebelsick's fine contribution and reaffirms the basic concepts.

Other Communications bring us back to the old problem of evolution. George Murphy and Fred Van Dyke respond to each other's widely different views on theistic evolution as presented by them in the March issue. To add still another dimension to the controversy, David Siemens presents the case for the "days" of Genesis 1 as days of revelation to Moses. At a time when the evangelical community is being overwhelmed by a distorted history, theology, and science—that vigorously proclaims that *only* a literal six-day, recent creation has any claim to being truly biblical, it is important to emphasize that the views of Murphy, Van Dyke, and Siemens (and numerous other conflicting views) have long been held by Christians with a firm commitment to Jesus Christ and to the Scriptures as God's infallible word. In the ASA Journal we will continue to welcome a variety of views on this subject in addition to other problem areas which people are wrestling within an evangelical framework. We welcome your participation through regular papers, short communications and letters. Of course we have to do some editing to help one another clarify and strengthen our presentations, but I hope we will always do this in a way which honors our Lord by "speaking the truth in love."

WLB

The Moral Responsibility to Be Intelligible—

Clinical research is predicated upon the belief that its significant results should be communicated and used by others. How miserably this is accomplished is any contemporary editor's tale of woe and any thoughtful reader's sorrow. The pseudo prestige of long and difficult words transcends the useful scientific term and diffuses widely through our papers. Simple things are made complicated, and the complex is made incomprehensible. Chaos reigns. The so-called medical literature is stuffed to bursting with junk, written in a hopscotch style characterized by a Brownian movement of uncontrolled parts of speech which seethe in restless unintelligibility. Every day we realize that the iron curtain which disbars us from sampling in adjacent fields of science is not so much the erudition of our colleagues as the tropical jungles of verbiage and gobbledegook in which this erudition lurks, unobserved save by the initiated. Has this unfortunate situation any corrective? If some small fraction of the time and effort which goes into the techniques of research were spent on study and perfection of the simple techniques of writing and speaking clearly, paths could be made in the jungle. Those who start late must read and study good models of exposition. Learn the simple rules: write, rewrite, delete, polish. For sage advice, Allbutt's "Notes on the Composition of Scientific Papers" has lost none of its cogency, and elegantly combines precept with example. For a contemporary view Gower's "Plain Words" is equally good. With such guides our scientific writing must improve. Correct grammar, thoughtfully combined with rhetoric, might lead through grace to that elusive quality style and make a worthy medium for telling of significant work.

From William B. Bean, "A Testament of Duty," *Journal of Laboratory and Clinical Medicine* 39:3–9(1952)

Christian Priorities in Science*

DONALD M. MACKAY

Department of Communication and Neuroscience
University of Keele
Keele
Staffordshire, England ST5 5BG

1. The Scientist as Map-Maker

The scientist is by profession a map-maker; and like other map-makers he is pledged to allow his own particular values to distort as little as possible the representation he makes of the state of affairs. "Whether I like it or not, or you like it or not, that's the way it is as far as I can see." In this sense, he strives to make scientific knowledge "value-free." His maps are meant to be reliable guides to other people, of whose values he can know nothing; so "scientific detachment" and "depersonalization," far from being arbitrary eccentricities of the trade, are all part of his duty as an honest craftsman.[1]

The world mapped by the scientist is a world of events as well as entities—a world where one thing *causes* another. His maps are not merely of observables but of *correlations* between observables and (in due course) of interacting causal factors. Thus, unlike a map of the continents or even a motoring route-map, his maps offer *explanations* and *predictions* as well as descriptions. His "laws" are *prescriptive*, not in the sense that they make things happen, but in the sense that they tell us what in given circumstances we ought to expect on the basis of precedent. Confronted with a reliable (and comprehensible) scientific map, we have lost the innocence of ignorance and can be held morally accountable for the expectations we entertain in the relevant domain. Scientific laws (as mere codifications of precedent) do not of course assure us that the unprecedented cannot occur; but they impose an obligation on us to justify any contrary expectations.

This emphasis on value-free objective knowledge might be taken to suggest that evaluation, as distinct from meticulous observation, plays little or no part in the practice of science, and that there should be little need for a whole lecture on "Christian Priorities in Science;" but let us see.

2. Evaluation in Science

Once we think of science as a human enterprise, questions of value crowd thick and fast upon us. To list just a few examples, science demands of us evaluation, explicit or implicit,

(i) In accepting the obligations, both ethical and social, of map-making;

(ii) In choosing what to map;

(iii) In choosing the categories in terms of which to map (e.g., geological, agricultural etc);

(iv) In assessing relative costs and benefits in relation to identified "needs;"

(v) In deciding where and in what terms to apply for financial support;

(vi) In assessing the ethical/moral acceptability of research methods;

(vii) In the creative process of inventing hypotheses to test;

(viii) In noticing and reporting data adverse to a chosen hypothesis;

(ix) In selecting *what* to publish, and *when* and *where*;

(x) In encouraging/discouraging specific applications of scientific discoveries;

(xi) In accepting/rejecting new scientific problems that may be raised by given applications;

(xii) In presenting to the general public, including any fellow-Christians who have to make pronouncements in the name of the Church, the implications (practical, theoretical, philosophical, religious if any) of scientific discoveries.

*Paper presented at the conference "Christian Faith and Science in Society," a joint Meeting of the American Scientific Affiliation, Canadian Scientific and Christian Affiliation and the Research Scientists' Christian Fellowship, held July 26–29, 1985, at St. Catherine's College in Oxford, England.

This list is not meant to be exhaustive, and it would make a dull paper indeed to run down it with the Bible in hand to identify relevant Christian priorities in each case, but I hope it may serve as a useful check-list in terms of which to test the implications of what follows.

3. Christian Priorities

"Man's chief end is to glorify God and to enjoy him forever." So the shorter Catechism sums up the rubric under which the Christian must practice his science. Not only must he seek to live to that end, but in all his efforts to serve his fellow men he must aim to further, and not to hinder, their own prospects of doing the same. This already constitutes quite a severe filter, as a glance at our twelve examples of evaluation will show. We glorify God first and foremost by establishing love (in its strongest sense) as the ruling spirit of our whole enterprise—love to him as our Master and Redeemer, and as the Giver of being to all our data and all our powers; and love to our neighbor which must never fall short of the love we have, or ought to have, for ourselves.

Love of God involves grateful and obedient service with all our heart (enthusiastic commitment), mind (scrupulous acceptance of the rational implications of God's data) and strength (diligence in action). Though God can be glorified by mere admiring contemplation of his works (e.g., Ps. 8, Ps. 104), full obedience, especially for the scientist, demands precisely those emphases on accuracy, objectivity and rationality that (in most disciplines claiming the name of "science") are recognized as professionally essential. Our service being that of stewards, our master sets a high priority on *initiative* as well as diligence.[2] We are meant to use our gifts of imagination as pioneers in areas where no specific biblical instructions may have been given, and in which we can be guided, or at least limited, only by general biblical principles. This is so not only in exploring new territory for the benefit of our fellow men, but also in cases where we may see no immediate practical relevance (e.g., in cosmology or some branches of pure mathematics). In these fields too, our Master is glorified by imaginative enterprise and let down by lack of it. We cannot remind ourselves too often that "God has given us richly all things *to enjoy*,"[3] and that the works of the Lord are meant to be "sought out by those who *take pleasure* in them."[4] For the Christian with biblical priorities, science is meant to be fun as well as labor, even though in a fallen and needy world he must be prepared for claims of compassion to compete sometimes with those of curiosity, however highly motivated.

4. Biblical or Pagan?

Already we see a strong contrast between the Biblical concepts of nature and man and a variety of pagan ideas. Many people in our day, as in previous ages, suppose the typically "religious" attitude toward natural science to be that embodied in the ancient Greek legend of Prometheus, who stole the sacred fire. Nature is thought of as semi-divine; she has her secrets. The gods would like to keep some of these to themselves, and jealously resent any advances in man's knowledge of them. Science is thus thought of as an irreverent and dangerous pursuit in which sinful man aspires unto the place of God. If disaster results from attempts to apply man's scientific knowledge, this is considered to be what he deserves for prying into the sacred mysteries of the Creator.

Now it cannot be denied that if your idea of God (or the gods) were that of the ancient Greeks, indeed of almost any pagan religion, all this would make good sense. To some people it might seem to represent the proper humility of man before the majesty of his Maker. But is it in fact biblical? I think not. The Bible has no time for human pride; but its teaching about the natural world is precisely the reverse of the pagan's at crucial points.

Donald M. MacKay, B.Sc., Ph.D., F. Inst. P., born 1922 in Lybster, Scotland, has Physics degrees from St. Andrews and London. Wartime radar experience, and early work on foundations of information theory and electronic computing, led him into brain research. The Department of Communication and Neuroscience at the University of Keele, which he founded in 1960 and directed until 1982, combines physiological and psychological studies of brain function. In parallel with his scientific work Professor MacKay has been active in exploring its philosophical and theological implications, and has written several books on the integration of Christian faith and scientific inquiry, including The Clock Work Image; Brains, Machines and Persons, *and* Human Science and Human Dignity. *He is an honorary Fellow of* A.S.A.

The Bible sets man in perspective as a creature of God, a part of the vast created order that owes its continuance in being to the divine upholding power. Unlike the rest of the natural world known to us, however, human beings have powers of foresight, planning and action that make us especially responsible in the eyes of our Creator. With these powers, according to the Bible, goes a special obligation toward the Creator. Men are commanded, not merely permitted, to "subdue the earth" (Gen. 1:28). This is to be done not, indeed, in a spirit of arrogant independence, but as the stewards of God's creation. Human beings are answerable to Him for the effectiveness with which they have fulfilled His mandate.

We are meant to use our gifts of imagination as pioneers in areas where no specific biblical instructions may have been given, and in which we can be guided, or at least limited, only by general biblical principles.

The Christian ethos is thus in complete contrast to the pagan caricature with which it is so often confused. In place of the craven fear that haunts the unwelcome interloper, we are meant to enjoy the peaceful confidence of a servant-son at home in his Father's creation. We know that we are on our Father's business no less when investigating His handiwork than when engaged in formal acts of worship. In place of jealously secretive gods we have One whose very nature is Truth and Light, Himself the giver of all that is true, who rejoices when any of His truth is brought to the light and obeyed in humility (e.g., I John, *passim*).

The Bible encourages man to roam the domain of the natural world in responsible freedom, showing all of it the respect due to his Father's creation, but none of it the superstitious reverence that would deny its status as a created thing like himself. As Professor Hooykaas has put it,

> The Bible knows nothing of "Nature" but knows only "creatures" who are absolutely dependent for their origin and existence on the will of God. Consequently, the natural world is admired as God's work and as evidence of its creator, but it is never adored. Nature can arouse in man a feeling of awe, but this is conquered by the knowledge that man is God's fellow-worker who shares with Him the rule of the fellow-creatures, the dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth . . . Thus, in total contradiction to pagan religion, nature is not a deity to be feared and worshipped, but a work of God to be admired, studied and managed. In the Bible God and nature are no longer both opposed to man, but God and man together confront nature.[5]

5. God's Fellow-Worker

The biblical concept of man as God's fellow-worker is not without its logical difficulties. If God is almighty, why does He need our help? If He has willed things thus and so, how can any action of ours improve upon His presumably perfect will? The answer sometimes offered is that God voluntarily sets limits to His power, and leaves us room to supplement His action. According to this model God does so much, and man's part is to do the rest. I will not go into the further theological difficulties that are raised by such an answer. All I would say now is that it is emphatically not the answer offered in the Bible itself.

For the biblical writers there is no question of any such partition of action between God and man. "Work out your own salvation with fear and trembling, for it is God who is at work in you to will and to do of His good purpose" (Phil. 2:12–13). This injunction was given to New Testament Christians. The Old Testament is just as clear that in one sense at least all men, whether they love God or hate Him, are giving expression to the creative purposes of God by their choices and actions. "You thought evil against me," says Joseph to his brothers, "but God meant it unto good . . . (Gen. 50:20). God is the immediate giver of being to all that is and all that moves, the wicked as well as the good. In a profound sense the whole drama of creation unfolds according to His "determinate counsel and foreknowledge" (Acts 2:23).

Unlike the rest of the natural world known to us, however, human beings have powers of foresight, planning and action . . . With these powers . . . goes a special obligation toward the Creator.

It would thus be a logical blunder to interpret human responsibility in the Bible as something that takes over where God leaves off. The Bible clearly represents us as both wholly dependent on God for every event of our existence, and wholly answerable to Him for the responses we make. The slogan: "Work as though all depended on you; pray as though all depended on God" may be somewhat oversimplified, but it comes far

closer to expressing the spirit of biblical realism than any attempt to parcel out zones of responsibility between God and man.

This is not the place to spell out the logical fallacy in attempts to make a contradiction out of these complementary emphases[6]. Suffice it here to say that if we pay attention to the differences in logical standpoint between talk about a creator (any creator) and talk about his creatures, it becomes clear that the agency of the creator is not an alternative to, but a necessary condition of, the agency of his creatures. This does not make the creator morally answerable for the actions of his creatures (it would make no sense to hold Shakespeare guilty as an accessory to the murder committed by Macbeth!). Nor does it abolish the moral responsibility of the creatures for the exercise of their created capacities. But if, as the Bible declares, our Creator is One to whom it makes sense to pray, then it makes abundantly realistic sense for us to acknowledge in prayer our total dependence on Him. Simultaneously, as agents within His created drama, we recognize also our full responsibility for our action or inaction, and the logical absurdity of shrugging any of it off on to him.

To put it in another way, it is essential to distinguish between two quite distinct meanings of the will of God. One, denoting what we might call His creative will, is what is expressed in the Genesis phrase "Let there be . . . " Any idea of our going contrary to God's creative will is strictly meaningless, since apart from His creative word nothing happens. "He upholds (gives continued being to) all things by the word of His power" (Heb. 1:3).

The other concept we might term God's normative will. This is what is expressed, for example, in the Ten Commandments or the Sermon on the Mount, in the words "Thou shalt . . . " The idea of our going contrary to God's normative will is, alas, far from meaningless, however wrong and unrealistic it may be. Without God's help, according to the Bible we will lack both the ability to recognize His normative will and the desire and strength to carry it through. The gift of vision and strength to do God's normative will is what the Christian knows as *grace*. It is mediated through God's creative will. It is the daily experience of living in dependence on the grace of God that unifies the complementary doctrines of divine sovereignty and human responsibility.

6. Technology In Biblical Perspective

The contrast between biblical and pagan theologies of nature is at no point more decisive than where science comes to inspire technology. "What right has man to improve upon nature; aren't we beginning to usurp the prerogatives of the Creator?" Such questions are often asked rhetorically, backed by observations of the kind parodied by Flanders and Swann: "If God had meant men to fly, he would never have given us the railways."

There is of course a sober warning for all ages in the story of the Tower of Babel, where men sought to build "a tower whose top may reach unto heaven" (Gen. 11:4). What the context makes clear, however, is that their sin consisted not in the building but in the motivation for it—an arrogant desire to be independent

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of God. Nowhere in the Bible is technological achievement disapproved, except where it expressed human pride and vainglory. More relevant is the reiterated biblical teaching that "He that knoweth to do good and doeth it not, to him it is sin" (Jas. 4:17). From the biblical standpoint whatever needs to be done to alleviate the lot of our fellow men is a duty from which we can excuse ourselves only for good cause.

The contrary pagan notion that it is both impossible and illicit for man to compete with or improve upon nature has had a long and fascinating history from ancient times. The Greek concept of the Golden Age, when men were supposed to have lived healthy and contented lives without technological aids, colored much classical and medieval thinking. The supposed divinity of nature was taken to imply that man would be claiming divine prerogatives if he attempted to copy or improve upon it. The general belief of the Middle Ages was that feats of nature could be surpassed only by magic.

The most powerful biblical arguments against this pessimistic view were advanced by 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) dismiss those preposterous philosophies which have led experience captive, and approach with humility and veneration to unroll the volume of creation.

As Hooykaas puts it, Bacon

> blew the trumpet in the war against the sins of laziness, despair, pride, and ignorance; and he urged his contemporaries, for the sake of God and their neighbors, to re-assume the rights that

> God had given them and to restore that dominion over nature which God had allotted to man. His ideal was a science in the service of man, as the result of restoration of the rule of man over nature. This to him was not a purely human but a divinely inspired work: "The beginning is from God . . . the Father of lights."

It is worth noting that traces of the Graeco-medieval tradition lingered even in such a champion of biblical Christianity as C. S. Lewis, who justified his anti-technological bias by identifying human dominion over nature with hubris, commending instead the (Stoic) "wisdom" of "conforming the soul to reality." Significantly, perhaps, he did not adduce biblical support for this attitude! As Hooykaas comments:

> It is true that results of our dominion over nature have been unhealthy in many cases; the powerful river of modern science and technology has often caused disastrous inundations. But by comparison the contemplative, almost medieval, vision that is offered as an alternative would be a stagnant pool.

7. Materialism

Here, if not before, I can imagine some fellow-Christians becoming restive. "Your science-based technology," they say, "is all part of the quest of Western man to free himself from the necessities imposed upon him by religion, society and nature. Science has been drawn in, perhaps without its knowledge, to become the engine of an essentially godless project of human self-mastery. Its most notable effect is the all-pervasive materialism of which our culture is spiritually dying."

From the biblical standpoint whatever needs to be done to alleviate the lot of our fellow men is a duty from which we can excuse ourselves only for good cause.

That a culture hell-bent on "freedom" from its Creator's demands will distort its scientific priorities accordingly has proved tragically true in many parts of our contemporary world, and I would say nothing to diminish the biblical content of such prophetic warnings. What worries me, however, is the confused and confusing tangle (as I see it) of extra-biblical presuppositions behind much currently fashionable "science-bashing," and the damage that can be done to the Christian concept of science and its priorities when fellow-Christians climb on this particular bandwagon. I have discussed this elsewhere,[7] and I want here only to draw one or two distinctions that seem essential if Christians are to make sense (let alone command respect) in this connection. First, the spiritually rebellious and damaging "materialism" that the Bible condemns was clearly as rampant in the pre-scientific days of the prophets and of Jesus Christ as it is today. Even the first man who built a shelter from the rain could have seen it as "freeing him from the necessities imposed by God and nature." He could have—but he need not. He could equally have seen it as a God-given improvement to be enjoyed with thanksgiving. Without belaboring the point, it is surely obvious that what is wrong in "materialism" in the anti-Christian sense is the *lack of filial love to God* in its self-gratifying enterprises, rather than any resulting "freedom from necessities."

What worries me, however, is the confused and confusing tangle (as I see it) of extra-biblical presuppositions behind much currently fashionable "science-bashing."

Secondly, the fact that (classical) physical science is built upon the concept of "matter" and its "properties," and is thus "materialistic" in a technical sense, is totally irrelevant to this issue. If TV sets and washing machines can one day be designed effectively using a new physics that discards the concept of "matter," they will present no less, and no more, temptation to the "materialism" that biblical preachers rightly deplore. A physics based on "matter" may offer more scope for some forms of reductionist "nothing-buttery," but that is in any case logically fallacious.[8]

Thirdly, whatever a few godless scientific popularists may have suggested, the whole idea of human "self-mastery" by scientific means is so manifestly incoherent in strictly philosophical terms that it is misleading to the Christian public if we preach against it as if it were conceptually a live option. "He that sits in the heavens shall laugh at them"[9]—and if there are good analytic reasons for our doing the same without invoking the authority of divine revelation, it is surely these that we should first urge. There is no merit, and grave risk of confusion, in urging fellow-Christians to give such nonsense the dignity of requiring specifically theological rebuttal.

8. "Fashioning the future"?

Some Christians express particular unhappiness with the idea that our scientific knowledge should be

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applied to what they call "fashioning the future" as distinct from simply "acting together." This, they argue, would deny or take the place of faith in divine providence. *Actions*, they say, are all right. An action has a beginning and an end; and when one completes what one is doing, what happens to it is out of one's own control. To act well, then, requires faith in divine providence, because one must hope (without the possibility of calculative proof) that what one has done will be used for the service of others rather than their hurt. To "fashion the future," however, (they would say) is to refuse to let one's act go. It is to strive to extend one's control even to directing the stream of history. It is to assume a "*totalistic*" responsibility for what will happen.[10]

Now we must agree that a God-defying spirit like that of the builders of Babel, snatching at *total* responsibility for our future, would invert Christian priorities. But who in his right mind, one wonders, ever imagined that technology *could* give anyone such total control of the future? The radical incoherence of the very notion has been well demonstrated by people like Sir Karl Popper[11] who have no religious axe to grind. Here again, utopian talk in these terms can be dismissed merely on technical grounds. To try to oppose it by contrasting "acting together" and "fashioning the future" is to fasten on the wrong distinction. Consider, for example, the actions of a Christian driver in steering a car-load of people to work. Is he morally or spiritually wrong to "refuse to let his act go" by applying continual feedback, so as to direct the stream of his local history in accordance with the norms of good stewardship and compassion for his passengers and other road users? If so, by what biblical criterion? As accident statistics show only too well, his control does not eliminate the need for faith in divine providence; but he would rightly reject as immoral and frivolous any suggestion that there would be merit in "letting go" his efforts to shape his future course as precisely as possible. The same applies to larger-scale operations in which the health, wealth and happiness of a whole community may depend upon continuous exercise of foresight and regulative power which it would be a mere dereliction of God-given duty to "let go," yet in the course of which faith in divine providence is even more necessary.

The danger in objections on the lines I have cited is that they fasten on the wrong distinction. They suggest that any attempt to change or control the shape of the future, however partially, must either be of the "act and let go" kind, or else fall into the "totalistic" category. This neglects a huge class of everyday actions of the sort that an engineer would term "closed-loop." Only a special class (termed "open-loop") conforms to the "act and let go" description.

No, the morally significant contrast that we must hold on to as Christians is not between open-loop and closed-loop efforts, nor between efforts to exercise our stewardship on a small scale and on a large scale (whether in space or time). It is between efforts in obedient love, and efforts in rebellious defiance, towards the Master who has given us that stewardship.

It is arguments in the other spirit, I fear, that make a professed unbeliever like Sir Peter Medawar[12] so angry with what he calls "postural anti-scientism." He cites an historic comment by *The Times* on Edwin Chadwick's (fortunately successful) efforts to promote the Public Health Act of 1848: "We prefer to take our chance of cholera and the rest than to be bullied into health. England wants to be clean, but not cleaned by Chadwick" (Medawar, p. 20); and he complains savagely of the "unquestioning, unthinking, almost reflexly contemptuous relegation to the devil of science and all its works and the attribution to it of all evils, especially those that are in reality due to political incompetence or commercial greed." Of course few Christian writers, however anti-scientific, would qualify for Medawar's description. What I would ask, however, given the solid biblical basis for both science and its uses for human benefit, is why Christian writers are not more unanimous and vocal in dismissing as unbiblical the irrational science-bashing of our day.

It can rightly be argued that if ever we had the technical means to reshape human society at large, we should still as fallen sinners have little or no assurance that our choice of ends would be for our good, or that of posterity. "Learning what to want," as Sir Geoffrey Vickers[13] has pointed out, is even more difficult, most of the time, than learning how to achieve what we want. But the Christian who depends in humility on God for his standards of "the good" can still sympathize with Medawar when he observes that "to make the world a better place to live in is an ambition not

falsified or diminished by the propensity of those who seek the reputation of finely critical minds to say knowingly, 'Ah, but what do you mean by better?'!"

9. How Things Can Go Wrong

As a would-be servant of his Creator, man suffers from two limitations that we must take care not to confuse. The first is his sinfulness. We are by fallen nature headstrong, rebellious, reluctant to accept wholeheartedly the "kingly rule of God." The second we may term simply his finiteness. At his best, and with the best will in the world, a man can take only a limited number of factors into account when planning to do what he believes to be God's normative will. Because both his knowledge and his foresight are limited, things can go painfully wrong in ways that it would be superficial and cruel to attribute simply to human sinfulness.

Because both his knowledge and his foresight are limited, things can go painfully wrong in ways that it would be superficial and cruel to attribute simply to human sinfulness.

This is not to deny that our sinfulness makes things worse, but to point out that the best of motives afford no automatic exemption from the unforeseeable risks of experimentation. It is both unnecessary and misleading, for example, to write down the development of the American Dust Bowls simply to human greed. The most selfless humanitarians, eager to increase the supply of food for the starving of the world, might have fallen into the same ecological trap as the hapless Mid-Western farmers. Again, the most conscientious steward of God's creation, totally devoid of any greed, might have been forgiven for thinking that DDT spraying was the responsible thing to do on a large scale in subduing the earth for the benefit of mankind. The temptation to ferret around for some ingredient of "sin" to blame when these things turn out disastrously must be resisted if Christians are to think biblically and realistically about their wider responsibilities. Selfish unheeding of foreseeable costs and risks is indeed inexcusable; but man at his best is only, as Pascal called him, a "thinking reed." What hindsight allows the rest of us to condemn as short-sightedness is sometimes an inescapable aspect of our being human. "Let him that thinketh he standeth take heed lest he fall" (I Cor. 10:12).

So when we turn to consider the possibilities for good in the large-scale application of scientific discoveries, it is important not to imagine that the Bible's one prerequisite for success is the elimination of sinful motives and the adoption of worthy goals. We are feeling our way to the controls of a world whose mechanism is more complex and delicately balanced than we are ever likely to comprehend. What the proverbial bull could do in a china shop is as nothing compared with the havoc we could wreak by a single well intentioned error. The biblical moral is not that we should leave well alone. All is far from well, and it may be our responsibility in God's sight to do something about it. The moral is that if we are not to make matters disastrously worse by our meddling, we shall need a wisdom infinitely greater than our own. If our Creator is willing to give this wisdom to those who ask in humility and sincerity, desiring only to be used by Him for good, then nothing could be more realistic than to beg it from Him "who giveth to all men liberally, and upbraideth not" (Jas. 1:5). We are likely to need the reassurance of those last three words!

10. Compassion—Individual and Communal

We have noted several times the Christian priority of "compassion;" but as we all know, judging what is the compassionate thing to do, especially in face of competing claims and much confusion between real "needs" and mere "wants," can involve layer upon layer of value-judgments with few if any simple biblical maxims to short-circuit the process. As shown by the example of David's action in feeding his hungry men on the sacred bread,[14] which had Christ's apparent approval,[15] not even general divine prohibitions can always be used safely to exclude options in an emergency.

I have actually seen Christians recommend in print that all we need do is to "feed the hungry" and trust God for the rest. This may sound pious; but it is hard to defend as responsible stewardship.

While all this is well-trodden ground, there is one aspect of the problem of compassion that may particularly trouble the scientist and those he advises, which I feel needs urgent attention from Christians. This is the conflict that can arise between compassionate assessments in terms of the interests of the individual, and of

those of a whole population. To begin with a simple example, if a child catches a dangerously contagious disease, it may seem cruelly lacking in compassion to prohibit its mother from nursing it among the family at home; but at the community level the reverse may be true. The claims of "individual" and "communal" compassion here pull in opposite directions. Again, most Christians regard it as something of a scandal that more people die annually of starvation around the world today than a century ago; yet in demographic terms this fact can be traced directly to the success of last century's efforts (largely motivated by Christian compassion) to reduce global infant mortality, without any corresponding efforts towards control of population growth.

As anyone who knows the difference between arithmetic and geometric progression can see, attempts to deflect this point by recommending agricultural improvements are hopelessly shortsighted. Food supplies ought, of course, to be augmented as a short-term remedy; but as long as vast tribes of fertile people continue to double the world's population every few decades as a matter of family or national pride and principle, it is far from obvious what is the most compassionate way to divide scarce resources among the competing demands for the preservation of infant life, the development of food supplies and the control of fertility. I have actually seen Christians recommend in print that all we need do is to "feed the hungry" and trust God for the rest. This may sound pious; but it is hard to defend as responsible stewardship. It is precisely in such situations that the confusion pointed out in section eight above can be disastrous, and the distinction between rebellious and biblically-responsible efforts to "shape the future" needs to be recognized. It is vital that when Christian stewards are trying to find the biblically and communally compassionate course in such situations, they are not discouraged by bogus theological objections from working out and steering by the foreseeable implications of their alternatives. Now that more and more policies are settled at the global level, there is an urgent need for theologians to work out the actually relevant biblical principles that should govern and inspire attempts to integrate individual and communal compassion.

11. Retrospect

We have uncovered no startling novel priorities for the Christian in science or technology, though I have tried at one or two points to give our well known priorities a new thrust where it might be easy to neglect them. Think of what it means biblically to be a loving son in his Father's house, a compassionate steward with specific talents, a rescued sinner in a fallen world, still plagued by the misperceptions natural to a fallen race, yet vassal to the one great God of truth and love. [Take time to consider prayerfully the workings-out of these images in each of the twelve headings we reviewed at the beginning (listed in section 2), and you should discover the difference it ought to make for a scientist to have Christian priorities.] It is obvious that to most of our practical questions, even of the evaluative kind, the Bible contains no ready-made answers; but it does, I believe, enunciate principles sufficiently clear to allow us—indeed to encourage us—to go on enthusiastically with our scientific map-making, in that biblical "fear and trembling" which does nothing to abate the joy of it.

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In our strange world, it is the impotent who are prone to instruct us in the excellencies of potency, the dyspeptic who proclaim a dietary way to happiness, the opponents of capital punishment and the killing of seals who insist on the killing of unborn babies.

Malcolm Muggeridge as quoted by Lloyd Billingsley, "Save the Beasts, Not the Children?" *Eternity*, February 1985.

Realism and Reverence*

WALTER R. THORSON

Department of Chemistry
The University of Alberta
Edmonton, Canada T6G–2G2

It is argued that a realist understanding of our knowledge of creation is linked in its fundamental attitudes to the response of reverence toward God as Creator, and that this is a biblical view. The question is asked whether in the current development of natural science there are any indications that sound thinking leads legitimately to awareness of the dimension of religious meaning, as a consistent pursuit of truth. An important distinction introduced by Barfield between "alpha-thinking" (thinking about things*) and "beta-thinking" (thinking about* thinking*) is discussed in its relation to modern scientific conceptual and logical developments, and several instances of scientific problems where the emergence of beta-thinking as a distinct activity from alpha-thinking has become a central issue are discussed briefly.*

According to the Scriptures, the creation shows us the glory, majesty and eternal power of God—whether we look upward to the heavens or handle with fascination the things that have been made.[1a] I used to argue from these texts that if one *presupposes* the existence of God then creation speaks eloquently about Him; I wanted to make allowance for an apparent realism of the modern mind which is not reverent. But I realise now that this is not what the Scripture says. It has a different explanation for irreverence.[1b] The biblical claim is that a true understanding of creation leads to reverence as an intelligent response, and the point of these texts is this logical or rather *ontological* connection.[2]

The thesis of this essay is that realism and reverence are closely connected. In particular, the biblical claim that realism leads to reverence is relevant to philosophical issues in our thinking about science and to further development of a genuinely scientific understanding of the world and its relation to God as the creator of all things. My concern is not just an abstract and academic one. Today there is a rising tide of pantheist religion which seeks on the one hand to transform the scientific tradition into an affirmation of human autonomy, the deification of man's will to power—and on the other to deny the real existence of a world beyond the mind and self of man, or *any* objective Other beyond himself to which he is responsible.

Against this background, I think it disastrous that some Christian apologists argue for views of scientific knowledge (and indeed all creaturely knowledge) which deny the possibility that it deals with truth. By doing this, they imply that creaturely knowledge is *isolated*, as a domain of thought and activity in which our understanding has no *intrinsic* relation to the Creator's actual handiwork and reverence is therefore merely an *option*, not an ontological necessity arising from the activity.

More positively, I believe that real progress in human understanding now requires a biblically inspired transformation of the attitudes to human knowledge which have marked the modern period. Christian thinkers can

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play a critical part in effecting such a transformation. When heard and understood, the Word of God always has a renewing influence on culture. For example, the roots of modern science are linked to biblical transformations in cultural and philosophical attitudes at the end of the Medieval period. We are again in a period of change; fundamental problems in logic and the conceptions of order, cause and meaning have emerged in nearly every area of scientific study. To resolve them we need a deeper understanding of the character of physical reality and our relation to it than we now possess—an understanding better able to appreciate the *spiritual* meaning of that relation. How far a corrupt, God-alienated culture can ever participate in such a transformation is quite uncertain, but I believe there is a biblical direction our thinking *ought* to take. It is worthwhile to ask what that might be, even if the culture fails to follow it. This may be a visionary hope, but Christian exercise of such hope has always had curiously practical consequences in the long run. In 1500, for example, who would have thought it much use for the actual future of humanity to bother about the nature of physical things?

In previous essays in this Journal[3] I have addressed a general theme I may call "a biblical understanding of epistemology." I argued that such understanding is possible because (a) the Bible is concerned with the knowledge of God, (b) all our knowledge is held by us as *creatures* and God's self-revelation is *consistently given in that context*, (c) knowledge is integrated in the persons of knowers, and (d) this integration means that there is a unitary continuum of truth, not a plural collection of realities which have no intersection: their intersection is the human being. To support this I indicated how biblical themes such as the principle of faith, the functional role of theoretical and linguistic frameworks, the principle of manifestation,[3c] and the issues of inner attitude implicit in the epistemic similes of hearing, seeing, grasping,[3d] emerge in a *philosophy of personal knowledge* as a sensible philosophy of science. On that basis I argued, as Michael Polanyi argued, for a *realist* epistemology and *against* either *operationalist* or *rationalist* views of knowledge; truth is the object and the potentially attainable goal of all creaturely knowledge, and it is in this hope and faith that all human knowing is sustained. This expectation toward the creation as God's handiwork was the mainspring of the scientific enterprise from the beginning, and the astonishing success of science is a very good argument that it is a justifiable expectation.

To make clear to Christians the fundamental reasons why a realist epistemology is so important to present thought, it is a helpful argument[4] to show how utterly unacceptable we should find an *operationalist view of theology* to be. For example, consider the notion of "the God behind God" suggested by the existentialist theologican Tillich.[5] To such an idea the biblical response must surely be that "what God is in self-revelation and Incarnation, He is in Himself"—a conviction rooted in the Scriptures and worked out in its theological implications in the credal formulations of the early Church. We consider that *theology* constructed in responsible commitment to the revelation of God in His Word is in some measure a *true* understanding of God Himself, even though it is a *creaturely expression and understanding*. Very helpful expositions of these theological points have been given by T. F. Torrance.[6] They show how the Incarnation is the basis for confidence that a *creaturely* knowledge of God granted to us by His revelation can nevertheless be a *true* knowledge.

However, I really raised the issue of *theological* realism because I wanted to persuade that operationalist or rationalist views of our knowledge of *creation* are also unacceptable. For the Christian, such views can only be defended by introducing a profound epistemological *dualism* between the knowledge of God and the knowledge of creation.[3d] This is a dualism which is not true to our actual living relation to God by faith,

Walter R. Thorson is Professor of Theoretical Chemistry at the University of Alberta in Edmonton, Canada. His professional interests are in quantum mechanics, especially its application to problems in the theory of atomic collisions and molecular dynamics. He is a member of the American Physical Society, Canadian Association of Physicists, and the American Scientific Affiliation, and has published about 60 professional papers. He is actively interested as a layman in theology and Christian apologetics, especially in topics bearing on the epistemology of science and its relation to religious knowledge. He is a frequent lecturer at Regent College, Vancouver, B.C., where he is Adjunct Professor of the Philosophy of Science. Dr. and Mrs. Thorson and their family reside in Edmonton.

mediated to us by His continual giving of *Himself* to us in grace, and I believe it also fails to grasp the full implications of biblical teaching about God's self-revelation.[7]

While these theological issues are really fundamental to the concerns of this essay, I do not propose to approach things that way. Firstly, I am not a theologian; secondly, I have a different object: to approach the topic from the creaturely perspective.This can make sense if in fact there is an epistemological unity in our relation as creatures to truth, the sort of unity suggested above.[3b, 3d] Michael Polanyi[8] described how consistent development of responsible knowledge in human experience could lead to the appreciation of "larger contexts of meaning" in which human beings are placed, and has striven to describe how that might arise in the human community, through individual persons as agents of *responsible commitment*, or faith (to use the biblical term). Polanyi was very much aware that such an understanding of knowledge reopens the possibility of religious meaning. He understood that the myth of an *impersonal* scientific knowledge and method had become the enemy of the fundamental values which create such knowledge, and he recognized that those values ultimately originated in biblical thought. The formulation of a philosophy of personal knowledge, as Polanyi saw it, was aimed at a recovery of the basic unity of thought which previously marked Western culture, including the embedding matrix of religious meaning which made that culture possible in the first place. Polanyi's fundamental goals, and the relevance of his "project" in its broadest terms to contemporary thought and to Christian belief, have been very clearly explained in a recent book by Drusilla Scott entitled *Everyman Revived: The Common Sense of Michael Polanyi*;[9] for those readers who wish to understand the issues in Polanyi's thought, presented in a different manner from my own scientifically oriented one, I strongly recommend this very readable work.

What would a *consistent* development of Polanyi's philosophy of personal knowledge imply for the question of religious truth itself?[10] I think the crucial point is that such an epistemological view *necessarily leaves open* the possiblity of divine revelation in the form of a creaturely Word, "God manifest in flesh," just the sort of revelation the Bible in fact proclaims. Polanyi of course did not argue positively for the existence of such a revelation, since he was primarily concerned with the nature of personal knowledge and the responsibility compatible with it.

The theme of this paper is a further commentary on what may be said from the creaturely perspective, more from Polanyi's starting point than from that of theology. Such a discussion should *not*, however, be misunderstood as a claim to an autonomous creaturely knowledge of God; rather, we may say that there is a *corroborating* witness available in the knowledge of creation. Although the Word of God is quite clear about the ultimate transcendence of God and the necessity of revelation as the fundamental basis for any knowledge we have of God, Scripture always proceeds on the working principle that there is an actual *continuity* rather than a *dichotomy* in the experience of the creature seeking understanding. Reverence is indeed the intelligent consequence of realism. We might naively explain this continuity by saying that by the grace of God there never was and never will be a world in which there is no Holy Spirit present, and in which an Incarnation never in fact occurred. We might illustrate this biblical attitude with many texts, but as with so many other issues related to creation perhaps the clearest illustration is the way in which the opening chapters of Genesis lay out for us the peculiar setting of humanity as dust of the earth and image of God at one and the same time, and proceed on the basis of those two facts as an intersecting unity. So I consider that Polanyi's notion of ascending levels of awareness of objective reality, to which we as humans may be responsibly committed, is a proper understanding of *creaturely response* to truth. If that is so *theologically*, in that God has committed even Himself to a creaturely revelation, then consideration of the "pointers" to religious meaning from the "natural" side is not irrelevant.

Religious Meaning in Scientific Knowledge

The question of religious meaning recurs perennially in the heart of the scientific enterprise. Jastrow's "God and the Astronomers"[11] or the current discussions of the "anthropic principle"[12] are good examples. The possibility that scientific truth may point beyond itself to more ultimate, metaphysical or religious meaning is always latent. We have firstly to decide whether or not this expectation is ever legitimate, even in principle, and then secondly whether we are warranted in connecting our expectation to any current scientific view of the world.

Most of us have an instinctive reluctance to suppose that any direct relevance to metaphysical or religious questions can be inferred from current understanding of scientific knowledge. We have all spent time refuting naive "God of the gaps" arguments and are very much aware that "God does not wear His heart on His sleeve." Such caution seems well justified historically.

However, if it is maintained indefinitely as a matter of principle, this attitude has important philosophical consequences. Are we really saying that scientific knowledge can never point truthfully to religious

meaning? The epistemological grounds for such a claim would appear to be based either on operationalism or on a view that religious meaning and scientific meaning can never be related. I believe there are good arguments against these views.[3] A realist epistemology implies that if the questions raised by science are pursued far enough they lead to issues outside of science.

We may then conclude that, *in principle, it is legitimate to expect scientific truth eventually to point beyond itself*, and that the real problem is to discern whether current knowledge truly suggests any such indication of larger meanings. If we believe that there has been cumulative progress in scientific knowledge, then we should expect such indications to become more evident as knowledge grows. I believe developments in many areas of science today indicate that we need to extend our categories of understanding and explanation in directions which give legitimate significance to religious questions, but in biblical, not pantheist terms. The intersection or point of convergence indicated is man himself and his thought.[13]

Fundamental problems in logic and the conceptions of order, cause and meaning have emerged in nearly every area of scientific study. To resolve them we need an understanding of the character of physical reality and our relation to it . . . able to appreciate the spiritual meaning of human thought and agency in the creation.

A Study in Idolatry

Owen Barfield's fascinating work *Saving the Appearances: A Study in Idolatry*[14] came to my attention some years ago when I had started to think about the biblical emphasis on reverence as proper response to knowledge. It has had a profound influence on my thinking, even though I do not agree fully with Barfield's metaphysical and epistemological views (as I understand them).

Barfield is concerned with the significance of science in the history and development of human thought. He uses metaphysical idealism or something close to it as a projective device, but his arguments really concern the relation of thought and perception. He adopts the Medieval "saving the appearances" argument: according to that view, the entities with which scientific theories are concerned can have no real existence but are merely devices for dealing with limited descriptions of "phenomena." However, the metaphysics or epistemology implicit in Barfield's use of the argument are not essential to the main issues. Barfield recognizes that the rise of science has profoundly affected human thought and experience, and that through this influence science has also become a kind of religious focal point in modern thought. He quite properly identifies this religious role as *idolatrous*, since he believes in the God of biblical religion.

Barfield has introduced a most important distinction between *thinking about things*, which he calls "alpha-thinking," and *thinking about thinking itself*, which he calls "beta-thinking." He argues that each mode of thought represents an important stage in the development of human consciousness and its relation to religious meaning in particular. This notion is important to us.

The emergence and eventual dominance of α-thinking as a way of experiencing and understanding the world is epitomized in the rise and development of modern science. Barfield argues that this mode of thinking and experiencing has replaced a much older and less intellectually controlled way of experiencing the world, which he calls "original participation."[15] He suggests that this older mentality and perception was really *qualitatively* different from our own—a direct, unreflected sort of perception in which genuine religious elements were present and recognized as such. The triumph of alpha-thinking has progressively destroyed this type of perception and the unconscious integration of experience which accompanied it; it has "scoured away" from our consciousness any direct perception of transcendent meaning in experience, by imposing a rigid conceptual grid or filter of *interpretation* tied to theoretical, abstract representations of the world as *thing*. The "scientific world view" is a kind of intellectual, conscious statement of this *largely unconscious* process, which goes on in all our cultural experience. Thus, contrary to modern assumptions, it is *modern*, not primitive, man whose raw perception of the phenomenal world is most structured, filtered and restricted by what he already thinks and believes. Barfield shows how both our own language and past culture and the study of primitive cultures provide evidence for this.

This argument suggests that before the advent of α-thinking, the propriety of reverence as a response to the experience of the real world was much more

obvious; the awareness of religious elements of meaning in the world was a matter of direct participatory experience. This pagan, primitive perceiving involved *participation* in the material world, whereas our sort of perceiving, structured by α-thinking, is fundamentally *non-participating*. We see objects, and distinguish them immediately from *ourselves* as *beings*; we have no feeling that their identity or spirit flows over into, or overlaps with, ours, nor do we sense anything numinous about them—but primitive man did.

A disturbing element in some contemporary thinking is the belief that this old synthesis of experience through an unreflected original participation should be recovered as a desirable goal, and that α-thinking and its formal expression in the culture of science should be rejected or suppressed. Theodore Roszak[15] has advocated this view explicitly, and (for example) a kind of return to it through the mentality of Far Eastern thought is implicit in the writing of Fritjof Capra.[16] However, in contrast to these and other writers, Owen Barfield does not regard the emergence of α-thinking as a fundamental error. At a critical point in the book, he states

> It may remove the risk of misunderstanding, if I mention at this early stage that *it is not part of the object of this book to advocate a return to original participation.*

Nevertheless, through the advent of α-thinking we have removed a perception or awareness that was previously present; we have scoured something away, even if, as a result, a world of objective realities comes into sharp focus, for by that very achievement the sense of the numinous has also been removed.

With this appreciation of earlier human culture it would be easy to interpret the biblical sense of continuity between realism and reverence as the expression of a context of original participation in which (supposedly) the Bible was written. However, this would be a fundamental mistake. Alpha-thinking had a beginning. Some of its roots may be traced to Greek philosophy and its interest in the nature of the physical world, but I think even deeper ones come from the Bible. The notion of an external, objective world independent of our minds has a primary origin in the biblical doctrines of creation and God's transcendence of the world system, and the critics of Western thought mentioned above easily recognize this fact.[15, 16]

Owen Barfield pursues this theme. What was significant about the Hebrew culture, he argues, is that long before the emergence of α-thinking as the dominating presupposition of Western culture, the Hebrews had been taught to refrain from original participation as a *religious* obligation—not because there is no god, but on the contrary because there is one God. They were taught from the beginning that there is a mistake in original participation, the mistake of thinking that the divine presence is *in the things themselves*: Barfield puts it, "*in* the phenomena, and *on the other side of them from man.*" Original participation is idolatry, the confusion of the Creator with the creature: "You shall not make any graven image."

This biblical root of α-thinking is very evident in the critique of idolatry given by the prophet Isaiah[17]: the prophet argues idolatry is *illogical*. What has been taken from creation by man, seen by his eye, fashioned by his hand, made out of the same resources which he uses to meet his practical needs, is given a status beyond its maker. The prophet appeals to *thought* to expose this error. It is *thought* which ought to lead the reflecting mind away from the idol to the conclusion, "Is there not a lie in my right hand?" Here then is the religious motive of α-thinking; it is the beginning of a true understanding of the world and our relation to it. Alpha-thinking must inevitably destroy original participation and the pantheism (or rather "entheism") of Nature upon which it rests. The concept of animal husbandry is incompatible with the sacredness of cows as such; the discovery that the orbits of the planets are predictable with Newtonian mechanics divests them of inherent divinity. This "disgodding" of Nature is necessary *religiously*, and it is also a *true*, though limited, perception of reality.

A realist epistemology implies that if The questions raised by science are pursued far enough they lead to issues outside of science. I conclude then that in principle it is legitimate to expect scientific truth eventually to point beyond itself, and that the real problem is to discern whether current knowledge truly suggests any such indication of larger meanings.

But Barfield argues that in their turn the theoretical constructs of science, α-thinking rigorously formalized, have themselves become "idols of the study," replacing the old idols of the cave. To these new idols the critique made by the prophet is just as relevant as before. Again it must be *thinking* which penetrates the absurdity of α-thinking exalted beyond its proper

role. It follows that a proper critique of α-thinking is not a repudiation of its *value* or its *validity* but a critique of its *adequacy*.[3a]

The key to the new critique is the recognition that beta-thinking, *thinking about thinking*, is not simply an indefinite extension of α-thinking into the domain of pure abstraction, but really requires a transcendence of it. I suggest that major conceptual problems in many areas of scientific thought today are closely related to the need to understand beta-thinking as a "clean different thing" from α-thinking. *Logically*, this difference appears in the peculiar character of self-reference and self-referencing structures in logical and symbolic argument. *Ontologically*, it appears as we attempt to understand our own identity and activity by pushing α-thinking to its limits.

Barfield's further argument diverges from that presented here, mainly for epistemological reasons. I believe that the representations of the physical world created through α-thinking are *true*, even though limited, accounts of the created reality, while I think Barfield might regard them as illusory. He adopts the fundamental Kantian distinction between the *noumenal* and *phenomenal*, while I believe that emphasis is contrary to the tenor of biblical thought and is eventually epistemologically destructive. Barfield's understanding of the notion and implications of *beta-thinking* is concentrated mainly in a discussion of language as symbol and metaphor. He argues that its end result is to discredit a realist metaphysics and to draw attention to *human consciousness* and its unfolding as a more basic reality than the representations of reality created by its thought. He argues that such a shift in thought would lead to a conscious perception of religious meaning in all experience, essential in a continued integration of meaning. He conceives of a new level of perception of material things, again *participatory* in character, but based on intelligent understanding. Given Barfield's generally Christian presuppositions, such "final participation" would be an integration of human experience in this world, in which a reverent awareness of God's presence could become a coherent and essential part of all intelligent activity. If I have interpreted Barfield's *intention* correctly, such a goal is not incompatible with the concerns of this essay.

However, I think Barfield's approach is not quite correct. It is vulnerable not only to an idealist metaphysics or an existentialist theology but to a radically false reinterpretation in terms of the egocentricity of mind which is endemic in Far Eastern thought.[18] The fundamental problem is epistemological: the role of the human subject as the controlling center of knowledge is overemphasized. We may use the notion of "epistemic modes"[3d] as a way of understanding the problem of egocentricity in knowledge. Our language about knowing is based almost entirely on analogy with our perceptual skills: grasping, seeing, hearing. The analogy is appropriate if, as Polanyi argues, our conceptual skills are *derived* from the perceptual, inarticulate ones by the use of language. These different analogies describe different aspects of the process of integration of focal entities into subsidiary particulars of a larger whole which Polanyi describes. A key point is that knowing begins with an objective reality outside ourselves, and that our first awareness of a reality is mediated in a relation that is best described by the "hearing" analogy. This maximizes the emphasis on the *other-than-ourselves* as the source of knowledge and is therefore inherently the least egocentric of the epistemic modes. This is why the Scriptures place such emphasis on speaking and hearing as the basic form of communication between God and man. I find however that Barfield's primary emphasis is given to the visual; this is true even of his interpretation of the role of language in biblical thought, since he conceives of language in almost exclusively figurative terms. What is lacking, I believe, is the emphasis on faith, hearing and the objective Other beyond our minds which is so fundamental to a biblical understanding, and which is the basis for realism and a realist epistemology. I am deeply indebted to Owen Barfield's brilliant insights in *Saving the Appearances*, but find—reluctantly—that some of the controlling assumptions differ from those implicit in biblical thought, and ultimately lead to a somewhat different conclusion. On the other hand, it may be that many points emphasized by Barfield will emerge even more clearly when we place them on a different epistemological foundation.

Major conceptual problems in . . . scientific thought today are closely related to the need to understand beta-thinking as a "clean different thing" from alpha-thinking . . . this appears as we attempt to understand our own identity and agency by pushing alpha-thinking to its limits.

The Significance of Beta-thinking

Beta-thinking, thinking about thinking, provides the critique of the idolatry inherent in α-thinking as an

ultimate and exclusive way of understanding. We can see it as idolatry if we consider examples such as the view of reality portrayed by Jacques Monod in *Chance and Necessity*,[19] or even more grotesquely in some logical positivist philosophy.[20] The critique is fully anticipated by the prophet Isaiah[17]:

> No one considers, nor is there knowledge or discernment to say, "Half of it I burned in the fire, I also baked bread on its coals, I roasted flesh and have eaten; and shall I make the residue of it an abomination? Shall I fall down before a block of wood?" He feeds on ashes; a deluded mind has led him astray, and he cannot deliver himself or say, "Is there not a lie in my right hand?" (44:19–20)

As C. S. Lewis pointed out, "abomination" was originally "ab-homination," a thing utterly incompatible with what is properly human. Isaiah's critique makes sense when we apply it to the positivist deification of scientific knowledge as impersonal objective fact, and recognize the critique as that implicit in a philosophy of personal knowledge. Science is our creative response to a real physical world, and its objects and intentions are linked inextricably to the human eye and hand. What is in question is not the legitimacy of the entities or their objective reality, but the place they occupy. To be able to say "Is there not a lie in my right hand?" implies that one has understood one's own creative role in relation to the tool or framework employed to grasp reality; it is already the beginnings of beta-thinking. However, we also need to think about the prophet's other questions. They show a profound, divine compassion: the prophet understands the majesty of the *divine image* as the *potentiality* in the human personality, and recoils in horror from the folly of worshipping the creature. Without such divinely granted understanding there is no way to be delivered from the idols in the long run, which explains why modern man has made an idol of α-thinking.

So I believe β-thinking properly has a different outcome than Barfield anticipated. For him, it meant smashing the images of α-thinking, i.e., discrediting any claim to objective truth for the theoretical constructs and objects of science. But epistemological views which deny objectivity or truth to personal, creaturely knowledge are finally susceptible to radical egocentricity, precisely because they then make the autonomous self the ultimate critic.[3d] Operationalism interprets the autonomous will of man as its own end—as though the man in Isaiah's description were to think that a tree is *there* only as the expression of his own purposes. But the exaltation of the visual mode,[21] expressed in metaphysical idealism or more profoundly in the world-dissolving thought of the Far East, leads to the same end result, that man conceives himself and his own thoughts as an ultimate idol.

Instead, β-thinking properly shows us that knowing involves ourselves, that what can be known must not only *be* what it is in itself but must *be intelligible* to our creaturely minds, and that if we intend to know what the *human identity* is these two problems are inseparably related. How shall we put ourselves in our theories in such a way that we do ourselves justice? The concern of a philosophy of personal knowledge is that we must certainly begin by acknowledging both objective reality and truth outside us *and* our participation through responsible commitment in all that we truly know. That is, we need an epistemology in which faith and hope placed legitimately *outside ourselves* are the recognized means by which knowledge is sustained; the reason for this, so simply and consistently communicated in the thought of the Bible, is that we can only then begin to understand *ourselves* and *our* true identity in the light of God's knowledge of and love for us.

Epistemological views which deny objectivity or truth to personal, creaturely knowledge are finally susceptible to radical egocentricity precisely because they then make the autonomous self the ultimate critic.

Beyond epistemology lies the question of the "larger contexts of meaning," to which human beings may become responsible. *These do not negate the reality of the lesser meanings, but assimilate or integrate them as subsidiary particulars.* Beta-thinking can play a constructive part in that integration.

The Emergence of Beta-thinking in Science

Let me indicate some issues in science and thought today which seem to me to involve beta-thinking as the basis of either a meaningful question or a new sort of answer or demonstration. Many of these will already have been anticipated by readers and there are others not listed here. In this catalogue I am not pretending I really understand the problems at anything like the detailed level needed to solve them; I am just illustrating a common theme of some kind in them, something just on the edge of perception as a new sort of understanding. Their common feature is that they involve human beings and their consciousness as the latent intersection of thought and its object. We are holding some sort of mirror to ourselves.

The presentation below moves roughly from *logical* instances to those that might perhaps be termed *ontological*, but I believe all entail beta-thinking in some way.

(1) ***Gödel's Theorem and Logical Self-Reference.*** The famous theorem of Gödel[22] is an assertion concerning certain types of logical or mathematical systems and the propositions constructible within them. It is conceived (and proved) by the use of a logical statement which refers to itself and a corresponding recognition of that statement as meaningful. The essential claim is that there are logical systems whose structure is sufficiently complex that we cannot decide on the basis of the stated axioms whether the axioms are complete or consistent: that is, propositions can be constructed within the system which cannot be decided as either true or false. Technically the basis for the proof is achieved by symbolic substitution or mapping of logical relations and operations onto the relations and operations of arithmetic. If a system is sufficiently complex to contain such a mapping of at least a part of it onto arithmetic, then undecidable propositions can be constructed within such a system. These form a special class of propositions which say *concerning themselves*, (upon a formally defined process of substitution) that they are *not provable*. As Gödel himself observed they are logically very close to the liar paradox and other logical puzzles constructed with self-reference. In the proof of the Gödel theorem, we conclude that it is *true* that these propositions (which refer to themselves) are undecidable. To understand the Gödel theorem and its proof is to do a form of β-thinking, since at some level one must transcend any completely formalized α-thinking statement and *tacitly conceive* the affirmation of the theorem as a statement about thoughts (or perhaps thinkers) themselves. It is not possible to formalize this act itself (except by a symbolic assignment).

(2) ***The Marks of Intelligence.*** The problem of logical self-reference is connected in some way with the capacity we have to 'leap outside' of a system of thought and argument and identify the system in a new context as a member of some other class or system. Any satisfactory description of intelligence—required to create a truly intelligent machine—must somehow find ways of describing this capacity. D. R. Hofstadter explores some aspects of this problem at a popular and readable level in the book *Gödel, Escher, Bach* and in several monthly columns published in *Scientific American*.[23] His articles serve as a useful source of citations on thinking relevant to self-reference and the problem of intelligence. However, I find the most interesting aspect of Hofstadter's discussions is the way in which his own attitude seems to move between occasional appreciation of the radical character of β-thinking and a dominant, almost trivially reductionist α-thinking presuppositional basis. He understands that the capacity to leap out of a system is not formalized, but persists somehow in the belief that the problem involved is an aspect of some impersonal and *mechanistic* logic. The deepest flaw in his argumentation—and in many of the arguments he cites—is a tacit appeal to models of intelligent behaviour which are alleged to be mechanical, but on closer scrutiny are always found to require *human intelligence* to interpret them or give them meaning at a higher "metalinguistic" or "metalogical" level; that is, his models are games only people can play. To argue that these models provide the basis for understanding intelligence *mechanically* is a mistake; they show how specific acts of intelligence may be recognized or logically represented by one comparably or more intelligent being to another, but provide no account at all of the construction and recognition of intelligence from scratch. Merely because the Gödel theorem can be stated, comprehended, and proved *by us* seems to imply to Hofstadter that its truth is then a kind of α-thinking truth. But the conclusion does not follow, since it begs the question by our including ourselves tacitly in the argument.

(3) ***Logical Indeterminacy.*** It is unnecessary for me to give a lengthy explanation of what is meant by "logical indeterminacy" since that has been done so well and in so many different contexts by Donald M. MacKay.[24] MacKay supposes that we may set up a hypothetically determinist apparatus which makes predictions about the state of an (intelligent) person's brain. Such predictions may be verified by ourselves and by third parties, that is, they may deserve accreditation by persons *other* than the subject to whom they then have reference (or even *a posteriori* by the subject himself). However, their status as assertions concerning reality is completely different if they are offered to the *subject* in advance, as propositions for affirmation or denial; MacKay argues that strictly speaking the subject would be wrong to believe them, since believing them is itself an act which cannot be made compatible with the calculation. This *logical indeterminacy* of scientific information or prediction when we apply it to ourselves as part of the system is quite independent of any *physical* indeterminacy that may exist. In MacKay's view this permits us to regard the freedom of human choice as an objective and *logically justifiable* truth. To understand MacKay's argument—and to accept it—is to do some β-thinking.

One may go further, and ask about the possibility of such a machine. Might it not be the case that the existence of this logical indeterminacy makes it impossible for any such physically determinist predicting-machine to exist in the world? That is, if the outcomes of determinist processes are in definite predictive cor-

respondence with beliefs ('states of mind')—a necessary condition for us to understand the machine's predictions—how could we ever construct a machine which can represent the recognition of logical indeterminacy itself as a possible "state" of an intelligent brain, and then proceed *logically* to compute a future state for it? Now this argument in itself may be seen as just another form of MacKay's argument for logical indeterminacy: no machine of the required sort could entertain or resolve the logical indeterminacy created by the feedback involved. However, it also seems to me that the creation of this sort of indeterminacy is already a possibility in the mind of an isolated subject, and the difficulty involved in constructing a predicting-machine of the required type already entails the problem of such indeterminacy, in the requirement that "beliefs" or "states of mind" be identifiably in correspondence with certain sets of physical brain states. If it existed, such a machine would have its own thoughts about the problem of indeterminacy! The phenomenon for which we must account is not the inarticulate behavior of cabbages or earthworms, though that is hard enough; nor is it that we have to account for their articulate formulation of calculations and predictions in relation to the world around them, though that is harder still. What we have to account for is that there are cabbages and earthworms which reflect on their own states of mind—who, as C. S. Lewis put it, give lectures on their origins and destiny.

(4) ***The Interpretation of Quantum Mechanics.*** To understand quantum mechanics, we have to resolve a conflict between beliefs we instinctively regard as *logically* self-evident and what is *ontologically* valid. The physical world's actual behavior disagrees with some of our most elementary beliefs about logical inference applied to space-time relations. As is well known this comes about because, in contrast to classical physics, quantum mechanics somehow includes the fact that we cannot possess knowledge of the world without interacting with it. The result is a calculus which makes probabilistic predictions about the results of measurements. There seems to be little doubt that this calculus agrees with the results of experiments, including recent critical tests.[25]

As to the *interpretation* of the formalism, however, the situation is confused. In the "orthodox interpretation," the actual state of a closed system is described by an entity called the wave function, a unique, precisely defined object, given conditions specifying it at some time. The equation for the time-development of the wave function for a closed system is perfectly definite. The problem comes when we ask how the wave function is to be interpreted in terms of predictions about system properties. In the orthodox view, everything depends on whether a "measurement" is made at some particular point. If it is, then the mysterious "collapse of the wave function" occurs and subsequent time-development involves only that portion of the previous wave function corresponding to the measured outcome. If on the other hand no measurement is made, "collapse" does not occur. The resulting predictions about subsequent behaviour are not the same in the two cases. This arbitrary procedure gives the correct results for the (probabilistic) outcomes of later measurements. The problem with it is the peculiar status it somehow gives to "measurement," since absolutely no account can be given *within* the theory of how a wave function can "collapse" (after all, a quantum theoretical description of the system including a measurement device must be possible too, and how can *its* wave function "collapse"?).

Quantum mechanics is not incompatible with the existence of a real world whose "state" . . . is independent of our knowledge of it . . . Its peculiar logic expresses what we who interact with a system can in fact know *about that reality. Our problems with classical logic of probability would then seem to be a matter of thinking about thought rather than about things.*

The history of the interpretation of this bizarre state of affairs is really an indication of the limits of α-thinking when applied not merely to logic but to real events.[26, 27] The positivist interpretation is that nothing meaningful may be said about reality itself and we must confine our statements exclusively to measurement values. There is a wide class of interpretations equivalent to various forms of metaphysical idealism, alleging that conscious observers somehow "decide" the state of the universe; an even more bizarre interpretation of the wave function is given by the "splitting universes" view.

The problem has been usefully clarified, I believe, by a new interpretation of quantum mechanics called "consistent histories," devised by R. B. Griffiths.[28, 29] Consistent histories predicts exactly the same results as the orthodox version of quantum mechanics, so it is a new interpretation rather than a new theory. However,

it differs substantially in the entities to which it ascribes meaning. In particular, it allows us to preserve something very much closer to a classically realist understanding of the behaviour and properties of a system *even in the absence of measurement*; conditional probabilities may be defined for physical properties of a system in a consistent relation to corresponding properties of measuring devices, so that "measurement" is a describable phenomenon not intrinsically different from less controlled or less humanly correlated interactions. No reference to "collapse of the wave function" ever appears, though the price for this is that the concept of a unique connection of a wave function with a "state" is sacrificed; instead attention is focused on the conditional probabilities of certain sequences of spatio-temporal events ("consistent histories"). One may then speak meaningfully of sequences of events or physical properties which exist independently of their actual measurement, and those forming consistent histories have probabilities which fit classical expectations of compatibility over contiguous sections of space and time. Of course the counterintuitive realities characteristic of quantum mechanics remain, but they appear in the rejection of certain histories as "inconsistent"—one may not, for example, give meaningful probabilities for sequences in which a property's value and its registration in the corresponding measurement device state are separated in time by an intervening, incompatible property or measurement value. However, I should not presume to give what must necessarily be an inaccurate understanding of Griffiths' formulation, and encourage you to read it for yourselves. What I find interesting about this interpretation is that it consistently allows us to believe that a system has a real sequence of consistent properties *whether or not they are "measured."* The bizarre characteristics of quantum mechanics are retained in the much weaker sense that they show up only when we try to assign conditional probabilities to states of affairs which cannot *in fact* be observed (e.g., *simultaneous* values for two properties whose dynamical operators do not commute). What such an interpretation seems to mean is that quantum mechanics is not incompatible with the *existence* of a real world whose "state," if isolated, is independent of our knowledge of it, but that its peculiar logic expresses what we who interact with a system can in fact *know* about that reality. Our problems with the classical logic of probability would then seem to be a matter of thinking about thought rather than about things (though I admit the connection to the previous instances of β-thinking is fuzzy).

(5) ***Basis for the Recognition of Order.*** If one examines work in modern biology—let's take the coding and replication of genetic information in a cell as the best example—one finds a curious assumption tacitly involved in all such work, namely an assumed analogy to ordering principles characterizing intelligent design. This has been a tremendously fruitful assumption, and forms the basis for all our explanations of structure and function in these fantastically complex systems, but after all it is a pattern of meaning borrowed from experience well outside the literal domain of α-thinking. It is no accident that our understanding of the DNA coding of genetic information and its reproduction and constitution of functional chemical structures by the t-RNA/ribosome/m-RNA system

The essential issue at stake in philosophical realism . . . is the declaration of our intention to go on being responsible to a reality beyond ourselves . . . to keep on listening to it in the firm belief that what we hear will instruct and lead us to understanding, fuller vision and manifestation in expression.

has developed in parallel with the advent of the high-speed digital computer. We interpret the behavior of the biological system by analogy with the logical ordering and controlled sequencing of function we have intelligently designed the computer to perform. We may well be able to work out a mechanism of control and function in a cell and its materials on this analogy, though of course we cannot be sure that it is adequate. However, it is then legitimate to ask what such an ordering, which after all is *objectively real*, can possibly mean. Isn't it at least an open possibility that just as the computer manifests and fulfills purposes transcending its hardware yet appropriately embodied in it, so the biological system is the result or embodiment of intelligent design, expressing some abstract existence or purpose which transcends the specific chemistry? This question cannot be answered unambiguously by the answer to any α-thinking problem. Many people will argue that it is not therefore a *scientific* question. I am not so sure, since—just as with the quantum mechanics—the meaningful question is one of *intelligibility*. There is a sort of mirror symmetry with the problem of describing intelligence which we discussed earlier. There the issue was whether our intelligence (acknowledged as real) could be accounted for on the basis of purely mechanical function; here the problem is to understand an actual functioning mecha-

nism (as it appears) without appealing to direct symbolic transcription from the artifacts known to have been created by intelligence. Our notion of an objective order in nature is derived explicitly from appreciation of ourselves and our artificial creations. Either we suppose that the notion is our illusion or invention (a dangerous option)—or we recognize that the order is *real* and the *meaning* transcends the machine as concept.[30]

Beta-thinking and the Future of Science

The appearance of β-thinking as a meaningful and even critical aspect of scientific understanding suggests a first step could be made toward intellectual awareness of the "larger contexts of meaning" anticipated by Polanyi. Such an awareness does not imply repudiation of the determinate, fixed descriptions of things and their relations which science has created. They have their legitimate (and even liberating!) role as limited models of reality. Increasingly, though, we may expect that the goals and settings for scientific problems, and the intelligibility of scientific theories, will involve some β-thinking as a mode of understanding.

We may expect widespread debate between those who conceive of scientific questions as limited strictly to α-thinking, and those who will demand for meaning's sake that our understanding of "science" step beyond those limits.[31] An important aspect of that debate will be the question of what may be called the "controlling paradigms of meaning." Up to the present time, it may be said that the dominant ideal of science has been the concept of the *machine*, with its linear, determinate and connective function; it has served as a model for the world, living things, and even human beings and society.[32] Its limitations are evident now. Perhaps the next paradigm may be that of the biological organism, with its characteristics of global coherence, *purposive* structures and integrated flexibility of function. Such a motif is prominent in much that is written nowadays about the need for transformation in scientific and cultural thought (cf. for example, Ref. 16.). The idea contains important and useful elements; yet, as John MacMurray pointed out, [32] the human identity is more than that of the biological organism; it involves the personal. Here again, the old question of the *imago Dei* is involved. Can we truly understand the *personal* without ultimate reference to a personal Creator?

The issue involved in β-thinking is much more than a matter of a controlling paradigm for science. We noted that the intersection of creaturely meanings is in the human identity. In the long run everything in human culture, not just science, will depend on our understanding of ourselves and our identity.

Some Reflections on Realism and Reverence

Recall that in the critique of idolatry given by the prophet Isaiah there are actually two appeals made to the intelligence. The second—the one we have considered here—recognizes that we ourselves are the makers of our idols ("Is there not a lie in my right hand?"). We have seen how this is the effect of β-thinking on α-thinking idolatrously reified. If we were so naive as to imagine that the models of the reality constructed by α-thinking were a kind of ultimate truth, we have had to learn (if we are logically consistent) that this apparent objectivity seems to be in danger of dissolving away into merely our self-expression or self-reflection. The attempt of positivism to establish an objective and impersonal truth through α-thinking has created insoluble problems when the apparatus is turned on man and his thought itself; continued insistence on the autonomy of the human mind, without commitments beyond ourselves, then leads either to operationalism or to a philosophy of illusion.

But the first question is just as important ("Shall I make an abhomination of the residue? Shall I bow down to a block of wood?"). What it asks is that the thinker conceive of himself adequately and that in such a conception there be the *appreciation of worth*. This passage reveals the divine compassion, God yearning for us to share His own valuation and appreciation of us. Everything in human culture will depend on our understanding of ourselves and our identity. However, we should note the somber tone of the prophet's commentary: "A deluded mind has led him astray, so that he *cannot* deliver himself, or say . . . " The capacity for a correct understanding of ourselves and our own creativity cannot originate from within the human mind itself; that is epistemologically inconsistent. This is why β-thinking in itself does not necessarily bring us to a true conclusion. It may be misinterpreted, and will be misinterpreted, by epistemological views founded upon egocentric inner attitudes. If we choose to believe that knowledge ultimately depends on ourselves or requires no commitment beyond ourselves, then the effect of β-thinking will always be to discredit all claims to know *truth* and identify all knowing as merely the kaleidoscope of perception emanating from our own minds or the assertion of our self-fulfilment. Such a direction in culture would mean the death of the scientific tradition.

The issue truly at stake in philosophical realism, then, is the declaration of our intention to go on being responsible to a reality beyond ourselves, and to keep on listening to it in the firm belief that what we hear will instruct us and lead us to understanding, fuller vision and manifestation in expression. This attitude, with its emphasis on the contingent reality of creation

and yet the expectation of a divinely created order and meaning to be found in it, originates in the Word of God, and it is sustained by a *continuing* expectation that yet more is to be heard.[3d] But the final object of such an attitude can only be God Himself.

Reverence is a realistic response for those who see truly, but for human beings it must be based on reconciliation.[33] Hence we do not suppose it is an *expected* response from those who do not know themselves to stand on that basis, no matter how realistic or reasonable it is. Yet we may appeal to those who do have faith, that they should rightly understand the situation. I really do not believe that an operationalist, phenomenalist or idealist philosophy of the created order is proper for us; we should not so understand our activities or our identity. I should like to end this essay with two passages from the Bible, which make the link between realism and reverence plain.

First consider the other great creation Psalm, which we have not so far mentioned, and with which I certainly am less familiar (perhaps understandably, as an inveterate α-thinker!). Psalm 139 concerns our understanding of our own selves in the awareness of God's having created us and of His continuing presence with and knowledge of us. It bears something of the same spiritual relation to β-thinking that Psalm 19 bears to α-thinking. I may mention just two points in it. The first is the Psalmist's profound awareness of God's presence in all creation and in his own innermost thoughts; and the second, coupled with it, is his appreciation that a proper response to his own complexity and depth is not self-adulation but fear and awe toward God—"such knowledge, too wonderful for me." It is no use for us to suppose that we can relate to creation in any way as if God were not there, least of all as we try to understand what we do there. Long ago, this was put so simply and yet so well by Isaac Watts:

> There's not a plant or flower below, but makes Thy glory known, and clouds arise, and tempests blow, by order from Thy throne; while all that borrows life from Thee is ever in Thy care, and everywhere that man can be, Thou, God art present there.

Watts wrote that in the eighteenth century, and it is not my impression that he supposed its truth to be incompatible with the unfolding truth of science.

The second passage is the account of creation given in Genesis 2:4–25. As is well known this has a different emphasis from Genesis 1:1–2:4, which seems more comprehensive of both space and time and emphasizes humanity's relation to God's purpose in creation. Here the emphasis is placed rather on man's relation as *creature* to the rest of creation, and his relation to God is seen in that perspective. The account comes to a first pause with the creation of woman and recognition of the unique relation of man and woman as "heirs together of the grace of life." However, en route to this a great deal is said about the relation of humankind to the rest of creation. In particular, the unique authority, gifts and vocation of human beings in relation to the garden is indicated by the story of the naming of the animals (v. 19). This passage forms a paradigm for the enterprise of science. The issues relevant to science, *viz.*, the contingency of the world, the role of the human mind in recognizing and bringing to light the order in nature, the capability and authority given us to do so, and above all the value placed on the activity by God, are all evident. God was *interested* "to see what the man would call them." Such interest and concern of God continues throughout the story as it unfolds in the rest of the Scriptures. God is not absent, but present.

The creation is not a domain of thought and activity in which we have no relation to or an independence of the Creator. Surely we should learn the relevance of this lesson for our care of the earth.[34] But equally it seems to me that operationalism as a philosophy of science really presumes that we are responsible only to our own minds and our own purposes for what we think about the world—so that God, so to speak, has no interest or concern with those activities and we have none with Him, except as an *option*. Such a dualist separation of the purposes and objects of redemption from those of creation seems completely wrong to me, since then *reverence* has no necessary relation to the understanding of creation.

For human culture, everything depends on our understanding of ourselves and our identity. That understanding cannot come from our own minds, but from hearing the Word of God. Our ability to hear, and therefore our capacity to see things as they really are, is closely linked to our reverent willingness to listen. Conversely, a realist belief, that the listening so basic to the scientific enterprise leads not to illusion or convenience, but to *truth*, is the belief most compatible with reverence for God in what we do and think here. Realism and reverence really are inseparable.

"A man of knowledge uses words with restraint,
and a man of understanding is even-tempered."

Proverbs 17:27

NOTES

1. (a) Psalm 19:1–14; (b) Romans 1:18–23.

2. T. F. Torrance has used the term *ontological* to describe those contingent relations created by God, and accessible to creaturely knowing as aspects of an objective reality. Such relations are not merely *logical*, but are relations of *actual being*, even though they are consistent with our creaturely logic as the tool which apprehends them. (a) T. F. Torrance, *Divine and Contingent Order*, Oxford Univ. Press, Oxford (1981); (b) *ibid., Reality and Scientific Theology*, Scottish Academic Press, Edinburgh (1985); (c) *ibid., The Christian Frame of Mind*. Handsel Press, Edinburgh (1985).

3. (a) W. R. Thorson, "Reflections on the Practice of Outworn Creeds," *Journal of the American Scientific Affiliation* (*JASA*) *33*, 3–11 (1981); (b) *ibid.*, "Science as the Natural Philosophy of a Christian," *JASA 33*, 65–73 (1981); *ibid.*, "The Biblical Insights of Michael Polanyi," *JASA 33*, 129–138 (1981); (d) *ibid.*, "Scientific Objectivity and the Word of God," *JASA 36*, 88–97 (1984).

4. This paper is a revision of the second of two papers presented at the Joint Conference on Science and Faith of the American Scientific Affiliation, Canadian Scientific and Christian Affiliation, and Research Scientists' Christian Fellowship (UK), Oxford, July 1985. The discussion of theological "operationalism" referred to was presented in the first paper, "Toward a Biblical Understanding of Human Knowledge." Since most of the ideas in that paper may be found in Refs. 3a–d, I have preferred not to publish it.

5. Paul Tillich, *The Courage to Be*. Yale Univ. Press, New Haven, Conn. (1952); *ibid., Dynamics of Faith*. Harper & Row, New York (1956).

6. (a) T. F. Torrance, "Karl Barth and Patristic Theology" [to be published], (b) *ibid.*, "Theological Realism," in *The Philosophical Frontiers of Christian Theology: Essays Presented to D. M. MacKinnon*, Eds. B. Hebblethwaite and S. Sutherland; Cambridge Univ. Press, Cambridge (1982).

7. Cf. T. F. Torrance, *Reality and Evangelical Theology*; Westminster Press, Philadelphia (1982).

8. Michael Polanyi, *Personal Knowledge: Toward a Post-Critical Philosophy*. Routledge and Kegan Paul, London (1958). Repr. in Paperback Ed., Harper Torchbooks, Harper & Row, NY. (1966).

9. Drusilla Scott, *Everyman Revived: The Common Sense of Michael Polanyi*. The Book Guild Ltd., 25 High Street, Lewes, Sussex, England (1985).

10. There is some ambiguity and perhaps even inconsistency in what "meaning" Polanyi himself supposed religious truth to have. There has been scholarly debate as to whether Polanyi did or did not intend the *existentialist* interpretation of religious meaning set forth in his last book, written as a co-author with H. Prosch [M. Polanyi and H. Prosch, *Meaning*, Phoenix Books, U. of Chicago Press, Chicago (1977)]. However interesting to scholars such debate about Polanyi's own views might be, it is not directly relevant to the question which really concerns us: what view is consistent with the general epistemological approach? Lady Scott (*loc. cit.*, Ref. 9) has made the same point and reaches the same conclusion as I do: a view of religious truth as referring to objective reality is fully consistent with the epistemology of personal knowledge. Given his view of his work as a beginning exploration toward the truth, Polanyi himself would have been the first to encourage discussion of the issue on its merits.

11. R. A. Jastrow, *God and the Astronomers*. Norton & Co., New York (1978).

12. A good bibliography on the "anthropic principle" may be found in W. J. Neidhardt, "The Anthropic Principle: A Religious Response," *Journal of the American Scientific Affiliation 36*, 201 (1984). Cf. sources also cited by Neidhardt: P. Davies, *The Accidental Universe*, Cambridge Univ. Press, Cambridge, (1982); E. R. Harrison, *Cosmology—The Science of the Universe*, Cambridge Univ. Press, New York (1981); B. J. Carr and M. J. Rees, "The Anthropic Principle and the Structure of the Physical World," *Nature 278*, 605 (1979).

13. For the ardent feminists among my readers let me say that I have struggled humanfully with the problem of 'man' in the sense of "human" as distinct from merely "male;" where possible a neutral term conveying both genders as one unity has been used. There remain a few isolated cases where I felt that such unwomanly violence would be done to simplicity, clarity or rhetorical strength that I opted for the traditional word. I apologize to those for whom this creates a block, but I believe there are more important issues in our time than this one.

14. Owen Barfield, *Saving the Appearances: A Study in Idolatry*. PB Edition (USA), Harcourt, Brace & World, Inc., New York (1965).

15. Theodore Roszak, *Where the Wasteland Ends*. PB Ed., Anchor Books, Doubleday & Co., Inc., Garden City, NY (1973); *ibid, The Making of a Counter-Culture*; PB Ed., Anchor Books, Doubleday & Co., Inc. (1969).

16. Fritjof Capra, *The Turning Point*. PB Ed., Bantam Books, Inc., New York (1983).

17. Isaiah 44:9–20.

18. At one point in *Saving the Appearances*, Barfield acknowledges the danger of a pantheist interpretation of his work: *loc. cit.*, Ref. 14, pp. 144–150.

19. Jacques Monod, *Chance and Necessity*. A. Knopf & Sons, Inc. New York (1971).

20. A. J. Ayer, Ed. *Logical Positivism*. Free Press, Glencoe, Ill. (1959); A. J. Ayer, *Language, Truth and Logic*. V. Gollancz, Ltd., London (1949); *ibid., Philosophical Essays*. MacMillan & Co., New York (1954); Bertrand Russell, *Our Knowledge of the External World*. 2nd Ed., Allen & Unwin, New York (1922); *ibid., Human Knowledge: Its Scope and Limits*. Allen & Unwin, New York (1971).

21. Toward the end of "Saving the Appearances," [*loc. cit.*, pp. 158–9] Barfield portrays the role of β-thinking as a *recovery* of the ancient conception of vision as the ray emanating from the eye of man and returning to him—as if that were true! Surely piety requires instead our admission that what is true physically is also true metaphysically and epistemologically, namely that we see because there is *light* filling the world and by that light we see reflected all the things in the world.

22. See for example J. van Heignenoort, *From Frege to Gödel*. Harvard Univ. Press, Cambridge, Mass. (1967).

23. D. R. Hofstadter, *Gödel, Escher, Bach: An Eternal Golden Braid*. Basic Books, Inc., New York (1979). Cf. also the column "Metamagical Themas" in *Scientific American*; see issues for January 1982; September 1982; January 1983. See also the notion of mind advanced by P. Davies, *God and the New Physics*. Simon and Schuster, New York (1983).

24. Donald M. MacKay, *The Clockwork Image*. InterVarsity Press, Downers Grove, Ill. (1974); *ibid., Brains, Machines and Persons*. Wm. B. Eerdmans Publ. Co., Grand Rapids, Mich. (1980); *ibid., Science, Chance, and Providence*. Oxford Univ. Press, Oxford (1978).

25. A. Aspect, J. Dalibard and G. Roger, *Physical Review Letters 49*, 1804 (1982).

26. J. C. Polkinghorne, *The Quantum World*. Longman Group, Ltd. London & New York (1984).

27. See for example J. A. Wheeler and W. H. Zurek, Eds., *Quantum Theory and Measurement*. Princeton Univ. Press, Princeton, NJ (1983); also M. Jammer, *The Philosophy of Quantum Mechanics*. John Wiley & Sons, New York (1974).

28. R. B. Griffiths, "Consistent Histories and the Interpretation of Quantum Mechanics," *Journal of Statistical Physics 36*, 219 (1984). Ref. 29 is a brief, non-technical account.

29. R. B. Griffiths, "Philosophical Implications of Quantum Theory" [Paper presented at Conference on Science and Faith, Oxford, July 1985].

30. A similar point has been made by C. B. Thaxton, W. L. Bradley and R. L. Olsen in *The Mystery of Life's Origin: Reassessing Current Theories*, see Epilogue. Philosophical Library, New York (1984).

31. In spite of arguments given in this paper it is not obvious to me which side of the debate is right. I favor the more conservative view that while meaning and setting for scientific questions, and intelligibility of scientific theories, may legitimately entail some beta-thinking, the *focal objects* of scientific investigation must properly remain within alpha-thinking limits. Confusion often evident in the "social sciences" is the result of not keeping these limits sharply defined, and illustrates my concern.

32. *Machine* and *biological organism* as contrasting models for scientific understanding have a long history. Cf. Ian Barbour, *Issues in Science and Religion*, Chapter 11, Prentice-Hall, Inc., New York (1966); PB Ed., Harper Torchbook TB 1566, Harper & Row, New York & London (1971). A good assessment of the limitations of the organismic model, in relation to the *personal*, is found in John MacMurray, *The Self as Agent*. Faber & Faber, Ltd., London (1957).

33. Cf. Isaiah 6:1–7; Hebrews 12:18–29.

34. Loren Wilkinson, Ed., *Earthkeeping: Christian Stewardship of Natural Resources*. Wm. B. Eerdmans Publ. Co., Grand Rapids, Mich. (1980).

Christian Objections to High Technology: Analyzing the Resistances

DAVID W. AYCOCK

University Counseling Center
Taylor University
Upland, IN 46989

High Technology is advancing at incredible speeds. It appears to be both shaped by and a shaper of our culture. The organized church has historically opposed technological advancements for a variety of reasons. Today, objections from Christians and others to technology are frequently encountered. Resistance to scientific progress may stem from psychological variables such as reactions to stress and overstimulation, technophobia, and ego-defense strategies. Christians must recognize these psychological mechanisms and overcome them in order to contribute effectively to the rational assessment of technological innovations in light of scriptural principles. Only then will their evaluations be meaningful and their voices credible in a rapidly changing world.

The twentieth century is an age of innovation. Technology progresses with such rapidity that developments are obsolete before they can be widely disseminated in the literature. Driscoll (1978) reports that during the last century the speeds of communication and data processing have increased by factors of 10^7 and 10^6 respectively. Scientists pursue gains in virtually every area imaginable, transforming yesterday's science fiction into today's reality.

We are so totally surrounded by technological developments that it is difficult to organize a list of commonplace objects or service delivery systems which were in existence before, or have remained unchanged during, the 1900's. Technology affects us broadly through our transportation and information systems, financial institutions, *et cetera*, and intimately through the clothes we wear, the deodorants we use, and the contact lenses which some are using to read this page. The use of the computer, technology's most heralded recent achievement, is illustrative of the widespread utilization of scientific achievements. Computers touch the lives of almost every American whether through a direct access by the individual (e.g., automated bank tellers, microwave ovens) or through indirect avenues (e.g., bank transactions, airline ticketing). Technology has a firm grasp on our lives. Christians are not immune (nor would most wish to be) from these applications of science. Schwarz (1979) maintains:

> We cannot turn the wheel of history back, aborting our technological advancements. Our civilization is much too complex and we are much too removed from "a natural way of life" to be able to do without technology. (p. 206)

Of course, not all would agree that the costs of reverting back to a less complicated lifestyle are prohibitive. Some see this as a viable option; but judging from the life choices being made, they would seem to comprise a distinct minority.

It is evident that technology continues to advance at a blistering pace and that it affects each of us personally. Is this good or bad? Most would agree that the improvement of the human condition is a positive outcome of technological progress. How many would trade their cars for a horse and buggy or even attempt to complete tax forms without a calculator? However, few will blindly deliver all their cares to technology.

We seem to be wary of its full intentions. Harvey (1984) writes:

> The computer evokes an uneasy fascination in most of us. Paradoxically, we admire what it can do, but we are apprehensive about what it might be capable of. We enjoy our power over it but fear its hypnotic hold on us. We like it when the computer "acts human" but insist on its intrinsic and unalterable "machine-ness." (p. 11)

A good number of voices are speaking out against modern technology, claiming that its blessings are accompanied by significant curses. Scientific advancements have been attacked for their detrimental effects on the environment, potential to be used for the nuclear annihilation of humankind, interference with personal creativity, hindrance of interpersonal relationships and general dehumanizing effects. Scientists are accused of irresponsibility and are having their experiments terminated (Babos, 1981). Gone are the days of blind trust in new medications, food processing techniques, and product safety claims.

These difficulties will not just disappear. Sin is a powerful force in the applications of science just as it is in all human endeavors. To complicate matters, the contraindications of today's technology are not always readily apparent. This was hardly the case during the industrial revolution when the benefits of mass production and accessibility of goods were easily contrasted with the curses of labor abuses, widespread poverty, and the widened socioeconomic class gap (Schwarz, 1979). The evils bred by modern technologies are not always readily discernible nor do they immediately accompany the advancements. Frequently, the "unintended, second-order effects of a technological innovation on society are . . . more influential, long-term, than its direct and deliberate effects" (Dede, 1981, p. 204). For instance, engineers recognized that the shortest distance between points A and B was a straight line, so they built highways that followed a direct path. Even though this procedure decreased the amount of driving time for motorists, it also increased the monotony and boredom of driving and, consequently, contributed to an increase in highway accidents.

The determination of whether a technological advancement is a boon or bane must be made and Christians should be in the forefront of this decision-making process. It is imperative that believers base their choices on their values which have been derived from Scripture and their personal relationships with God. The purpose of this paper is to explore the resistances to high technology among Christians and to investigate the values, personality variables, and fears associated with this stance. It is recognized that many of these objections are shared by non-Christians, but believers will be the focus of this paper.

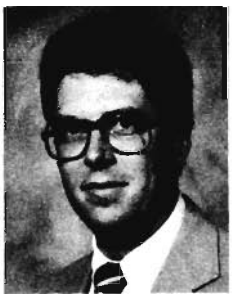
Historical Perspective

Historically, Christians have been wary of scientific advancements and theories. Ramm (1971) states:

> In the past, the evangelical response to new scientific theories (and/or their ethical or theological implications) has gone through somewhat the same pattern. The new theory is announced. In that it apparently conflicts with evangelical theology, evangelicals denounce it. The evidence piles up overwhelmingly for the theory. Then the evangelicals scramble around to undo their initial interpretation and find how the new science and its implications can be absorbed into evangelical theology. (p. 52)

It is interesting to see ministers who once railed against the evils of television now preaching on this "harmful" medium. This resistance to technological advance is most pronounced when an innovation appears to conflict with an ecclesiastical assumption (e.g., artificial insemination may subvert God's role in procreation).

Church history is filled with examples of organized Christianity's anti-technology stance. The opposition of the early church to innovative activity was a factor in their persecution along with their disdain for Caesar (Ellul, 1964). The organized Church continued this resistant stance toward scientific advancements. The Church barred the dissection of cadavers until 1348. Pope Leo XII proclaimed vaccinations sinful. Even Galileo was forced by the Inquisition to withdraw his evidence supporting Copernicus' theory that the sun



David W. Aycock is an Associate Professor and Director of Counseling Services at Taylor University, Upland, Indiana. He is a licensed psychologist with major research interests in stress management. He received his Ph.D. in Counseling Psychology from Georgia State University and his undergraduate degree from Tennessee Temple College.

was the center of our solar system because it contradicted ecclesiastical thought.

The charge that science has eroded Christian values is made frequently, supported by evidence ranging from the contradiction of scripture by Darwinian theory to the menace of video games to adolescents.

The reasons for Christian opposition to technology are probably diverse. From a political standpoint, innovations were suppressed because they would improve the lot of the masses and upset the status quo. Some philosophical views also clashed with scientific advancements. Some viewed matter as antithetical to spirit and opposed energies devoted to this hostile element. Others objected because technology was seen as a disrupter of natural order and, therefore, of God's divine design. Endicott (1981) summarizes this point:

> In retrospect it is easy to see that Christianity over the centuries has not always been kindly disposed to the idea of technology, and in fact at times held back its growth. Whether mechanical objects and technical systems faced arbitrary moral judgment from clergy and state, or whether the ecclesiastical hierarchy conspired to keep the masses illiterate, the Church was involved to a great degree in restraining technological advancement. (p. 18)

To be certain, there have been instances of Christian support of technology. Before widespread distribution of information, monks meticulously recorded technological innovations along with their other writings. Mendel was a pioneer in genetic research. Carhart (1981) reports that the study of physics was initiated by Christians who held a strong belief in the regularity of nature. The Christian dogma of humans' transcendence of nature has spurred scientific advancements as well. In the Protestant Reformation Christianity greatly aided advancement in the sciences as old barriers of resistive thought were broken down. American Protestants courted science regularly even into the 19th century. However, Darwinism and reductionism frightened many Christians in the mid-1800's, and that distrust persists in segments of the Christian community today.

Present Day Fears

Today, Christians level many complaints against technology-induced change. Many see high technology as a Frankenstein monster which will assuredly turn on its human creators and wreak havoc on God's creation at large. Others see it as an irreverent attempt to subvert and/or replace the Creator Himself—a twentieth century tower of Babel. The charge that science has eroded Christian values is made frequently, supported by evidence ranging from the contradiction of scripture by Darwinian theory to the menace of video games to adolescents. The social aspects of technology, especially in regards to the church, are often viewed as a threat. Whether by microcomputers or television sets, some fear that the local church and its body-life are imperiled. Many are deeply concerned about the destructive forces of technology and its potential effects on humankind and the environment. Some Christians resist innovations (even demonstrably positive ones) simply because "it's never been done that way before."

One segment of the resistant Christian population which this author finds intriguing is constituted by those who vehemently oppose advances in computer technology for fear that it is, or will be, utilized by Satan. These believers draw their support for such fears from the apocalyptic scriptures and are avid readers of premillennial eschatological literature. They have derived mathematical formulas (such as the one developed by Rev. Jerry R. Church) which once fingered Henry Kissinger as the antichrist and now astoundingly tell us that "New York," "Mark of Beast," and "*computer*" all sum to the dreaded numerical value of 666.

A prominent doomsayer is the television and radio evangelist, Jack Van Impe. He asserts that Revelation 13 identifies the antichrist who will fulfill eschatological prophecies of destruction and satanic advancement with the aid of a "beast—an image which may well be the computer of computers—the masterpiece of the knowledge explosion!" (1982, p. 9). He describes the "shocking" existence of speaking computers and the "most chilling report" of the biological computer which can be implanted in humans and has already reached the drawing board. Van Impe (1982) devotes a significant amount of space to the discussion of a macrocomputer now located in Luxembourg which has the capacity to store twenty pages of information on every person in the world. He asserts that this mother computer can be connected to any computer system in the world and that its present international computer code of "6" is anticipated to expand to "666." He warns, "A new 'Hitler' with a monstrous computer to enslave millions may soon take over the earth. All these events signal the imminent return of the Lord Jesus Christ" (p. 17).

Christians who subscribe to the prophecies of Van Impe and other doomsayers are noticeably concerned

about technological advancement and computer proliferation because these developments signal the nearing of the Great Tribulation period and the ending of their earthly lives. Personal participation in computer technology is typically shunned for fear of compromising their faith by unwittingly benefiting Satan's methods or accepting the frightening mark of the beast.

There exists a wide range of opinions among Christians regarding high technology. Although many believers base their assessments on rational evaluation of facts, the Church's historical opposition to innovation and fear of compromising scripture predispose others to approach technology with a great deal of apprehension. Extremist groups boldly proclaim the evils of scientific gains while others quietly distrust them.

Psychological Explanations for Resistances to Technology

Rapid technological advancements have taken a toll on the populace and our social structures. In 1970, Alvin Toffler prophesied the deleterious effects of this progress, coining the term "future shock—the shattering stress and disorientation that we induce in individuals by subjecting them to too much change in too short a time" (p. 2). Many researchers have responded by investigating the mechanisms of change and their social consequences. As a result, the literature contains various explanations for resistances to technological change.

Resistance as a Response to Stress

Hans Selye, the pioneer of stress research, defines *stress* as "the nonspecific response of the body to any demand placed upon it" (1956, p. 63). The organism responds to *any* change by adaptation—attempting to return itself to a state of equilibrium. Novel stimulation can be a significant stressor because it forces one to adapt without the benefit of a tested plan of action. Almost any new situation will arouse the stress response and its attendant physiological and emotional discomforts. After the stimulus has been presented several times, adaptive skills and self-statements are learned which lessen the event's stressfulness.

Evidence supporting the assertion that change breeds personal stress abounds in the literature (Dohrenwend & Dohrenwend, 1974; Johnson & Sarason, 1979; Matheny, 1983; Rahe, 1979). The pivotal role of personal perceptions of environmental stimuli has been studied as well. The negative effects of life changes appear to be moderated by numerous factors such as cognitive appraisal (Lazarus, 1976), perceived control (Matheny & Cupp, 1983), self-efficiency (Bandura, 1982), and social support (Brown, Bhrolchain, & Harris, 1975). The individual who possesses adequate coping resources tends to view change as a challenge instead of a threat, and thus the event's stress potential is reduced. Persons who either lack stress management strategies or *perceive* themselves to be deficient in coping skills tend to escalate the personal significance of a life change and experience a comparable increase in its associated stress. These people are often resistant to novelty or change.

Many adverse reactions to technology can be more adequately explained as defenses against perceived threats to personality components rather than realistic fear responses.

The introduction of technology into our lives brings change. Those who believe they possess the resources necessary for adaptation to this change have the ability rationally to evaluate the innovations with respect to issues such as ethics, cost-benefits, values, *et cetera*. Accordingly, they can calmly accept or reject the change and offer a rationale for their decisions. Individuals who lack stress-coping resources sufficient for adaptation will respond instinctively with another management strategy—resistance to any technological advancement. As Leavitt (1970) concludes, "Human acceptance of ideas is the real carrier of change; and that emotional human resistance is the real roadblock" (p. 369).

Toffler (1970) maintains that "change is the process by which the future invades our lives" (p. 1). The technological changes that so regularly confront many are unwelcomed trespassers. These people resist because the change forces adaptation to accommodate the innovation, making them feel fearful of losing power or control as well as incompetent because they lack requisite skills (Rose, 1982). However, the most salient reason for resistance is the perceived disruption in social relations which accompanies the change (Malinconico, 1983). People will find ways to defeat any changes which threaten their social roles or interpersonal relationships.

The manifestations of resistance may take many forms. Some are suspicious of any novelty. They express disapproval and predict a reduction in work quality or the ultimate failure of the innovation. Others passively avoid the new technology (Malinconico, 1983). In all cases, the use of resistance to change as a coping resource is an attempt to prevent a stressful incident.

Overstimulation

Each individual has a range of stimulation within which the person can function most adequately. This is called the optimal stimulation range. Frankenhaeuser and Gardell (1976) state:

> To function adequately, the central nervous system requires an inflow of impulses from the external environment. Both lack and excess of stimulation threaten the homeostatic mechanisms by which the organism maintains an adequate degree of arousal. (p. 36)

Many search for the one *solution to all their problems and rely on technology for deliverance from all of life's ills. Needless to say, they never discover the elusive equation.*

Matheny (1983) adds

> The (optimal stimulation) range offers stimulation to provide challenges and interest but not enough to cause significant discomfort or performance breakdown. Stimulation intensity can be judged only by the experiencing person. It varies from person to person, so one person's optimal stimulation range is not necessarily that of another. (p. 12)

Arousal is curvilinearly related to behavior efficiency and well-being (McGrath, 1970). Low arousal results in inattentiveness and boredom which can further impede performance as cortical processes slow down. Conversely, high arousal results in excessive tension, intense emotionality, and a decline in performance as cortical control is weakened and the ability to respond selectively is impaired (Frankenhaeuser & Gardell, 1976).

Over-shooting one's optimal stimulation range is generally regarded as being more stressful than underload (Matheny, 1983). Stimulus overload inhibits adequate information processing and decreases both performance and quality of life. Graphic evidence supporting the debilitating effects of prolonged overstimulation was collected during World War II in the studies of breakdown among soldiers in battle (Janis, 1971). These men, who were beleaguered by constant threats to their survival requiring hypervigilance, eventually were rendered incapable of functionally attending to their environment at all. They became totally confused, lost their decision-making abilities, and were prone to mindless behaviors.

Technological advances are capable of producing overstimulation. They may serve to deluge users with inordinate amounts of information, organize data in unfamiliar ways, introduce novel procedures, or demand new skills which the user does not yet possess. Extended exposure to these stimuli which exceed their optimal stimulation ranges can be met with adaptive strategies which lessen the demands or with stress, frustration, disorientation, apathy and illness. Each of these negative effects can produce an antitechnology mind-set.

Technophobia

A phobia is a debilitating irrational fear of an environmental stimulus. When confronted with this (perceived) noxious stimulus, a phobic will experience an acute stress response, characterized by physiological changes which prepare the body to run or fight and psychological effects which interfere with concentration and escalate anxious affect. A phobic response is an *overreaction* to a stimulus, even one which warrants at least some degree of rational fear (e.g., snakes, heights). The individual suffering from a phobia is unable to exercise normal levels of self-control and task orientation when the phobic stimulus is in close proximity either in fact or in the imagination.

The accelerated growth and development of technology in our culture has engendered the rapid rise of abnormal or unrealistic anxiety. This has been called "technophobia." Technophobia is most commonly associated with the fear, distrust, or hatred of computers—"computerphobia" or "cyberphobia." Although these terms are often used to describe adversive reactions which fall short of a clinical phobic reaction, an amazing number of people are quite frightened by a computer terminal. In a study of several hundred computer users who were tested for galvanic skin resistance while actually at the terminal, Rice (1983) reports that 33% were computerphobic and 5% evidenced symptoms of classic phobia (nausea, cold sweat, etc.).

Jay (1981) reports that computerphobia is indicated by resistance to talking or even thinking about computer technology, excessive fear and anxiety surrounding technological equipment, and hostile and aggressive thoughts and behaviors. Some cyberphobics are afraid to touch the computer for fear that it might be damaged. It is not unusual for these individuals to believe that the depression of one key will irreparably damage the machine or, worse yet, cause it to explode. Another misconception of the computerphobic is that once one uses a computer, one will become a slave to the technological device. There is an irrational fear of a

psychological addiction which effectively holds one in front of the terminal and refuses to allow alternative life activities. The idea that one can master the machine is a foreign one.

Even though computerphobia is a widespread phenomenon in the 1980's, the label is sometimes misapplied to those who are simply unexcited by this technology. Indeed, many are not frightened by computers, but rather they have a well considered disinterest (Rubin, 1983). Undoubtedly, some do not see any personal value in a computer or else they determine that the resource expenditure required to obtain and learn to operate the machine outweighs its potential benefits. These individuals are not cyberphobic.

Other Personality Variables

Some fears of technology are attributable to other individual personality factors. People cognitively appraise any event that touches their lives in regard to the event's interaction with their intrapsychic structures. Many adverse reactions to technology can be more adequately explained as defenses against perceived threats to personality components rather than realistic fear responses. These defensive mechanisms serve to protect the ego from psychic dangers and exercise significant control over behavior. Healthy defenses (e.g., rationalizing one's failure to act on a trivial matter to close an issue) are beneficial and conserve energy. However, some individuals heavily employ ego defenses to their own detriment. This is evidenced by their frequent engagement in dysfunctional behaviors and experience of dysphoric emotions.

Analyses of objections, resistances, and other negative responses to technology often reveal the profound influence of personality features which predispose persons to unfriendly assessments of new ideas and inventions. One pathological strategy is steadfastly to refuse to acknowledge the presence of the feared stimulus. This denial, or attempt to block out unwelcomed reality, is characterized by a belief that innovations are merely tricks or repackaged old ideas and by failure to accept new information. Another dysfunctional attitude is the inability to confess that one lacks knowledge of a technological advancement or that one has skill deficits. Persons with these attitudes are prone to believe in a personal omniscience or else abnormally to fear appearing inept in front of others. Since they are embarrassed to let others know of their deficiencies, they voice disapproval of the change or they attempt to operate computers without adequate training. This quickly results in frustration and negative pronouncements on the technologies. Others view the unknown as necessarily threatening and catastrophize that computers will replace them, that they could *never* learn to operate the new equipment, or that the use of any technology will necessarily dehumanize them, force dependence, and publicize all of their secrets.

The interaction of technology with unreceptive personalities breeds various responses. Some adapt by choosing a narrow field in which to specialize and ignore peripheral changes. This is a form of denial and is dysfunctional because it blinds one to the entire spectrum of life and can thrust one into a crisis if the chosen speciality becomes obsolete. Others respond by obsessively reverting to outmoded, but previously successful, coping techniques (Toffler, 1970). They pine for yesterday and miss out on today. Many search for the *one* solution to all their problems and rely on technology for deliverance from all of life's ills. Needless to say, they never discover the elusive equation.

Christians applaud the use of technology to spread the Gospel and, at the same time, blame it for fostering materialism and human self-glorification.

In some cases the negative reaction to a perceived technological threat is overt aggression or hostility—bending, folding, and mutilating the cards. Rubin (1983) described an office manager whose computer seemed always to be malfunctioning. It was discovered that she was taking out her frustrations on the machine itself by actions such as removing discs while the computer was in drive. Likewise, Rice (1983) reported equipment abuse which included dumping coffee and cigarette ashes into the computer console.

Technologists cannot afford to ignore these unintended effects of their advancements. After all, innovations are made, ostensibly, to serve people. Perhaps as much effort should be placed into strategies for the introduction of changes as into their development. On the other hand, individuals must recognize their characteristic modes of dealing with novelty and refrain from quickly identifying any change as a destructive or menacing force.

Taking action to shield oneself from excessive stress, overstimulation and perceived threats to the ego are expected human responses. When high technology is classified as a disruptive force, many employ resistance as a protective mechanism. This resistance can take many forms, but its purpose is to reduce stress and

preserve homeostasis. This strategy is available to Christians just as it is to others. Encounters with numerous technology-resistive Christians in his clinical practice and stress management seminars has led this author to believe that the majority of objections to technology can be traced to these factors.

Values and Technology

Exposure of the psychological mechanisms which precipitate resistances does not intimate that all objections to high technology are self-serving, invalid, or unwarranted. Christians should understand personality variables which impinge on their choices, but they *must* rationally evaluate the techniques and effects of scientific advancements and boldly voice their opinions. Reflexive pessimism and doomsaying may be the road to self-fulfilling prophecies while noncritical acceptance of societal and institutional change resigns us to the designs of others. As in every area of the Christian life, balance is required.

The Morals of Technology

It is interesting that morals are so often ascribed to technology itself as if it were an autonomous personality capable of devising plans. Obviously, this is not the case. Any invention has the potential to be used for good or evil, but the technology itself is amoral. The user of technology must assume any blame for its abuse.

Christians must cease to ascribe omnipotence to technological machines and recognize that these mechanisms are dependent upon humans. A computer's conversational ability is limited to the lexicon that has been programmed into its memory. It cannot contemplate the meaning of life nor can it display emotion. There are sometimes glaring flaws in the device's abilities to complete assignments for which it was (supposedly) programmed. Hassett (1984) provides an example of how the computer can be too literal. When a computer used a bilingual dictionary to translate the biblical warning "The spirit is willing but the flesh is weak" from Russian into English, the verse was rendered, "The wine is agreeable but the meat is spoiled." Although cybernetic theory is now at the point where machines are less dependent on humans than ever before, their ability to deal with novelty and to improvise falls drastically short of human creativity. Therefore, people are still essential for computers to function instead of the converse.

Another misconception about technology is that the ethical dilemmas surrounding its use are amenable to technical solutions and that once developments are refined, the problems will disappear (Babos, 1981). This presents the unhappy occurrence of "the tail wagging the dog"—if we can accomplish something, then we must. The proper perspective is quite the opposite. Just because geneticists are learning much about engineering gene pools, we are not obliged to abandon natural reproductive methods. Discovering a new method of splitting the atom does not dictate its implementation.

Technology must be controlled by non-technological evaluation. This direction is most profitable if applied before innovations are developed. However, this is often impossible or futile since the consequences of many gains are unpredictable (Schwarz, 1979). Even changes which initially were deemed beneficial can be rendered evil in the long run.

Technology must be judged in the context of cultural and institutional influences. To blame moral erosion on the advent of technical achievements is to engage in scapegoating and simplistic thinking. Decadence may have arisen along with technology, but technology should be considered merely the vehicle, not the cause (Kuhn, 1981). For instance, modern medical techniques used in abortions have not legitimized the practice; they have only made it safer. Likewise, wars have plagued humans throughout their existence and are not merely the outgrowth of sophisticated military weaponry. Technology always reflects the ethical standards of the people who employ it. Our values will determine whether or not we transcend our machines.

Christian Perspectives

If Christians are to involve themselves in the moral evaluation of scientific progress, they must develop an integrative understanding of technology and biblical teaching. Genesis 1:26,

> Then God said, "Let us make man in our image, in our likeness, and let him rule over . . . all the earth,"

is frequently cited (Babos, 1981; Endicott, 1981; Schwarz, 1979) as a rationale for Christian support of technological advancements—human transcendence of nature and continuance of God's creative activity. Some see human lordship over the world as a religious duty. Endicott (1981) warns, "It would be a sheer act of disobedience if we were not to do what we could to have dominion over the world. That, indeed, is literally an article of faith" (p. 18). However, one must be mindful of other biblical directives which restrain the use of any technique for the mere pursuit of dominion (Schwarz, 1979). The fruit of the Spirit should govern technical strivings.

Christians applaud the use of technology to spread the Gospel and, at the same time, blame it for fostering materialism and human self-glorification. God thwarted the construction of the tower of Babel and

forbade transporting His ark with wheels, yet He utilized the first century Roman highway and communication systems to spread Christianity throughout the world. How are we to understand His designs?

Believers are required to look beyond the surface of innovations in discerning their appropriateness. The key to a proper assessment is to ask how an advancement conforms to God's expressed will. As such,

> Judeo-Christian tradition has no reason to reject modern technology as a result of human pride and sinfulness. Modern technology does not exhibit a greater degree of human sinfulness than did the mallet which Cain lifted to slay his brother Abel . . . A more sophisticated technology does not imply a better (or worse) technology in a moral sense. (Schwarz, 1979, p. 208)

Its indications and contraindications must be subjected to God's ruler.

Several models for Christian involvement with technology are available. Some develop an anti-science attitude and spurn any advancement, condemning it for all of society's ills. Others adopt a laissez-faire attitude and do not concern themselves with science at all. For example, Guthrie (1968) reassures us:

> If science opens up and controls the secrets of the world around us, masters the space above us, and learns to understand and deal with the psychological depths within us, then it is only doing the will of the Creator, whether it knows it or not. (p. 163)

Carhart (1981) asks us to place more faith in the scientists:

> I don't think the untrained Christian really can evaluate technical issues. . . . The problem is, to have a real appreciation for a proposed experiment or a proposed technological development, one really must be an active participant. . . . I also think Christians who are scientific lay people need to trust the professionals who are involved in the actual issues. Christian lay people need to put away their suspicions that the professions are selling out to scientism. They need to believe that many are following the Lord. (p. 13)

These views are deficient in fundamental ways. Extremists distance themselves from the facts and, therefore, others rarely take them seriously. The unconcerned forfeit their abilities to "add salt" to the scientific community. Those who exercise blind faith in professionals license scientists to dictate morality—a discipline in which they possess no special qualifications. The proper response of Christianity to science is essentially the same as its response to any other discipline—interest in the fundamental issues, evaluation in light of God's Word, and communication of findings. In this way believers can appropriately season the dish in preparation for its widespread consumption.

Believers cannot afford to remove themselves from the technical arena. Christians who have the ability to transcend reflexive resistances to technology and the courage to investigate the ethical implications of technical developments will discover the existence of many difficult ethical dilemmas. These must be addressed in a credible fashion if Christians are to make a significant impact on policy makers.

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Resource Managers and the Environmental Ethic

LAURENCE C. WALKER

Lacy Hunt Professor of Forestry
Stephen F. Austin State University
Nacogdoches, Texas

To the Hebrew-Christian Bible and to those who claim to be its adherents have been attributed the environmental degradation, and the resulting ethical dilemmas, that now face mankind. Resource managers who are Christians must understand the historical rationale for this accusation and then move to challenge it. To do so, they must grasp an understanding of the nature of man, which leads all men to exploit natural resources, and of the edict of Scripture that calls men to be capable stewards of the environment entrusted to them. Resources are to be used, and not abused, to provide for the needs of people.

Professional resource managers have participated too seldom in formulating policies for society and society's institutions. The task has been left to lobbyists and laymen. Now there is a new opportunity for members of these professions—geologists, foresters, range, watershed and wildlife managers—to provide guidance for the church and temple as these institutions begin to grapple for a proper understanding of their roles in environmental care. The alliance of natural resource caretakers and religious organizations is not inappropriate, for the origins of several of these professions are rooted in altruism. The church—perhaps apart from government the nation's largest institution—is acclaimed as a citadel of altruism. And, also, the motivation that led to the founding of both the profession of forestry and the Society of American Foresters was altruistic. Gifford Pinchot, who some say coined the term "conservation" and defined it as the wise use of natural resources, was a Calvinist. So too was Theodore Roosevelt, probably the nation's most conservation-minded president. Carl Schenck, founder of the Biltmore Forest School in 1898, the first such institution in the New World, expressed his concern for altruism to his students with the phrase, "Excelsior, the higher good." With a doctorate from a German university, he often preached from pulpits of southern Appalachia. And Aldo Leopold, among the first wildlife management professionals, wrote of the need for a "land ethic" in his classic essays published as *A Sand County Almanac, and Sketches Here and There* (1949). E. O. Wilson (1984) calls this concern *biophilia*, implying a fondness for all living things.

Even if not participants in policy formulation by the institutional church, resource managers should have at least some understanding of the debate. To provide for that discernment is the purpose of this paper. Its pertinence is noted by current considerations to include chapters on resource use and abuse in denominational confessions of faith, inclusion of natural resource curricula in church-supported colleges, use of the wealth of religious organizations for financing conferences to discuss responsible positions in the realm of environmental ethics (Squiers 1982), and employment of specialists to encourage and to teach church members how to live a simpler life style (Hessel and Wilson 1981). The significance of the manager's stewardship of the resource entrusted to him (generic sense throughout) is readily apparent in first-hand encounters with those involved in these efforts. And in almost every dialogue, even with the most profit-oriented industrialists, the propriety of what resource managers do in using and abusing the lands and waters of the earth is verbalized in ethical terms.

Petroleum engineer-turned-clergyman Norman Faramelli (1971) and Jeremy Rifkin (1979), the latter of The People's Business Commission, have endeavored to

lead their readers to bridge the gap between technology and ethical behavior in the use of resources in "the emerging order" that lies before us. Rifkin considers God in the age of scarcity; Faramelli encourages readers to recognize Christian mission in an age of technology. Since technology both encourages scarcity and enables scarcity to be turned into plenty, it is seen as the ethical gap that must be bridged.

Argument and Apology

Ironically, the first significant statement concerning the relationship of the church to the environmental crisis appeared in the secular press. Professor Lynn White's (1967) now famous lead article in *Science* attributed the Western World's exploitive attitude toward resources to the Judeo-Christian tradition from which much of our culture stems. This, White insists, derives from the command of Scripture for man to "have dominion" over nature (Psalm 8:6, Genesis 1:28, *et al.*). Shortly thereafter Richard Means (1967) continued White's theme in the *Saturday Review;* others, like Ian McHarg, the land-planner, pursued the church as the culprit for the world-wide environmental dilemma we now face. Historian-sociologist White's article, entitled "The Historical Roots of our Ecologic Crisis," is considered so significant that it appears first among many essays in *Ecology and Religion in History* (Spring and Spring 1974) and is reprinted in the appendix to *Pollution and the Death of Man* (Schaeffer 1970). In addition, a special committee of the Calvin Center for Christian Scholarship considered it a pivotal statement in the committee's effort to suggest an appropriate position for the Church on environmental care (Wilkinson 1980).

Lewis Moncrief (1970), also in the pages of *Science,* refuted White's thesis, claiming that Judeo-Christian teaching has had only an indirect effect upon the environment. Obviously non-Christians, including aborigines, in and outside of the West exploit. Passmore (1974) aptly concluded (p. 195) in *Man's Responsibility for Nature* that "greed, ignorance, shortsightedness, fanaticism are not Western inventions." It is the modern West, he said, which provides more options in the realms of poltics, intellect, traditions, and morals than most other societies for enhancing the environment. J. W. Klotz (1971) argued that White errs in at least one significant point: what Westerners do or do not do is not necessarily because of edicts of Holy Writ. Indeed the only command of God ever taken seriously by the masses is "Be fruitful and multiply" (Gen. 1:28). Schaeffer also distinguishes between "dominion" and "sovereignty." The former implies supervisory oversight, the latter ownership. Man's authority is dominion only; he cannot own that which is only lent to him. As the steward of scripture, his responsibilities are therefore awesome.

Whether White or those responding to him may affect attitudes within the churches is moot. The fact is that an emerging concern is apparent. Human understanding of ecology is conditioned by beliefs about man's nature and destiny: that is, religion (Derrick 1972). *Eternity,* a journal for the more discerning layman, editorialized, "In what passage of the Bible can you find a discussion of ecology . . . ?", and then forthrightly notes, "A thoughtful Bible student can see how the Word speaks to these matters, but his thinking will require a good bit of philosophizing and influence." Moody Institute of Science of the Chicago Bible school produced "Energy in the Twilight World," a film about the ethics of energy consumption; and Evangelicals for Social Action, a parachurch group, lends forceful persuasion to the propriety of gearing down lifestyles. Possibly the most succinct of the efforts is that of the Calvin College group which—after seven man-years of debate by an assortment of experts—published *Earthkeeping: Christian Stewardship of Natural Resources.*

Oikos—The Household

The church generally has looked upon stewardship as

Laurence C. Walker began his career as an assistant district ranger on the Sabine National Forest. Following assignments as research forester with the Southern Forest Experiment Station and research professor at the University of Georgia, he was appointed dean of the School of Forestry at Stephen F. Austin State University. His research has focused on tree nutrition and herbicide use. Dr. Walker is a fellow of the Society of American Foresters, AAAS, and ASA; and recipient of the BSA's Distinguished Eagle Scout and Silver Antelope awards. He is the author of four books, the latest of which is Trees *(Prentice-Hall).*

the proper care of money and personal talents. But the well known narrative in St. Luke's Gospel (Chapter 16) in the *New International Version* of the Bible is entitled "The Shrewd Manager."

That shrewd manager is both the ecologist and the economist. *Oikos*, from the Greek, meaning house or household in the Lukian passage and elsewhere, is the basis for our word ecology. The earth is the house and its keeper is the manager or steward. Anglicizing the Greek has altered the spelling slightly, but foresters and other resource professionals of forty years' service will recall *ecology*'s being spelled *oecology*; and the word defined as the study of the relationships of living things to each other and to their environments.

A forester, for instance, as an ecologist, is the managerial steward of resources that have been entrusted to him. So too is he the keeper of the watershed and the overseer of the range.

The idea of stewardship introduces the Latin translation of *oikos*. The Fourth Century *Vulgate*, or *Commoner's*, Bible of that language gives *iconaea* as the equivalent of *oikos*. Change the initial *i* to *e* and the root word for economics appears, suggesting the inseparability of ecology from economics and thus the managerial connotation of the steward of the earth's resources. Hence a forester, for instance, as an ecologist, is the managerial steward of resources that have been entrusted to him. So too is he the keeper of the watershed and the overseer of the range. Although economics and ecology are in fact inseparable, few people other than those on the roster of resource managers seem to recognize it. Many professionals also fail to grasp the connection.

Historical Synopsis

The connection between ecology and economics was slow in coming in spite of the translations of the basic terms noted above. In a search to learn the development of man's concern for the natural world, we turn to Plato. In him there is neither reverence for nature nor concern for ecological relationships. For Plato, the world is too dynamic and lacks order. Plato's student, Aristotle, arrived at another conclusion: nature is well ordered mechanistically and also has value. One might suggest he recognized the connection. Concepts of both Plato and Aristotle make sense, for the biome continuously changes with ecological succession, yet the transitions are reasonably predictable to managers of renewable natural resources.

The Roman Empire seemed to be without an appreciation for its resources. Cicero, as a royal consul, is said to have had utilitarian attitudes toward the crown's raw materials. Its forests were so recklessly cut over, watersheds abused, and minerals exploited that the Empire's fall has been attributed to environmental degradation. Yet some concern was evidenced, even before Cicero's time in the last days of the Republic, for the desolation was such that by the fourth century, B.C., a government forest policy had been established (Hughes 1975). This, however, did not inspire an ecological conscience. It is not clear how much a fear of the gods can be assigned to the apparently prevailing attitudes of the Greeks and Romans toward forestry in their respective times and places.

The Stoics, as did the Old Testament psalmists, endowed nature with personality, implying therefore that the earth was to be treated with the respect one reserves for fellow men. Mother Nature became an expression of that personality, perhaps eventually leading to Leopold's idea of a "land ethic." Gray (1981) in *Green Paradise Lost* further emphasized the femininity of the personality: "rape" of the earth and "virgin" resources, for example. Epicureans, in contrast, found no purpose to anything in nature, their aim being to live as comfortably as possible, whatever the cost to the environment. Theirs was an exploitive utilitarianism.

As for the Medieval period, man's attitude toward nature was little changed by philosophical or theological ideas. There were exceptions, of course, like the Benedictine fathers; Francis, the Assisi monk who venerated God's natural creation and befriended His creatures; and Bonaventure of the Franciscans who encouraged the study of nature to learn of God (Wilkinson 1980). St. Francis' theme is perhaps redolent of the sentimental attachment to nature which culminated during the Romantic period of the nineteenth century. In its most objectionable form, this reverence for nature degenerated into an egalitarian pantheism which accorded the same status to a blade of grass as to God. Eighty years ago leaders of America's conservation movement called this pantheistic bias "sentimental nonsense." This ethos has, however, persisted until the present in what might be called radical environmentalism. Indeed, many a middle-aged and older practicing conservationist chose his career because he found Assisi's philosophy to be more appealing than the alternative of exploitive utilitarianism.

Changing attitudes toward nature in the period of the Scientific Revolution are attributed in part to the

writings of Francis Bacon. If nature is to be commanded, it must be controlled. As the Calvin College group, referred to earlier, noted, one cannot have dominion without subscribing to nature's principles, and to do that one must observe and understand its behavior; that is, ecological relationships. An example is that of the forester who observes that an exposed mineral seedbed, full sunlight, and a seed source are required to regenerate many species of trees upon which economies, housing, and paper depend. In nature, fire or storm provide the first two. Man does the same with a bulldozer. Yet leaf-cutting ants or diseases like fusiform rust, destroyers of seedlings, overtake him in his effort. C. S. Lewis (1975:43) grasped this continuing struggle when he wrote, "Man's conquest of Nature turns out, in the moment of its consummation, to be Nature's conquest of Man." We cannot win, but comprehending ecological restraints helps us to manage the estate in order to provide economic resources.

The Scientific Revolution brought with it a depersonalization of nature, reversing the attitude of the Stoics (Derrick 1972). With this depersonalization came a loss of a sense of the sacred with respect to nature. No longer did men consider that "the heavens declare the glory of God" (Psalm 19:1), but rather they came to honor the wisdom of astronomers and space physicists. In this period utilitarianism reigned, and a materialistic greed often precluded wise management. Yet Calvinists among Christians held that the ability for scientists and engineers to reason and understand in a given time and place is God-ordained, that God moves them to do His will, even to the extent of planting human footprints on the surface of the moon or producing a "super tree" or deer with super racks. How else, may one suggest, could the uncanny synchronization of invention and discovery in so many diverse departments of engineering and science have occurred in so brief a period of time? Of what use would the internal combustion engine be without Colonel Drake's oil? And of what value was his Pennsylvania crude without a knowledge of chemical refining that enabled its use in the Duryea brothers' "horseless carriage?"

In the conquest of the land of the New World, the Puritan refugee settlers found nature obstinately defiant of efforts to tame it. "The woods and thickets," the governor at Plymouth wrote, "represented a wild and savage hew" (Wilkinson 1980:136). They still do to those who challenge their thorns, seed ticks, copperheads, and widow-makers. The forest must be tamed and used. Its taming was described two centuries later by Walt Whitman in *Song of the Broad Axe*. The axe leaps, and from the forest come shingle, rail, sash, and floor. And more. Materials used by people mandated utilization and consequently the management—or taming—of these lands. People use paper for communicating, packaging, and sanitation; lumber for housing and bridging; poles for utility lines; pilings for foundations for society's building structures; fuel for furnaces; and raw materials for chemicals. A century ago, when Whitman described the woods, civilized peoples depended almost solely upon wood for housing (roofs, window frames, siding), for fuel (train locomotives and steamships as well as hearths), structures (train tracks as well as crossties and trestles), woodenware (table plates and eating utensils, buckets, and barrels), and chemicals (potash for soap, alcohol, turpentine, and rosin).

Altruism, that uncalculated devotion to the interests of others usually accorded to an ethical principle, is both preserving nature and providing material for man's comfort.

In time, because of the cut-out-and-get-out experiences of the timber barons in the Northeast, these woods would be romanticized. This sentiment is exemplified in the words of Transcendentalist Ralph Waldo Emerson ("Waldeinsamkeit"):

I do not count the hours I spend
In wandering by the sea.
The forest is my loyal friend,
Like God, it uses me.

Transcendentalism is with us yet; so too is the obstinately defiant forest from which must come the sash and floor. This is the dichotomy with which the church and professional resource people within the church must come to grips. Altruism, that uncalculated devotion to the interest of others usually accorded to an ethical principle, is both preserving nature and providing material for man's comfort. Romanticism and utilitarianism must yet be wed by wise resource management, or stewardship. That kind of taming of a natural resource is altruistically motivated.

Later in Emerson's poem, two lines tell more:

Oh, few to scale these uplands dare,
Though they to all belong."

The couplet reminds us that today, as in Emerson's and his neighbor Henry David Thoreau's time, we often assume that the lands purchased by others, and for which others pay taxes, are for all to enjoy. Wilderness enthusiasts see this as a dogma in an unwritten code of environmental ethics. The more radical among them

lie down in front of herbicide-dispersing tankers on private lands, walk through a hunter's lease at dawn during deer season beating on cans, and sue the federal Government to prevent the owner of timber that stands on national forest lands from harvesting his purchase.

Contemporary Synopsis

White's essay, noted earlier, claims that Christianity, in contrast to paganism and other non-Christian world views, "not only established a dualism of man and nature but also insisted that it is God's will that man exploit nature for his proper ends" (p. 1205). His thesis leads one to Pantheism, in a manner similar to Albert Schweitzer's reference for all life, because it considers everything to be of one material. Pantheism, more complex than simply the love of the wilderness, may lead to a worship of trees such that the trees are allowed to control our lives, much as the sacred rats of India are allowed to consume the food that could save a starving man. Some Christians in an earlier time have gone to the other extreme, cutting groves of trees, not because they hated trees or loathed the beauty of the woods, but because those groves had been worshipped as idols by the Druids of Ireland.

Schaeffer's further concern is that Platonic thinking, in its belief that all nature is subservient to man, leads to aesthetic degradation. Perhaps he was naive in equating environmental awareness with beauty. "Psychologically," he writes, "we ought to feel a relationship to the tree as . . . fellow-creature. . . . We really are one with the tree! . . . But while we should not romanticize the tree, we must realize God made it and it deserves respect because He made it as a tree" (1970:54, 55). One is compelled to caution, however, that we do not cut down a person when we cut down a tree. Rather we build a home or print a book and provide a job.

Churchmen interested in environmental care must bear in mind that the economic costs involved are always transferred to consumers. Schaeffer, for example, seems to again infer that the only reason power lines are not put underground is because it takes longer to do so. Even if that were the case, time is money. More importantly for the church, whose proper concerns include aiding the poor, environmental protection costs make poor people poorer and fewer people able to afford to appreciate the beauties of nature. The price of restoring previously abused landscapes and the reclamation of presently disturbed sites is simply passed to consumers. The above-ground transmission line is a highly localized aesthetic insult only. Placing it underground requires disturbance of the soil and consequent erosion of soil to silt-in streams often a thousand miles away. The necessary trenching uses fuel and causes air pollution as the trenching machine belches exhaust. Thick insulation, made from mineral resources, must coat the cables, the repercussions of which might be felt two thousand miles away where surface mining removes the ore from which to make the wire cover.

The high cost of mineral resources in America today, for instance, can be attributed in part to the reluctance of society to require that strip-mined sites of the 1940's and 1950's be promptly reclaimed. Not until legislation in the 1960's mandated such rehabilitation was it likely to be done. Thus a later generation pays in the purchases it now makes for the profligate abuses of resources by its parents' or grandparents' generations. Children who grew up in 6-room houses will rear their offspring in 5-room dwellings, other things being equal.

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Other environmental problems faced by resource managers, like soil erosion and depleted range, involve the question of short-term versus long-term economics. Present management practice which is less than the best may add greatly to the costs of food and fiber in the future. Good practices now, however, increase the price of commodities for today's consumers.

The following examples provide further illustrations of the complexities of environmental policies. Congressional action makes permissible the regeneration of stands of trees on national forest lands by the most expeditious scientifically accepted methods. For many commercially valuable species, this means clearcutting. (See Walker [1970] for an explanation.) This practice produces landscapes which are ugly for a few years, but to employ other methods doubles the cost of logging, and that cost is passed to the home-buyer. The practice required by the State of Oregon, of removing any material from a permanent or intermittent stream following logging, by itself adds a hundred dollars to the cost of wood in a house. A score of such environmental edicts may make the purchase of a house an impossible dream for low-income people.

Nature may be "awful-ly" ugly as well as "awe-full-ly" beautiful. Black widow spiders, cancer, and (to

some) the slowly decaying timbers lying under a high-country stand of western red cedar are not things of beauty. A compulsive "neatnik," for instance, could not tolerate the accumulation of organic debris that awaits fungal action.

Thus the dichotomy of Man's attitudes toward Nature—a thing of beauty and yet sought for its utility—is apparent. Lewis (1975:44), the Cambridge don, phrased it well when he wrote, "We do not look at trees as Dryads or as beautiful objects while we cut them into beams; the first man who did so may have felt the price keenly, and the bleeding trees . . . may be far off echoes of that primal sense of impiety."

The primeval sense of impiety for the destruction of any resource, even if that resource is utilized by man, is what René Dubos saw as the reason "for the emergence of a grass-roots movement . . . that will give form and strength to the latent public concern with environmental quality" (Derrick 1972:14). The movement will be powered by romantic emotion as much as by factual knowledge.

Klotz (1971), placing responsible utilitarianism above romantic sentiment, maintains that man has the responsibility, not just the authority, to "harvest ripe timber" in order to satisfy the needs of people. It is in fact ethical to do so. It is the meaning of dominion, even dominion over a "delicate creation."

To maintain the delicate balance of creation, the Science Action Coalition's *Environmental Ethics* manual (1980:233) calls for a self-sacrificing rather than self-serving activism. "When looking into the sacred Scriptures and the living experience of people stayed in Judeo-Christian tradition [we see]: a prophetic witness to the need to reform; exemplary lifestyles demonstrating the need for harmony with the earth; and a stewardship that stresses the major elements of environmental conservation." This is the voluntary surrender of power of which Lewis (1975:35) wrote about in *The Abolition of Man*: "What we call Man's power over Nature turns out to be a power exercised by some men over other men with Nature as its instrument." A recent assignment in Indonesia vividly demonstrated this principle to the author. Each governmental decree issued in an effort to prevent exploitation of resources by foreign interests inevitably backfired to economically harm the very citizens—those on the lowest rung of the social ladder—it was intended to benefit. Foreign industries, rather than subscribe to the directives, went home. Their exodus left peasants without employment. The land, to be sure, will look more appealing in its natural, virgin state (Walker 1986). But what about the people? They hunger for the employment that consumes resources.

Thus the real "tragedy of the commons" is Man's egocentricity which Miller (1972) notes is hardly to be trusted for environmental care. If laws and taxes cannot enforce conservation, we may expect martial repression and government-imposed rationing (in contrast to the marketplace) to handle the task.

Always the Church's task has been to call its people away from egocentricity, even while the Church must recognize the improbability of the success of its cause due to the Adamic Fall. And nowhere is the rebellion that makes a god of man more obvious and odious than in the institution of the Church itself. Hence, the *fall*ibility of decisions and judgments regarding the care of resources by citizens of the West are attributed to the Church and its Book. The critics, I believe, have confused Christendom, the institution, with Christianity, the faith. Even the pronouncements of the organized church regarding environmental-caring lifestyles may not represent the Judeo-Christian position, though they may truly denote the stance of Christendom.

Each governmental decree issued in an effort to prevent exploitation of resources by foreign interests inevitably backfired to economically harm the very citizens—those on the lowest rung of the social ladder—it was intended to benefit.

Nature of Man

The following, then, is presented as one systematic and abbreviated statement to consider in what will surely be an ongoing discussion. (Alternate translations of biblical terms are given in parentheses.)

God created the earth and "saw that it was good" (Gen. 1:4,12), thus establishing a "covenant (agreement) with every living thing" (Gen. 1:28–30; 2:18–19). Adam was assigned the task to till (serve, be a slave to, dress) and keep (tend, watch, preserve) the garden (earth) (Gen. 2:15). The Fall followed the First Adam's disobedience and entailed his removal from the Garden of Eden (Gen. 2). By that act—the use of the resources beyond the permissible limit—not only the man Adam (the Hebrew word for man) but all creation has been affected (Gen. 3:17). Given his freewill to make decisions requiring judgments, man—because of his fallibility—tends to err in making such decisions in the act

of caring for the resources entrusted to him. Because of the Fall, too, he is egocentric and selfish about the use of resources. Also, since the Fall, all has not been well in nature itself. All creation groans, as the Apostle Paul wrote to the Romans (8:22). However, during this time of nature's agony, man, as the crown of God's creation endowed with intellect, is to exercise stewardship of the earth's recources (Psalm 8). It is to be the kind of loving stewardship which Jesus attributed to God in His care for sparrows, ravens, lilies, and lambs (Luke 12). The word "steward," too, may be translated "slave," one who is accountable to his owner. Thus, that accountability for man takes the form of a responsibility to God to cultivate a sense of loving care toward His creation and to act upon it.

Theologians continue to tussle with the passage in St. Paul's Epistle to the Romans (8:19–22) that suggests to some scholars that all creatures—not just man—fell. The Wilkinson (1980) group anticipates that all creation will be redeemed, and that redeemed man will actually participate in that task of redemption. That is, the race of man will have a role as a mediator for nature in the Christ-centered redemption of the World. Even John Calvin, according to Blocher (1984), attributed thorns and thistles to the introduction of sin.

On the other hand, God said that all He made was "good," a declaration nowhere negated in Scripture. Hence some conclude that Earth's non-human resources, never having fallen, have no need for redemption. (Ivory-tower preservationists find that position easy to accept; foresters and farmers, continually plagued by the likes of briars and boll weevils, somehow feel this is not the *awesome* world of creation depicted on film and canvas, but the *awful* world which is to them so real.) Blocher holds to the man-only interpretation, noting that if man "had all the faculties that were his at creation, he would be able to turn the upheavals in nature to good account, without suffering at their hand" (1984:184). It is, he says, because man scorns the balances of the created order that he turns a garden into a desert.

Forester Arthur Greeley, former associate chief of the U. S. Forest Service and later ordained to the ministry of the United Methodist Church, writes of these Pauline verses: "Why would the creation wait with eager longing for the children of God to be revealed unless the children of God are to have some hand, and some responsibility, in the 'setting free' of creation which that [Romans] passage speaks of?... Lifting sin ought to change the land, too" (personal communication, March 27, 1982). He continues with the theme that our concern is more than an ethical consideration, for ethics "connotes an impelling by conscience." Rather, as co-creators with God, our concern for the land and its healing should be motivated by love, not conscience. Yet conscience plays a role in ethical decisions.

The need for ethical reminders, like this paper, is because of man's greed, and that the result of the Fall. It is the Christian faith, challenging us to cast aside our selfishness in the use and abuse of resources, that enables us to see so clearly our weaknesses as stewards. Will we be *Homo "egoiens"* or *Homo sapiens*? As the latter, Christian stewards of natural resources must take a world-wide view of the biblical injunction to love their "neighbor." That one is he in every age and clime for whom the woods and wildlife are now cultured and husbanded.

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"A word aptly spoken
is like apples of gold in settings of silver.
Like an earring of gold or an ornament of fine gold
is a wise man's rebuke to a listening ear."

Proverbs 25:11,12

A Model for a Christian Approach to Scientific Endeavor

T. M. MOORE

Oak Grove
706 W. Valley Road
Strafford, PA 19087

This paper introduces a model for "doing science" which seeks to establish a proper relationship between the various arenas of scientific activity. The author suggests that the "theological sciences" must be permitted to serve as a backdrop against which all scientific activity should be pursued. At the same time, theology must remain open to input and interaction with the physical and human sciences in order to remain relevant as well as true to the whole spectrum of divine revelation.

The purpose of this paper is to add to the growing discussion concerning the relationship between Christian faith and modern science by setting forth a model for scientific endeavor within the framework of evangelical Christianity. After the model is presented, various alternative models will be briefly considered; then the model itself will be explained, its justification and uses described, and, finally, a series of questions suggested by the model will be set forth in the hope of encouraging further discussion and investigation.

First, however, it seems necessary to provide some rationale for the model which is here to be proposed. Why is such a model even necessary?

We live in a period which has been described by various writers as being a time between two eras.[1] An old and inadequate world view is being effectively challenged and, by many, discarded, while a new and yet amorphous Zeitgeist is struggling to be born.

One aspect of that new order which is beginning to make its presence felt in ever increasing ways is the evangelical Christian community. So manifest has the evangelical presence become that numerous writers—both secular and religious—have taken special note.[2] Its expressions are many and diverse: a broad-based and rapidly growing Christian day school movement continues to thrive; a variegated evangelical media front has been opened up; new journals and publications sympathetic to the evangelical perspective have appeared; at least two evangelical publishers (Zondervan and InterVarsity) have initiated series expounding a distinctively Christian world view; and thousands of intelligent, thinking men and women continue to discover a home within the evangelical religious tradition.

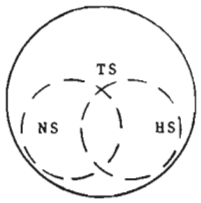
There is, moreover, a gathering momentum of discussion and activity among evangelicals oriented toward the application of evangelical Christianity to the larger issues of everyday life in today's world. With respect to the role of Christian faith in the activity of modern science, numerous scholars have contributed to what is rapidly becoming a vibrant discussion with far reaching implications and applications.[3] In this vein, the provision of a simple but effective model may be helpful to guide the efforts of evangelical scholars who are laboring to apply the old, old story in ever new ways to every aspect of human life and interest.

The model here proposed may or may not be sufficient for that purpose. At the very least, however, it may serve to generate some discussion among others

more qualified than this student to elaborate the parameters and benchmarks for evangelical activity in the areas of science and knowledge in general.

The Model

The model which I am suggesting takes the following form:

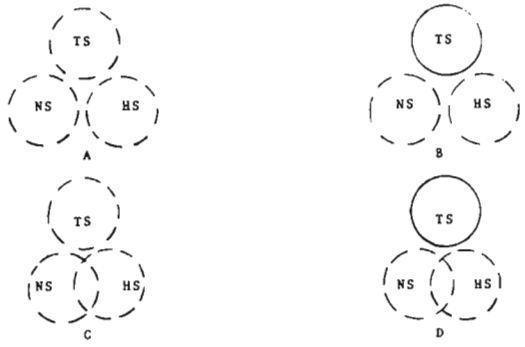


To summarize by way of introduction, this model shows a high degree of interaction and interdependency between three spheres of knowledge: Theological Sciences (TS), Natural Sciences (NS), and Social or Human Sciences (HS). The latter two spheres of knowledge are seen to be open, though not without definable form, while the Theological Sciences are seen to be closed. The significance of this will be discussed later.

The importance of this model would lie in its role both in establishing some boundaries for human knowledge and in demonstrating the essential interdependence of the various sciences.

Before proceeding to discuss the implications of this model in some depth, let us first consider what some alternative models of the relationship between the sciences might be.

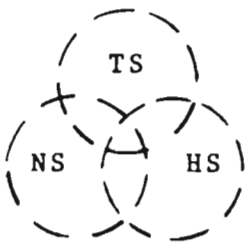
One set of four models can be dismissed as unacceptable for an evangelical Christian approach to scientific endeavor. These may be variously portrayed as follows:



The first pair of models (A and B) shows the various spheres of scientific study as open and unrelated (except that the second model shows the Theological Sciences as appropriately closed). This pair of models is unacceptable for two reasons. First, it portrays each sphere of knowledge as independent and unrelated to the others. Thus, it suggests that work done in any one area may be pursued without reference to the requirements or implications of research in either of the other areas. This is a prescription for epistemological relativity and chaos of the highest degree. Second, this pair of models is unacceptable because it leaves that sphere of knowledge most peculiarly relevant to the articulation of a Christian world view altogether incapable of impacting the other spheres. No Christian scholar can be satisfied with such an arrangement. There can, in fact, be no Christian world view in such a context as this, except within the narrow confines of pure theological discussion.

The second pair of models (C and D) is also unacceptable. These do show the relationship between two of the spheres of science, yet they leave the Theological Sciences cut off from the other areas of study. This approach might be seen as that which obtains among those secular scientists who hold that religion should not be encouraged to "interfere" with the work of modern science.[4] Again, the Christian scholar will not be able to find this a suitable approach to doing science. That these models could find supporters, however, should not be doubted by anyone who has paid attention to recent discussions in such areas as politics, education, and the life sciences in this nation.

Two other models come closer to satisfying the requirements of a Christian approach to scientific endeavor. The first may be set forth in the following manner:



This model is a vast improvement over the previous alternatives because it shows the need for interaction between the sciences and gives a place for the Christian world view to impact the other areas of human knowledge.[5]

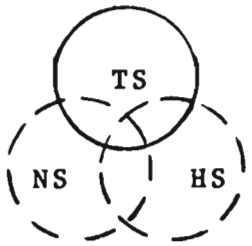
Nevertheless, there are three important reasons why this model is yet unacceptable. First, it portrays the Theological Sciences as open and, therefore, susceptible to being reshaped and reformed according to ideals and paradigms emanating from either of the other two areas. Over the last century we have seen what this approach can do to the place of the Theological Sciences in an academic setting. It was convictions similar to this which led to the reduction of religion's

place in the college curriculum from a foundational discipline to something vaguely called the "sociology of religion." The devastating effects of higher criticism on the theological discipline of hermeneutics is another example of how this model can negatively impact the theological realm. Developing out of the new science of literary criticism in the middle of the last century, higher criticism subjected the Scriptures to the same kind of manuscript scrutiny which was being given to classical literature, leaving no place for the doctrine of the providential preservation of the text. The result in many Christian circles has been that the authoritative role of the Scriptures in Christian life has been seriously undermined. I will explain more fully the importance of holding to a closed perspective on the Theological Sciences in just a bit.

Second, this model is unacceptable because it indicates that the Theological Sciences have only a tangential relationship to the other areas. The Bible cannot be considered as a final bar of appeal in such an arrangement. Rather, it must be taken as merely one of three competing voices which need to be balanced and weighed against one another before statements of truth can be set forth. Given the anti-supernatural and quantificationist bias of the modern era, we might well expect that the role of Scripture in intellectual discourse would again be minimized.

Third, and closely related to these other objections, this model suggests the equal ultimacy of all three scientific spheres. That is, it leads to the conclusion that no one area of knowledge should be allowed to give final guidance to the others, either in settling on the meaning or determining the application of science to modern life. No Christian who believes that in the Bible we find the light in which all other light becomes comprehensible will be comfortable with such a framework for scientific endeavor (Psalm 36:9).

A second model which represents yet another improvement on those already suggested can be represented as follows:



Yet the only improvement which this model represents is that it effectively closes the Theological Sciences. All the other problems previously mentioned remain, however, and, for this reason, this model should also be rejected by serious Christian scholars interested in developing consistent guidelines for scientific endeavor within the evangelical Christian framework.

I will proceed now to elaborate on what my proposed model attempts to communicate.

What the Model Communicates

There are four primary messages embedded in this model of Christian scientific endeavor. The first is that there are three distinct areas of human knowledge concerning which Christian scholars and the Christian community at large need to be informed. The Theological Sciences are those aspects of human knowledge which have their touchstone in the Scriptures of the Old and New Testaments and which are finally appropriated by faith alone. This does not preclude the use of a rational and scientific approach to understanding both the broad outlines as well as the intricate details of the Theological Sciences. Rather, it asserts that the true meaning and value of the Theological Sciences can only be appropriated within a context of faith in the living God of Scripture.

Basically, there are only three subdivisions of this sphere of scientific activity, although numerous subsubdivisions could be elaborated. These are hermeneutics (or the study of how we understand the message of

T. M. Moore holds degrees in theology and Christian education and has engaged in doctoral studies at the Universities of Pretoria and Miami in theology and educational leadership. He is presently serving as Pastor of Ministries at Church of the Saviour in suburban Philadelphia.

the Scriptures), Biblical theology (or the study of the organic development of the message of God's special revelation), and systematic theology (or the synthesis of what Scripture teaches across the whole spectrum of what we must believe).

The second sphere of science includes all the Natural Sciences. These are the areas of human knowledge dealing with the material cosmos, how it is to be known and understood and how we may most wisely and efficiently subdue it for the benefit of mankind. The Natural Sciences include such familiar fields as chemistry, physics, mathematics, biology, botany, geology, astronomy, and all the rest. Also included in this sphere of knowledge are the various methodologies and technologies appropriate to the study and application of the Natural Sciences to human life.

Only the Scriptures as explained in the areas of Biblical and systematic theology are adequate to serve as a touchstone for every aspect of human life and interest.

The third area of knowledge is that of the Human Sciences. These include such areas of study as psychology, education, economics, sociology, politics, history, the arts, and so forth. These also possess their own methodologies and technologies, which are likewise included in this area of knowledge.

The proposed model suggests that everything which we can know may be located within one or the other of these spheres. Certainly there will be some areas of science which are difficult to classify and which, more than the others, partake of features of more than one sphere to what may appear to be almost equal degrees. Nevertheless, careful investigation will enable us to use this model to classify our research and study as a helpful first step in the pursuit of useful truth.

The second message communicated by this model is that the Theological Sciences are to be allowed to provide the integrating framework for all human knowledge. Or, as Calvin Miller puts it, it conveys the idea that "the cosmoswide God, unacknowledged by the cynics, is still the vast arena where all human struggle takes place."[6] This suggests that any scientific undertaking which is pursued outside the framework of theological awareness will be rootless and incomplete. This argument has been elaborated somewhat more fully by Frederick Turner in a recent issue of *Harper's* magazine.[7]

This should not be construed as calling for a return to the medieval curriculum in which the Theological Sciences were understood to be the "Queen of the Sciences." Then theology and its related disciplines were not open to input from the natural realm, as witnessed by the case against Galileo. Theology tyrannized rather than collaborated with the budding Natural Sciences. Indeed, the model signifies that the Theological Sciences must be in constant conversation with each of the other spheres of knowledge if all three spheres are to move in the direction of completion and be truly relevant to vital and effective Christian living in the world.

Third, this model intends to convey the idea that the Theological Sciences are a closed category. That is, we must understand that there is nothing beyond the areas dealt with by the Theological Sciences which may serve as an ultimate frame of reference either for scientific endeavor or for life. Only the Scriptures as explained in the areas of Biblical and systematic theology are adequate to serve as a touchstone for every aspect of human life and interest. These Scriptures have been once and for all delivered to the Church. No further special revelation from God is anticipated prior to the return of Christ. Therefore, the Word of God has been closed up in a Book, and the teaching of that Book must be allowed to guide our scientific endeavor as well as our lives. This has been the conviction of historic Christianity from the earliest councils of the Church.

At the same time, however, I want to re-iterate that the Theological Sciences are not to be an isolated category. They must be seen as closed, yet they may not be understood as isolated. Instead, they are incomplete and inadequate unless and until they have effectively interacted with the other spheres of science. The preacher or theologian who does nothing more than elaborate the subtleties of pure theology without indicating their meaning for life is less than thorough in his labors. Theology in all its forms must be made meaningful to human life if men are to realize their God-given purposes.

This requires that the Theological Sciences both receive illumination from the Natural and Human Sciences and endeavor to participate in spelling out the implications of their conclusions for each of these areas. It also requires of theologians a breadth of general understanding which is all too frequently lacking and, of scientists working in other areas of knowledge, a familiarity with and ready grasp of theological truth.

Finally, this model suggests that the Natural and Human Sciences are not closed categories of knowledge. Although they have defineable form at any given time, those forms are not necessarily static. Instead, scientists working in these areas must be open to fundamental and even radical changes in perspective as knowledge and understanding grow, a point more fully elaborated by Thomas Kuhn and others.[8]

This means that the Natural and Human Sciences interact with one another necessarily. Examples of the benefits of this interplay are already in evidence. The Public Broadcasting Service's recent series, "Connections," which showed the relatedness of the Natural Sciences and human life down through the ages, is one such example. Another may be seen in the excellent discussion of teaching as both art and science which is being pursued by educators such as N. L. Gage.[9] The development of computer graphics and computer art is another example of the value of this interplay, as are recent developments in high-rise architecture.[10]

This means further that these areas must agree to be guided by the light of revealed truth as expounded by and in interaction with theological scientists of all kinds. This has enormous significance, especially in the applications to which advanced technologies may be put in the social sphere. One thinks especially of such issues as abortion, euthanasia, *in vitro* fertilization, genetic engineering, and other life-related questions currently within the public purview.

Finally, it means that the implications of the work and research of natural and human scientists must be attached to different works, yet theologians in all disciplines must be ever concerned to reflect on the question, "What do these findings tell us about God and His purposes for men?"

This, then, in the broadest of terms, is the message of our model. How may we begin to justify it?

First Steps in Justifying the Model

In what I take to be a manner consistent with the model I have proposed, I turn to the Scriptures in an attempt to begin to justify this model. As a matter of fact, other insights from the Natural and Human Sciences could be referenced to support the justification set forth here, yet such detailed documentation should be left for a more thorough treatment of the subject.[11] Here let it suffice to hang up some Scriptural pegs which can support the overall framework herein recommended. Six brief references will indicate the general drift of this argument.

The first is Genesis 1:1, 26–31. Without stopping to argue the subtleties of the creation account, I would suggest that several things appear as certain and beyond dispute from these verses. The first of these is that God is the Designer and Architect of the created order, and He fashioned it according to criteria and for purposes which suited Him. Thus, He intends that His creation should be developed and cared for in the same manner, that is, to reflect and display that which He describes as good. Moreover, to that end He has made man in His image to exercise vice-regency over the creation. Man is to use his hands and his mind to subdue and order the creation and to work out relationships with his fellow men such that what God describes as good will obtain on earth, even as it does in heaven. This seems to be supported as well by our second passage, Genesis, chapter 2. Man's work and man's arranging of his human interactions must proceed against a backdrop and in the knowledge of what God has declared.

This means that not everything which man can imagine is necessarily a legitimate area for his involvement. This seems to be the clear lesson of the knowledge of the tree of good and evil and man's subsequent fall into sin. At the level of the Natural Sciences, where observation and investigation were involved, and at the level of the Human Sciences, where human interplay came into the picture, all systems appeared to be "go"

It would appear that our labors are incomplete if they stop short of compelling our attention toward the God Who put everything in place.

for eating the fruit. Conveniently forgotten were the Theological Sciences where red flags were waving brilliantly in the breeze of God's revealed but ignored truth. Had the proper theological framework been permitted to obtain in this situation, the catastrophe of the fall might never have occurred.

The third passage is Ecclesiastes 1:13 in which the narrator advises that God has mandated men to search out everything in wisdom "under the heavens." In the book of Ecclesiastes the interplay of the phrases "under the heavens" and "under the sun" is crucial to an understanding of the message of the book. The author tells us that God intends everything to be understood "under the heavens," that is, with reference to its place

in the divine scheme of things (cf. Eccl. 3). The problem which the narrator continually encountered throughout his own life, and of which he seems to have been repenting in this book, is that he consistently chose to try to understand his life only as "under the sun,"

Science is incomplete that does not enrich the Christian experience of the believing community at the same time it contributes to the well being of mankind.

that is, with reference only to events and matter in the created order. Such an approach to "doing science" led Qoheleth only to despair and disappointment. He came to see that fearing God and keeping His commandments provides the only proper backdrop for gaining true wisdom and understanding (cf. Eccl. 12:13).

Next, we consider Psalm 19:1. Here the psalmist advises that, as we go about to investigate the breadth and depth of matters in the created order, we can expect to encounter the knowledge of God at every turn. Paul also holds to this point of view (cf. Rom. 1:18ff.). Thus, as a community of scholars and believers, we must be ever asking ourselves what it is about God and His will that is revealed in any of our work or research in the created order. It would appear that our labors are incomplete if they stop short of compelling our attention toward the God Who put everything in place.

Fifth, Psalm 119:105 advises that God's Word must be allowed to cast its light on our path regardless of where we walk. This holds true for any work in the scientific arena as well. Jesus told a crowd of "social scientists" that they had gotten grievously off the proper track because they had pursued their endeavors apart from knowledge of God's Word (Matthew 22:29). Such must not be allowed to be the case with today's Christians working in any field of knowledge.

Finally, all our studies and all our labors must redound to a better knowledge and understanding of the Lord Jesus Christ and His ways with men. If it is true that in Him "are hid all the treasures of wisdom and knowledge" (Col. 2:3), then all our scientific research should lead us ever more deeply into the knowledge and adoration of Him. Science is incomplete that does not enrich the Christian experience of the believing community at the same time it contributes to the well being of mankind. This is the very essence of "taking every thought captive to Christ" (2 Cor. 10:5). It must be a part of the duty of the community of Christian scholars to orient the whole of its labors to this end.

This much, then, should serve to indicate the direction which a more thorough justification of this model might take.

Uses for the Model

There are at least three ways in which this model can be useful to the Christian community. First, it can aid in classifying the various fields of knowledge and study. Classifying the sciences, in turn, can be important for curriculum development in colleges and secondary schools. The model might also be useful in this vein to stimulate new thinking in the area of interdisciplinary studies and research. Finally in this regard, this model, more fully elaborated, discussed, and debated, might serve as a stimulus and guide to work in the area of developing an encyclopedia of Christian knowledge and scientific endeavor.[12]

Second, this model could be useful in guiding research in any of the three spheres of scientific endeavor. It could help to keep the spheres in touch with one another—through journals, conferences, interdisciplinary studies, and so forth—and could lead practitioners in those spheres to articulate more fully the implications and applications of one area of study for the other two, as well as vice-versa. This, in turn, could be a great stimulus to further research and development in all the areas of knowledge.

Finally, this model could be of much benefit in serving to enrich the Christian experience of every member of the believing community. If the implications and applications of this approach to doing science were made to filter down (through popular books and magazines, films, television specials, day school curricula, and the like) to the pulpits and classrooms of local churches and Christian schools, as well as Christian homes, the effects on students, parishioners, and families could be signal, indeed. Theology—including preaching and teaching—could become more powerful and relevant to everyday life as well as to current events and developments in all fields. The understanding of God and His world which individual believers gain through home, school, and church could become vastly more polychromatic and down-to-earth. One might envision the Christian community taking more seriously its obligation to articulate a comprehensive Christian world view and to work more fervently for the implementation of that world view in a wide range

of new and exciting Kingdom-building enterprises. More horizons for work and ministry would be opened up for generations of Christian students and workers to come. Certainly our apologetic in the face of an unbelieving world would be greatly enhanced by so broad and visionary an approach to our responsibilities as this model suggests.

These are but a few of the uses and benefits which one might imagine stemming from the adoption of the model here proposed. I turn finally to suggest some further questions which the model would seem to beg.

Further Questions

A simple listing of these questions might be the most appropriate way to set them forth.

First, can evidence in support of this model be gleaned from existing literature in each of the spheres of knowledge? That is, does this model help to concretize current discussions, and is there truly supporting evidence to be found for the reliability of this model apart from the appeal to Scripture alone?

Second, how can a proper "trialogue" among the sciences be established and maintained? What is the role of professional associations, periodicals, publishing houses, and colleges and seminaries in this effort? What new kinds of conferences might be envisioned? Is there a role for the electronic Christian media in this endeavor?

Third, what are the implications of the model for Christian education at all levels and in all educational contexts? What would such a model mean for the propaedeutic and curriculum of a theological seminary, for instance? Of a Christian liberal arts college? A Christian high school?

Next, to what new kinds of discipline does the model obligate Christian scholars in any and all of the spheres of knowledge? How should his or her research be guided? Of what kind of general substance should scholarly works consist? Popular works?

Further, can this model achieve a credible place in academe in general, or is it doomed to remain a paradigm useful only to Christians? How might an effective apologetic be developed on the basis of this model?

Finally, will Christian scholars in all spheres of knowledge be willing to discuss or debate the model or the necessity of such a model for Christian scientific endeavor? What are the merits and demerits of the model? What other alternative models might be imagined?

NOTES

1. Cf. Jeremy Rifkin, *Entropy* (New York: The Viking Press, 1980); R. J. Rushdoony, *Intellectual Schizophrenia* (Philadelphia: Presbyterian and Reformed, 1961), pp. 113, 114.

2. Cf. Jeremy Rifkin, *The Emerging Order* (New York: Random House, 1979); Herman Kahn, *The Coming Boom* (New York: Simon and Schuster, 1982); John Naisbitt, *Megatrends* (New York: Warner Books, 1982).

3. Cf. the works of Ramm, MacKay, Barbour, et al.

4. This view tends to be very prominent in the popular works of Carl Sagan, especially toward the end of such widely read volumes as *The Dragons of Eden* and *Cosmos*.

5. It would be fair to say, I think, that this approach is represented in the works of W. A. Whitehouse. Cf. *Creation, Science and Theology* (Grand Rapids: William B. Eerdmans Publishing Company, 1981).

6. Calvin Miller, *A Hunger for Meaning* (Downers Grove, Il.: InterVarsity, 1984), p. 11.

7. Frederick Turner, "Escape From Modernism," *Harper's*, November, 1984, pp. 47ff. Turner observes that "We are at a curious junction in the history of science and technology. The empiricism of the Renaissance gradually flattened out the ancient hierarchy of the universe and broke up the Great Chain of Being. But just when the world seemed to have been reduced to a collection of objective facts—the world view of modernism—a new order came into being." This new order was that of materialism which, though dominant for a time, now is beginning to disintegrate from a lack of internal consistency and is being rivaled by new religious and philosophical world views arising in various parts of the world. He remarks that, "All over the world, revolutionary forces are championing complex and traditional value systems—ethnic, religious, and political—against materialism, whether it be liberal, fascist, capitalist, socialist, or communist."

8. Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962). Cf. also Reney Myers, "Thomas Kuhn and the History of Science," *Continuity*, Number 6, Spring, 1983, pp. 95–111, who gives a strong vindication of Kuhn's argument.

9. N. L. Gage, *The Scientific Basis of the Art of Teaching* (New York: Teachers College Press, 1978).

10. Jonathan B. Tucker, "Superskyscrapers: Aiming for 200 Stories," *High Technology*, January, 1985, pp. 50ff.

11. Cf. works by Jaki, Jastrow, Maslow, Polanyi, et al.

12. Cf. Abraham Kuyper, *Sacred Theology* (Wilmington, Del.: Associated Publishers and Authors, n.d.). In his preliminary discussions of the subject of encyclopedia, Kuyper notes that "no writer of encyclopedia can carry an argument, save from the view-point which he himself occupies, and except he start out from the hypothesis upon which his general presentation is founded." He goes on to note that, while Christians can acknowledge as valid the contributions of unbelieving scientists, they must at the same time accept the responsibility for working to bring that knowledge to completion by developing it further within a proper theological perspective. He says, "A theologian can acknowledge truth in another position, without recognizing the truth of the position as a whole. The start is taken from one's conviction, with an open eye to one's own imperfections so as sincerely to appreciate the labors and efforts of others, and to be bent upon the assimilation of their results."

"Remind the people to be subject to rulers and authorities, to be obedient, to be ready to do whatever is good, to slander no one, to be peaceable and considerate, and to show true humility toward all men."

Titus 3:1,2

Theological Clues from the Scientific World*

HAROLD P. NEBELSICK

Louisville Presbyterian Theological Seminary
1044 Alta Vista Road
Louisville, KY 40205

The theories of Relativity and Quantum Physics, as illustrated by the discoveries of Albert Einstein, Werner Heisenberg, and Niels Bohr, offer epistemological implications which indicate that the world does not necessarily exist as we usually see it and/or think about it. Rather the most profound aspects of nature are apprehended and understood by means of intuitional insights that are enabled to probe an order more profound and more comprehensive than that which we usually comprehend.

Insights from Günter Howe and Carl Friedrich von Weizsäcker suggest that the methods of discovery and understanding in natural science are applicable to the science of theology as well. If so, these two "sciences" may well mutually modify and complement one another so as to assist us in possibly rethinking reality *as a whole.*

Beginning with the scientific revolution in the seventeenth century and with the technological revolution in the eighteenth century, natural science and technology have done more to reorder and change our world and our lives in it for good and for ill than any other single force. The year 1776, important as it is as the birthdate of a nation, is perhaps more important as the year that James Watt invented the first viable steam engine. With it he ushered in the scientific-technological age, the age which, according to British historian Herbert Butterfield, has done so much to alter our world and our lives that only one other movement in history, the rise of Christianity, may be compared to it (B OS, p. 190). Since the beginning of the seventeenth century, however, with the exception of Newtonian *scientism*, theology in general has tended either to oppose or to ignore natural science as such.

Fortunately, in our time, there is a growing awareness of the importance of natural science for theology and indeed for the faith that theology is supposed to guide. Already some 40 years ago, the German theologian, Professor Karl Heim, saw something of the writing on the wall.

> It was a disastrous turning point in the history of Protestantism when Protestant theology shortly after Schleiermacher cut itself loose from its link with philosophy. Since then it has more and more withdrawn from the difficult task of placing the world view of faith over against that of un-faith. It thereby satisfied itself with the task of extracting the central theme, the Heilsgeschichte (salvation history) from the total picture of reality, which picture every believing person must have if he is to act responsibly within this world . . . Theology then proceeded to develop this central theme in every direction thinking it could confidently leave everything else to the profane sciences. (H GN, p. 26)

In abandoning its relationship to the total picture of reality, theology has substituted the "world within oneself" for the "world outside the self." This subjectivization of the faith to the neglect of the world with which science deals has characterized much of Protestant theology from the eighteenth century until the present. By contrast, theology's growing interest in natural science in our time may be seen as a beginning of an attempt to reconsider the whole of creation

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including human creation, rather than human creation alone, as included within the primary concern of God.

Hence, the re-interest of theology in science that, after Heim, has been and is being represented by such persons as Günter Howe (*Mensch und Physik*), Carl Friedrich von Weizsäcker (*Zum Weltbild der Physik*), A. M. Klaus Müller (*Die Präparierte Zeit*), Thomas F. Torrance (*Christian Theology and Scientific Culture*), Stanley Jaki (*The Relevance of Physics*), Mary Hesse (*The Structure of Scientific Inference*), Ian Barbour (*Issues in Science and Religion*), Arthur Peacocke (*Science and the Christian Experiment*), and to a certain extent Wolfhart Pannenberg (*Theologie als Wissenschaft*), and my own *Theology and Science in Mutual Modification*, to name a few, is of indispensible import for theology as such. The main point of the dialogue that is now beginning in a serious way between theology and natural science, is, as I see it, not the ethical dimension, important as that is, but the question of epistemology, i.e., *How do we know what we know?* and *How do we go about learning what we need to know?*

The Impact of Twentieth-Century Physics

In the comparatively short compass of this paper, I want to refer to four theories that have redirected natural science and changed our world and much of our thinking with it. In that these theories have implications not only for natural science, but for knowledge in general, they are affecting and will inevitably affect theology as well. The first two are from Albert Einstein, the third from Werner Heisenberg, and the fourth from Niels Bohr. All three are Nobel Prize winners. Together they have changed the face of modern physics and with that they have changed our perception of reality.

The Relevance of Relativity

In 1905, the then obscure clerk in the Patent Office in Bern, Switzerland, Albert Einstein, published his paper, "On the Electro-Dynamics of Moving Bodies," in which he spelled out his Special Theory of Relativity. Some twenty years previously, in 1887 to be exact, Albert Michelson and Edward Morley were faced with one of those beautiful experimental failures which are so essential for progress in natural science. The experiment was contrived to verify the existence of the so-called "ether"—that invisible property which was supposed to permeate all space and all matter and through which the earth as well as all other cosmic bodies were thought to move in much the same way as we move through the air when we move on earth. Just as we feel the air resisting our motion when we run at a rather rapid rate so, it was thought, the ether should cause a drag on any object moving against its flow. That being so, there should be a measurable differentiation between the velocity of a ray of light propagated in the direction of the earth's movement as it orbited around the sun and that of a ray of light propagated in a direction at right angles to the direction of the earth's orbit.

In order that a precise comparison might be assured, Michelson and Morley set up their apparatus to split a single ray of light in half. They directed one half of the ray in the direction of the earth's movement to give opportunity for the "flow of the ether" past the earth to retard the light ray. They directed the other half at right angles to the first. In spite of repeated experiments Michelson and Morley found that the two rays generated from the split beam of light persisted in giving them identical readings on their interferometer no matter in which direction the rays were propagated. Their consistent failure to detect any difference in the velocity of the two rays of light used in the experiment caused Michelson and Morley to doubt that the experiment had been performed correctly. Subsequent experiments right up until 1930 continued to corroborate the data of the 1887 experiment.

It is not certain whether or not Einstein paid any special regard to Michelson and Morley's experiments

Harold Nebelsick is Professor of Doctrinal Theology at Louisville Presbyterian Theological Seminary in Louisville, Kentucky. He holds a B.A. degree in Philosophy from the University of Nebraska, a B.D. degree from San Francisco Theological Seminary and a Ph.D. degree in Divinity from the University of Edinburgh. He has done post-doctoral study at Princeton, Göttingen, Berlin, Basel and Paris and is a member of the Advisory Committee of the Center of Theological Inquiry, Princeton. His books, Theology and Science in Mutual Modification *(1981) and* Circles of God, Theology and Science from the Greeks to Copernicus *(1985) are studies of the interface between Theological Science and Natural Science.*

at the time. It is certain, however, that he had a *better idea*. In one of those fantastic flights of intuition which have marked the revolutionary theories of natural science from its beginning, Einstein theorized that, rather than light varying in velocity relative to the movement of either its source or its target, the velocity of light is invariant. Further, he postulated that that invariance had to be understood as the basis of all physical measurement. The fact, for instance, that the velocity of light is constant, independent of the motion of its target or its source (and since "velocity" means so much space is traversed in so much time, i.e., 60 miles per hour = 1 mile is covered in 1 minute), would mean that space and time are to be understood in relation to the velocity of light and relative to one another. Whereas space was considered three dimensional, time added a fourth dimension so that space-time became a four dimensional continuum.

If Einstein's Special Theory of Relativity challenged our usual conceptualities, his 1915 General Theory of Relativity compounded the challenge.

In addition, since the velocity of light is constant in relation to all moving objects, it followed that *absolute motion* had to be ruled out. In fact, according to Einstein himself, the "principle of relativity" in its widest sense is contained in the statement: "There is no absolute motion" (E OLY, p. 41). Thus the motion of any particular object must be measured *relative* to the distinct frame of reference or coordinate system that, at the time of measurement, is being considered as the base from which the measurement is being made. In addition, because the laws of physics apply equally to all coordinate systems, any one frame of reference is as good as any other for *valid measurement*.

Einstein was not the first to develop a theory of relativity, of course. In a posthumously published paper in 1703, the Dutch physicist Christian Huygens worked out "a principle of relativity," a principle now referred to as "the Galilean principle of relativity" to distinguish it from that of Einstein. Huygens too recognized that there is no way of establishing the real (or absolute) velocity of any moving object since the measuring of velocity means measuring one object as moving relative to another and given that all objects are in motion (Sch II AE, pp. 506–7). Einstein's theory of relativity, however, based as it is on the universal invariant character of the velocity of light, made it clear that even though observers experience different states of motion the *laws of physics retain their validity* under differing states in question. It is therefore of interest to note that, in print, Einstein frequently referred to his own theory as the "so-called relativity theory" (H SSP, p. 57). In letters to close associates he preferred the name *Invariantentheorie*, which name stresses the notion that the varying observational data are explained by the *invariant laws* that derive from the theory (H SSP, cf. Sch I AE, pp. 253f).

To elaborate, since light moves at a constant speed of 300,000 kilometers (186,000 miles) per second no matter what the velocity of its source, its direction, or the velocity of its destination, any inertial (non-accelerating) coordinate system is as good as any other as a basis for measuring the velocity of objects that are in movement in relationship to them. The velocity of all objects is measured relative to the particular co-ordinate system which the observer of the object chooses to use as the base of measurement. All measurements and all observations therefore are relative to the position in relation to which the measurements or observations are made. As Henry Margenau has stated:

> To achieve *objectivity* of basic description, the theory must confer *relativity* upon the domain of immediate observations. (Sch I AE, p. 254)

Here we will simply have to pass by the other equally important aspects of Einstein's 1905 Special Theory of Relativity such as the interpretation of space and time, the removal of the principles of simultaneity and action at a distance, and even the formula, $E = mc^2$ that relates mass to energy, powerful and fateful as it is. Like the basic *Invariantentheorie* itself, however, these show us that the world does not necessarily correspond to the ways in which we have been taught to think of it, nor does it necessarily correspond to our intuitions or our sense impressions. Consequently, while we hold to what we know tenaciously, we must also be prepared to alter our understandings of reality when evidence, which we recognize as being true, forces a change in our conceptions.

If Einstein's Special Theory of Relativity challenged our usual conceptualities, his 1915 General Theory of Relativity compounded the challenge. The theory is based on the equivalence of gravitational and inertial fields. The theory combined space and time into a single space-time continuum according to Gaussian (rather than Cartesian) coordinates and shaped the continuum according to Riemannian geometry which prescribed that all lines be curved. The theory was given its first substantiation by Sir Arthur Eddington's expedition in 1919 which sought to test the theory by measuring the path of light rays emitted from distant

stars, rays that passed near the sun during a solar eclipse. As Einstein had predicted, stars, which if measured *rectilinearly* were behind the sun, could be seen when the moon blotted out the sun's corona during the eclipse, because the sun's gravity acted as a lens and refracted, i.e., curved the light rays from the stars around it. It is now thought therefore that the universe itself, following the pattern of light coming from distant stars, is shaped according to the gravity of the bodies of space.

In a word, it was no longer possible to know exactly what the outcome of basic physical processes would be in all particulars.

This gives rise to the concept of a finite universe in which all lines, rather than extending outward to infinity as in Euclidean geometry and Newtonian science, eventually come back on themselves. The universe is thus finite, a closed continuum, rather than infinite. When this is correlated with the theory of the *red-shift* first introduced by the astronomer Edwin Hubble in 1929, according to which the galaxies are rushing outward from one another, there arises the fascinating concept of the expanding finite universe conceived in terms of the curved space of Riemannian geometry and according to Gaussian coordinates that include time. The universe is thus finite but unbounded (W FTM, p. 30). Its bounds are ever expanding in time. At *what for us* are its outer limits, i.e., at the limits furthest away from the galaxy of the Milky Way of which our solar system is a part, the universe is expanding at nearly the velocity of light. Whether or not it will continue to expand forever or will someday pause, stop, and begin to contract, depends, according to present theory, upon whether or not there is enough matter in the universe to generate an amount of gravity sufficient to overcome the inertia of its present expansion.

From the epistemological point of view, it is important to realize that both of Einstein's theories of relativity not only demonstrate that our fundamental knowledge of reality is subject to change, but also that it is by way of *simplification*, by unifying previously disparate understandings, that new understandings of reality come about. In the Special Theory of Relativity, based on the speed of light, time and space have become integral concepts and the principles of energy and momentum have been united into one principle. In the General Theory, the principles of energy and gravity are focused into a single principle (Cf. Sch l AE, p. 61). Both follow "Ockham's razor," a principle that is as old as the pre-Socratic Pythagoreans and which we may state as follows: "The simpler the answer that explains the known phenomena, the more likely it is to be true."

The Quandry of Quantum

Of equal importance to the theories of relativity both for the development of natural science itself, and for showing how our concepts of reality change, is the Quantum Theory and the discoveries that have been made in relationship to it. In 1900, Max Planck found that he could successfully explain the nature of radiation emitted by a hot object (*black body radiation*) only by assuming that the walls of the object could emit or absorb energy in *discrete amounts*. Thus, in contrast to the idea that energy was always emitted or absorbed in a continuous stream, the Quantum Theory is based on the understanding that energy is always radiated in disconnected *chunks*. In 1905, Einstein, who in later life was to have great difficulty with the implications of quantum physics, nevertheless advanced the theory via his interpretation of the photoelectric effect experiments in which he assumed that light, a form of electromagnetic energy, consisted of a stream of distinct particles which he called "quanta" or photons. It was for his theory of the photoelectric effects, by the way, rather than for his better-known theories of relativity, that Einstein was to receive the Nobel Prize.

As a result of Einstein's theory, Newton's concept of light as corpuscles was again recognized, along with Huygens' understanding of light as traveling vibrations or waves. In 1924, the French physicist Louis de Broglie advanced the theory that not only light but other manifestations of energy-like electrons could be considered as having particle-like or wave-like aspects with equal validity. Light, for instance, showed itself to be in particle form or in wave form, depending upon how the energy was measured. If one set up an apparatus which measured light as a stream of particles, it registered itself as photons. If one set up an apparatus which measured light as waves, it registered as undulatory motion. After experimentalists who found that electron beams exhibited similar dual behavior confirmed de Broglie's theory, scientists became aware of what seemed to be a basic contradiction in nature. Nature appeared either as particulate in structure or as undulatory motion depending upon the experiment that was set up to observe it.

A further advance in quantum physics that served to confuse our usual understandings of the way things are was introduced by the Göttingen physicist Max Born

who, in 1926 when theoretically interpreting electron collisions, found that the trajectory of the individual electrons was not predictable. If one were to direct an electron from an emitter to a good-sized target, it was possible to predict that the electron would hit the target, but, as far as the observer could judge, there was a distinct lack of accuracy. The exact trajectory of the electron could not be known in advance nor could its place of impact be predicted. Further, its trajectory could not be retraced after the experiment was finished. Taken in aggregates, the electrons acted more like shotgun pellets than like rifle bullets. Although it was not possible to predict which electron would hit which place on a target, it was possible to trace the pattern of hits. The pattern made by the aggregate could be predicted but individual impacts could not. From this data Born developed the statistical interpretation of electron collisions that was based on the observation that individual electron behavior could not be predicted but given a great enough number of instances, a predictable pattern would result.

For de Broglie, since electrons appeared under some conditions as waves and under others as particles, there was no way of designating the exact properties of electrons with certainty. For Born, when electron scattering was treated as consisting of particles interacting with a target, there was no way of knowing which particle would arrive at which spot on a target, although it was possible to predict the pattern that would result.

The only way, therefore, that "proof" of the existence of an object *in science may be demonstrated is for the scientist to explain the experiment under which the observation and measurement has taken place.*

Non-determinant Nature

Thus, on the one hand, physics moved away from the classical sense of objectivity—*we know exactly what things are.* And on the other, it moved away from determinacy—*if we know the present position, velocity and trajectory of any particular object, we can know and predict the exact future velocity, trajectory, and position of that object.* In a word, it was no longer possible to know exactly what the outcome of basic physical processes would be in all particulars. That is, the present state cannot be derived exactly from the past nor can the future state be predicted in all particulars from the present. "Natural laws" in quantum physics, therefore, are expressed statistically, which means that the future courses of events can be "predicted" only if sufficiently large quantities of them are taken into consideration. It is on the basis of such evidence that people such as Günter Howe (H MP, pp. 64 ff.) and Carl Friedrich von Weizsäcker (W ZWP, pp. 332 ff.), and A. M. Klaus Müller (M PZ, pp, 293 ff.) *were* and/or *are* convinced that there is a principle of non-determinacy at the heart of nature itself.

Non-determinacy as a principle goes back to 1927 when Heisenberg at Göttingen propounded the indeterminacy relation with regard to the velocity and location of electrons. Heisenberg found that, if in an experiment one were to set up an apparatus to measure the position of a particle, it was possible to show the particle's location. Further, he found that, were one to set up the apparatus for measuring the momentum of a particle, one could measure the momentum. However, it was an *either/or* affair. Not only was it impossible to measure both the location and the momentum of a particle at the same time, but in addition the more precisely one measured the momentum of a particle, the less precisely one would be able to measure its location and vice versa. Hence, simultaneous measurement for location and for momentum was impossible. The measurements were mutually exclusive.

To repeat, the problem which Heisenberg set about to solve was the simultaneous measurement of both the *location* and the *momentum* of an electron as it moved from source to destination. He found that simultaneous *momentum-place* measurement was impossible; for the more accurately the experimenter measured the one, the less accurately he or she could measure the other.

Consequences of Complementarity

The next short but very important step in the quantum physical understanding of nature was taken by the Copenhagen physicist, Niels Bohr, Heisenberg's teacher. At the Physical Congress held in September 1927, at Como in Italy, Bohr advanced Heisenberg's principle of indeterminacy by propounding the "theory of complementarity." The theory took Heisenberg's principle of indeterminacy one step further and insisted that both the "momentum picture" and the "location picture" are necessary complements of reality. Although it is impossible to know velocity and location simultaneously—i.e., although the measurements are actually mutually exclusive—both are equally necessary to the understanding of reality as a whole: hence the *principle of complementarity.*

With this, of course, absolute identity between measurement and object, between concept and reality, was severely questioned. The procedure approaches the *phenomena-noumena* distinction of Kant but is even more elusive. According to Kant, we can not know reality in itself—its *noumena*. We only know the appearance of reality—its *phenomena*. Thus, the wave-particle dichotomy that resulted from de Broglie's discovery of the wave-particle nature of mass-energy was compounded by the location-momentum dichotomy that resulted from Heisenberg's experiments. Just as the wave-particle dilemma raised problems of the identity of reality, so too, as Bohr pointed out, the fact that "we cannot know both the momentum and the position of an atomic object" raises some very real questions as to the attributes of the object itself (Sch I AE, p. 211). According to Bohr, reality that revealed itself only in a manner contradictory to observation had to be *held together* in the mind if some kind of wholeness were to be preserved.

As a result of this *identity crisis* which still persists in modern physics, we can no longer say that nature *is* such and such, we can only say that under such and such circumstances, nature reveals itself to be such and such. The only way, therefore, that "proof" of the existence of an *object* in science may be demonstrated is for the scientist to explain the experiment under which the observation and measurement has taken place. If the explanation is such that the scientist is able to persuade the scientific community of the validity of the procedures of the experiment in question and of the results obtained, and if these results can be obtained by successive experiments, the scientist is said to have proven the point. In a word, the procedure of gaining knowledge affects the knowledge gained. Any automatic one-to-one relationship between "seeing" and "knowing" no longer holds. *Proof is an agreement of minds that have followed similar procedures in discovering a certain matter.* We re-learn to know reality according to *the theories* that are judged to best explain it, theories that are substantiated by experiment.

Subject-Related Reality

Further, in the experiments that demonstrated the impossibility of simultaneously measuring both the momentum and the location of a particle, it became clear that the result obtained depended upon the scientists' decision as to which of the two *aspects of reality* the scientist *intended* to measure. The decision in turn determined which of the two *phenomena* the experiment would reveal. The scientist set up the apparatus according to preference and, if all went well, the object involved showed itself to the scientist according to the scientist's intentions. It showed him or her what he or she was looking for. Hence, we find ourselves in a situation where, according to our best understanding, in the very process of experimentation,

Since science is on the move, should theology marry it today, theology might well be widowed tomorrow.

there is the influence of the observing mind (by the choice of measurement technique) upon what may be observed. Matter thus reveals itself to us according to the way we are *set up* (i.e., programmed) to observe it. This means that, as we can no longer say that nature is absolutely determined, so we can no longer say that it is possible to ascertain the properties of nature independent of the decisions of the scientist. *Objectivity* results when all scientists who choose to perform a certain experiment in the same way will, if all goes well, get similar results, results that are recognized as *valid* by the scientific community.

To return to the *principles of indeterminacy and complementarity*, it is, for instance, according to Heisenberg, Bohr, Howe, von Weizsäcker, and Müller, most important to realize that the inability to fix the momentum and position of a particle simultaneously is not a failure of ability on the part of the scientist. This lack of momentum-position coordination is, according to the aforementioned thinkers, due to the nature of nature itself. Nature at the atomic or sub-atomic level is of *locatable stuff* or it is of *speeding stuff* but not of both at the same time. If this is so, and if there is no third possibility (for which Einstein hoped and continued to work toward in his proposed Unified Field Theory until his death, believing, as he said, "Der Alte würfelt nicht" ["God doesn't play dice"]), then we are faced with the fact that it is human intervention which allows the experimenter to *observe* and thus to *know* distinct aspects of reality. As von Weizsäcker (W ZWP, pp. 48 ff.), Howe (H MP, pp. 69 ff.), and, following them, Müller (M PZ pp. 43, 132, 150, 172 et al.) have stressed again and again, in Heisenberg and Bohr's interpretation of quantum mechanics, we see at an extremely basic level—at the level of the composition of matter itself—that we do not stand in a neutral relationship to nature nor does nature stand in neutral relationship to us. Rather our knowledge of nature depends upon our interaction with it. With that, of course, the *subject-object dichotomy* of Descartes as well as a strict *either/or logic* must be set aside.

Following von Weizsäcker, it may, therefore, be necessary for us to realize that we now have to do with

complementarity at two different *levels*. Building upon Bohr's Theory of Complementarity, in which he held the mutually exclusive understanding of the location and the momentum of a particle together in the mind, von Weizsäcker has spoken of a concept of "circular complementarity," wherein it is necessary to allow our concepts of the different aspects of nature to be mutually and continually corrective. We must think of the one even as we focus on the other, or, hold on to the one as we "walk through" the other (W ZWP, pp. 290 ff.). In addition, we have to do with a mind-matter circular complementarity, a complementarity in which mind and matter are partners in the selection-revelation process. As mind attempts to understand and conceive of matter, so matter determines the parameters of such conceptions.

The Dialogue Renewed

All of the above helps us to realize that natural science, which in the last century was so powerful in the construction of a materialistic, pre-determined, mechanical, machine-like, spirit-denying universe, has in our time rediscovered both the interaction between the conscious and the unconscious parts of nature and the limitations of the descriptive processes of science itself. The same physics that, according to Heim, was once one of the main forces drawing people out of the church and the Christian faith and leading them to put their faith in natural science, progress, scientific materialism and Comtian positivism, has now reversed itself and moved from determinacy to open-endedness. In the words of the physicist Pascual Jordan, "Physics, which once said, 'Nein,' to the faith, has now taken its 'Nein' back again" (Cf. H CA, p. 112).

This, of course, doesn't prove the faith, As von Weizsäcker has put it, there are two attitudes in relationship to science that are of no use at all to theology or the church. The first is a rejection and ignoring of the findings of physics by theology, as if theology only has to do with the realm of the spirit and has nothing to do with physical reality. The second equally unfortunate attitude is theology's complete acceptance and submission to the findings of natural science, followed by the attempt to apply these findings directly to the formulas of faith itself (W ZWP, pp. 262 f.). Since science is on the move, should theology marry it today, theology might well be widowed tomorrow.

Nevertheless, even as the closed-system, deterministic world view of the eighteenth and nineteenth centuries not only became a view of science but a world view which stretched far beyond science and into the thought structures of faith itself, so there is a possibility, at least, that a reversal may take place in many of the thought structures of faith as well. We may see the open-ended, non-determined, interactive mind-matter world view of natural science moving us beyond the subject-object dichotomy of Descartes that characterized not only classical physics but also Enlightenment philosophy and the theology based upon it. If so, the present dialogue between theology and natural science may well move us toward new thought constructs wherein the realities of faith and those of natural science will be understood as inter-related, interdependent, and complementary aspects of the totality of reality.

Scientific Hints for Theological Thought

Being more specific with regard to the *clues* that natural science has to offer theology, we may mention first that Einstein's theories of relativity give us a vivid illustration of the necessity, the place, and the process of *theoretical* thinking in relationship to both discovery and understanding. New "facts" are not reached by a process of deduction from what is known in the past, nor is understanding reached by a process of abstraction from experience. Rather, as Einstein has stated again and again, there is no truth and no meaning to experience without theory, a controlling concept, or what we refer to in theology as "doctrine" or "dogma." Theory, doctrine or dogma is not the result of experience, not *abstraction from experience*. Rather, they, like the fundamental axioms of geometry, are, as Einstein has reminded us, "*free creations*" of the intuitive mind (E IO, p. 234). Such theories, doctrines, or dogmas, *if valid*, enable us to apprehend and interpret reality at profounder levels than has heretofore been possible. Once propagated, the new theories or doctrines are, in fact, formative of experience. Hence, they are prior to it. One quote from Einstein may suffice to illustrate this very important point.

Any theology that is certain its answers are the truth, the whole truth and nothing but the truth, and forever the only truth, is in grave danger of ignoring the epistemological complexities of human perceptual processes.

> The natural philosophers of those days [18th and 19th centuries] were . . . most of them possessed with the idea that the fundamental concepts and postulates of physics were not in the logical sense free inventions of the human mind but could be deduced

> from experience by "abstraction"—that is to say by logical means. A clear recognition of the erroneousness of this notion really only came with the general theory of relativity, . . . the fictitious character of the fundamental principles is perfectly evident from the fact that we can point to two essentially different principles, both of which correspond with experience to a large extent . . . (Sch I, AE, p. 273)

It is thus only to a limited sense that we can agree with the poet Alexander Pope:

> *The laws of old, discovered and devised*
> *are nature still but nature methodized.*

We may add for contrast:

> *The new laws of nature* although *devised*
> *reveal nature, nature methodized.*

We do not know reality as such beyond any remainder; we know it at all only as we "methodize" it into formulas that fit the reality being investigated well enough for it to show itself to us by the experiments that the formulas prescribe. Truth, then, is not a matter of tradition as such nor is it a matter of perception and experience as such. Truth comes about when we fit our perceptions and experience into known concepts, or when we alter our concepts or, if need be, exchange them for others that, according to our deepest convictions, more satisfactorily present reality to us than did the concepts that were once considered valid. Hence, both natural science and the science of theology are matters of educated, trained, perhaps changed and/or continually corrected perception. Truth is a matter of experience satisfying the categories of reality which we hold to be valid, categories that are tested and retested against the *objects* they seek to designate in a constant process of mutual modification between formula and designated *object*.

Relativity and quantum physics have replaced Newtonian physics; the latter may at best be considered to be a limited case of the former. Newtonian physics still *works* within a limited perspective. We are still quite "safe" in using Newton's second law (force equals the product of mass times acceleration) to predict the motion of hockey pucks, automobiles and even space-satellites. However when we attempt to deal with the extreme velocities and small masses of the sub-atomic world and/or the intense gravitational fields of the cosmos where space-time curvature is appreciable, then relativity and quantum physics must be employed if reality is to be represented with the degree of accuracy modern physics demands.

This simply illustrates again that classical Newtonian physics may be considered valid only if we ignore questions that are of a more ultimate nature than those which classical physics is prepared to answer. In physics as well as theology, as Paul Tillich has insisted, our concern must eventually be with that which is ultimate. Ultimately we who are Christian may want to understand natural science and theology as interpenetrating disciplines simply because both have to do with God's creation. Natural science attempts to know creation. Theology attempts to know God who is responsible for and reveals himself through creation. Following Einstein, who said, "Science without religion is lame; religion without science is blind" (E OLY, p. 26), so too theology without science is likely to be muddled and antiquated, and perhaps also somewhat empty and irrelevant.

Objectivity *results when all scientists who choose to perform a certain experiment in the same way will, if all goes well, get similar results, results that are recognized as* valid *by the scientific community.*

With the integration of space and time as a consequence of the invariant velocity of light, and the integration of inertia and gravity in the theories of relativity, the space-time absolutes of the Newtonian physics, along with the space-time *a priori* categories of the understanding that Kant based upon Newton, are seen to be *relative categories* rather than absolute categories. They apply only within limited perspectives. Hence, important as was the pivotal role that Kant's thought played in the development of a modern mindset (Cf. N TSMM, pp. 63–71), we continue to follow his *subjectivization* of reality to our peril. There is no doubt that Kant's attributing to mind an active part in the knowing process was a helpful contribution to epistemology at the beginnning of the eighteenth century Enlightenment. However, there would also seem to be little doubt that the absolutization of his system, which completely subjected reality to the knowing mind, began a process of individual subjectivization in philosophy, the negative impact of which is still being felt, especially in theology. With Kant, the Cartesian rejection of the heteronomy of authority, which subjected the self to external authority, reached finality with the autonomous self that subjugated reality to itself. It never seemed to have occurred to Kant that different minds with equally legitimate credentials would or could picture the world in different ways any more than it occurred to Newton, on whose physics Kant built his "metaphysics," that his model of the

universe might be one of many. Kant would be equally astonished by the precision of current theory and experiment in confirming non-Newtonian models of physical reality.

Much of post-Kantian theology, therefore, which is built upon the Kantian epistemology and the world view of classical physics, including much of Bultmann and Tillich and even some of Barth along with those emphasizing *Heilsgeschichte* (salvation history) to the neglect of *Weltgeschiche* (world history), has to be rethought in the light of post-Newtonian and post-Kantian categories (Cf. W GN, p. 51). The "process theologies" that build on the scientific interest of Whitehead are aware of the necessity of continuing conceptual change and realize that the concepts of absolute time and space have to abandoned. In the light of modern science, however, such theologies need to rethink the relationship of experience to theory or doctrine. They need also to take seriously the ramifications of both the concept of the finite universe in relationship to transcendence and the problem of implicating God with time in a world in which simultaneity has been ruled out.

In this regard it is of first importance to remind ourselves of the epistemological implications of Einstein's disproof of space and time as absolute along with Heisenberg's theory of indeterminacy and Bohr's concept of complementarity. Together, these theories gave the lie to the Newtonian conception of the cause and effect predictabiltity nexus that, in classical physics, had eventuated in a deterministic view of nature for every individual object. Hence, although Einstein continued to maintain predictability as probability (Sch I AE, pp. 261 f.), modern physics insists that mechanistic determinism is *passé*. Thus, the idea that anything or anyone is pre-determined to be and become the being or individual prescribed by precedents that follow unchanging *natural law* can now be considered as invalid, as can the view that nature is an independent, self-sufficient and self-enclosed system (H GT, pp. 62 f.). Modern science, therefore, allows room for the possibility of the interaction of God with humankind as well as for human freedom.

Any theology, therefore, that continues to accept the Cartesian subject-object dichotomy and divides the mind from the reality of the world, the *res cogitans* from the *res extensa*, which division entails a God-nature dichotomy such that any reference to God's activity in the world must necessarily be classified under the category of "myth," must be considered suspect. Equally, any theology that has an anti-miracle bias, because miracles are understood as abrogations of classical "natural law," may well have to re-think its basic conceptuality. Howe may well have had a word for today when he said that the modern physicist expects that the theologian will "begin with miracle and think out the consequences accordingly" (H CA, p. 49). On the other hand, in consideration of the finite nature of the world, any theology that follows Newton and fails to differentiate between God and nature, or any theology that follows the nineteenth century's subtly pantheistic or even panentheistic ideas should recognize that the thought structures on which they are based are anachronistic.

Until the end of time . . . we must be satisfied to work with incomplete, partial answers, answers that, although they may be adequate for the life of faith for the time being, are never final in an absolute sense.

At the same time, any strident kind of "orthodoxy" that depends on once-for-all answers may well have to be called into question. As "*natural law*" changes with our perceptions of reality, so too our theological concepts may be subject to alteration. Because of both the imperfection and the limitation of humankind, to say nothing of the "wrong-headedness" of the human mind, we never possess perfect concepts of reality—be they our understandings of nature or our understandings of God. Therefore, any theology that is certain its answers are the truth, the whole truth and nothing but the truth and forever the only truth, is in grave danger of ignoring the epistemological complexities of human perceptual processes. It is this "whole truth" and "nothing but the truth" complex of theology, in contrast to natural science which at its best realizes its limitations, that too often causes particular theologies to treat its answers as absolutes. In doing so, theology often cuts itself off from the positive insights of thought patterns which, though different, may serve to correct its concepts of reality. Hence Howe, speaking from a continental point of view, could say:

> Theology today often judges the liberal theology, magnificent as it was, after its own fashion, very harshly, while a physicist is more inclined to acknowledge earlier physics within the boundaries set for it by new theories and to honor it as "classical physics." (H CA, p. 46, n. 2)

In theology, as well as in natural science, we always work in a relativized observational context. This is true even in our attempts to allow biblical insights to guide us toward better understanding of the world and of

God. In all knowledge we continue to search for those ever elusive invariant structures that will provide intelligibility and meaning with respect to the richness and multi-dimensionality of human experience. However, until the end of time when, as the Apostle Paul tells us, "we will know as we are known," when all things including our theological thought will be brought to completions, we must be satisfied to work with incomplete, partial answers, answers that, although they may be adequate for the life of faith for the time being, are never final in an absolute sense. These answers, although valid as far as we can judge, must also be seen as being possibly open to new formulation. Einstein has perhaps put this best in his obituary to Ernst Mach:

> . . . concepts which have been proven useful in ordering things often acquire such authority as to seem "inevitable," "necessary," and even "*a priori*." If we remember their human origins, however, the conditions on which their usefulness and justification depends and their relationship to experience, then their "exaggerated authority" is broken. They may then be removed if they do not legitimate themselves, corrected if their correspondence with given experience was too careless, replaced by others if a new system which we prefer for good reasons can be developed. (*Phys. Zeitschr.* 17, (1916), p. 101, translated and edited for simplification)

Parameters of Truth

This in no sense means, in either natural science or theology, that there is no truth, that we are left only with our own individual impressions or that we are given over to arbitrariness, as if one theory, natural law, or doctrine were as good as another. Just as Immanuel Kant was convinced that it was the lawfulness of nature that makes experience possible (W ZWP, p. 155), so Einstein was as certain that there is a "right way" (Sch II AE, p. 398), as he was convinced that there is order in reality (Sch I AE, p. 285). However, even as we appreciate the validity of the "physical laws" of science that scientists, by means of leaps of imaginative insight, have discovered to show us *the right way*, we know that these *laws* are always open to possible further modification. Thus the Christian who sees the rhythms and patterns between the phenomena of nature that are not apparent to the naked eye, but reveal themselves to the mind in the insights of intuition, as evidence of God's *ultima ratio* visited upon the world, knows also that the most profound understanding of God and his relationship to the world is subject to new understanding.

The quest for deeper understanding, whether in the science of nature or in the science of theology, is of utmost seriousness. We enter it with our whole being. As Michael Polanyi has pointed out so cogently, "Truth is something that can be thought of only by believing it" (P PK, p. 305). When we assert what is true, we do it with universal intent. We submit ourselves to it. Out of the quest for truth itself, a firmament of standards comes into being which, in turn, becomes the tradition we respect and the culture of which we are a part (P PK, pp. 300 ff.).

Tenaciousness in the cause of truth is absolutely essential if natural science and/or theology are both to be preserved and to progress.

Tenaciousness in the cause of truth is absolutely essential if natural science and/or theology are both to be preserved and to progress. It is in this way that natural science and theology are always seeking new understanding. In both disciplines, concepts, theories and doctrines are constantly being tested and are perhaps being re-understood. They may even pass in and out of their ranges of validity. Old systems of thought may be replaced by new if, as we have quoted Einstein as saying, a new system can be developed for good reasons. It is the "good reasons" that constitute the rub. These can only arise if we believe what we are doing in natural science or in theology has indeed to do with truth.

Polanyi has compared the recognition of truth to the Apostle Paul's understanding of redemption. Faith demands the impossible of us. It demands perfection. The pursuit of the unattainable, however, is rewarded by grace in which the believer is given that which is beyond attainment. So the scientist who surrenders himself or herself to the constructs of reality, posed in problem form, is rewarded with an understanding which seemed beyond the possibility of his or her own realization (P PK, p. 324). The good reasons, in the light of which we may justify theological changes, then, are those which arise when the grace of truth hits us with its inevitability. Then and only then can we justify giving up old persuasions. Our reasons will then show how the new realization of truth has come about, as well as how the new understanding modifies, puts a new perspective upon, and makes a limited case of the old, once certain persuasion.

The change of perspective, the giving up of one, once valid and perhaps still revered concept for a new one is of the nature of scientific thinking itself. In the words of von Weizsäcker:

> Science demands of us again and again the offering up of old convictions for better insights. The least important student can stand up against a Newton or an Einstein. (W ZWP, p. 189)

Doubt, then, as to the formulations of either science or the faith is not the antithesis of truth. Both belief and doubt, as Polanyi has said, are inherent in knowing. Our search for truth, in fact, necessitates doubt. If this were understood then perhaps the faith itself might be so transformed as to be again meaningful to humankind (P TD, p. 92).

Faith in Search of Understanding

In considering the relationship of faith and doubt it is helpful, as T. F. Torrance has pointed out, to distinguish between beliefs that are held at "the bottom of one's heart" and those beliefs held at "the tip of one's tongue." The former type of beliefs is ultimate or fundamental to the existence of any science including the science of theology. These beliefs cannot be "proven." They are, however, truly rational for they are genuine personal responses to the rich multidimensionality of all human experience. The belief that the universe is intelligible, for example, is ultimate simply because one must assume it in any attempt to "prove it" and any doubt of it destroys the very possibility of doing science. Although such ultimate beliefs must be identified over and over again, once identified they are not to be doubted simply because they both make science possible and motivate and guide the scientific community's development of working beliefs. These in turn take form in the particular theoretical structures or *working beliefs* that are used to describe any restricted region of reality and, as such, they may be subject to doubt (T BSCL, pp. 19f).

Such *working beliefs*, like explicit scientific theories, are continually tested against experience, and this process brings about enhancement and/or modification or, should the "belief" fail, abandonment. Any healthy scientific procedure, therefore, will have fundamental beliefs that are held "at the bottom of one's heart" in addition to the working beliefs held at "the tip of one's tongue." The former give a basic structure to the quest for truth. The latter change as the evidence warrants. The line between the two, however, is never fixed, but the one will tend to alter, interpenetrate, and modify the other.

Thus, while formulas, theories, explanations, concepts, institutions, dogmas, and doctrines are necessary, no formula, no theory, no explanation, no concept, no institution, no dogma or doctrine is necessarily forever sacrosanct. They are good, justifiable, and valid as long as they continue to be transparent to the realities of the world on the one hand and/or to the realitites of faith on the other. If and when reality begins to escape and move beyond the power of such concepts, when they no longer are able to focus reality for us, then those concepts must be called into question or they will call us into question.

For our part, it we find old accepted formulations adequate, we are morally bound to submit to them. On the other hand, if, according to our deepest convictions, we find that accepted doctrines are limiting or even false, we are under the constraint of the truth itself to correct them. We may, perhaps, even need to replace them with new conceptual structures that more accurately reveal reality, and hence generate a greater degree of understanding than did the once good but now less than adequate constructs.

Here the prayer, "We believe, Lord, help thou our unbelief," must be supplemented with the plea, "Help us to understand and so formulate the faith that we along with all humanity in the scientific-technological age may understand and believe." Our hope in the possibility of being made aware of perhaps new and more adequate concepts and the ground of our courage is given by our trust in the God of truth who leads us into all truth (John 16:13).

On February 2, 1949, Einstein wrote an article in which he replied to his critics. After apologizing for expressing himself rather too sharply, he made an observation that may well be appropriate here as well: "One can really quarrel only with his brothers or close friends; others are too alien" (Sch II AE, p. 688). It is as *friends* in this new ecumenical age that Christians of all persuasions face the natural world and the faith together. With Anselm of Canterbury our motto is *fides quaerens intellectum*, "faith in search of understanding."

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Communications

THEOLOGICAL CLUES FROM THE SCIENTIFIC WORLD—Some Reflections

As Professor Nebelsick indicates, Einstein stressed that all further theory, doctrine or dogma comes about as a result of reflecting upon experience in the light of one's physical intuition and basic intellectual convictions. From such theoretical reflection the scientist and the theologian make a jump of imaginative insight, a "wildly" speculative and bold leap in postulating a logically-not-obvious new theoretical structure. The validity of this new theory or doctrine is then tested by using it to deduce specific theoretical propositions capable of being tested against experience. Thus one is brought back to the realm of experience. In this ongoing, cyclical methodology originating from and terminating in the realm of experience, new theoretical structure emerges as a free creation of the human mind. Upon successful testing against experience, such theory, doctrine or dogma reveals a hidden, possibly deformed intelligibility that undergirds the realm of confusing and often seemingly contradictory human experience. The discovery of such hidden intelligibility is the principle motivation and final goal of all science: natural, social and theological. Such *intelligibility*—shared among human observers conceptually, rather than as a matter of *sensibility* or *pictorability*—is the cornerstone of a realistic objectivity in today's quantum-oriented world. The shared character of the awareness of any particular "reality" guarantees objectivity; for even though different observers do not have the same sensory experience of the "reality" in question, through their diverse sensory experiences they are able to acquire a *shared or common understanding* of it. This shared, possibly deformed, intelligibility is the linchpin upon which to build cooperation between scientists and theologians. As the distinguished particle physicist and Anglican curate, J. C. Polkinghorne, puts it:

> If it is true, as I think it is, that intelligibility is the ground on which fundamental science ultimately makes its claim to be dealing with the way the world is, then it gives science a strong comradeship with theology, which is engaged in the similar, if more difficult, search for an understanding of God's ways with men.[1]

The search for intelligibility that Einstein's theory-directed model of the scientific enterprise describes, agrees well with how creative science and theology actually has been done. Einstein's own pioneering work in creating special and general relativity was motivated by the theoretical ideal that mathematical laws truly representing physical reality must retain their form under the widest possible coordinate transformations, i.e., general covariance. Bohr's development of the principle of complementarity was guided by the insight that quantum phenomena occurring at the atomic level are always observed with classical, macroscopic measuring instruments with the associated physical concepts being deeply and tacitly immersed in the language texture of macroscopic, everyday human experience: i.e., particles and waves. Similarly, at critical stages in the growth of the Christian church, creative theologians have benefited from theoretical insight as they reflected upon the depth of human experience, including God's concrete actions in human history documented in the Old and New Testaments. One example will suffice. The church Fathers at the Council of Nicea found concepts borrowed from Greek philosophy, in particular the term *homoousios* (consubstantial—of one being, substance), to be extremely helpful in formulating a creedal statement that would do full justice to the ample Biblical evidence for the profound unity of God and man in Jesus Christ: the God-Man (and by being so providentially guided they may have preserved the church). As Thomas F. Torrance puts it:

> The *homoousion*, then . . . is of staggering significance. It crystalizes the conviction that while the incarnation falls within the structure of our spatio-temporal humanity in this world, it also falls within the Life and Being of God. Jesus Christ is thus not a mere symbol, some representation of God detached from God, but God in his own Being and Act come among us, expressing in our human form the Word which he is eternally in himself, so that in our relations with Jesus Christ we have to go directly with the ultimate Reality of God. As the epitomized expression of that fact, the *homoousion* is the ontological and epistemological linchpin of Christian theology. With it, everything hangs together; without it, everything ultimately falls apart.[2]

Thus scientific and theological history testify to the soundness of Professor Nebelsick's perspective on the integrative interplay of theory and experience in science and theology. Figure 1, based upon Professor Nebelsick's thought,[3] is an attempt to represent this perspective visually.

The last theological example reinforces another of Professor Nebelsick's themes, the usefulness (and perhaps necessity) of complementarity theory in both science and theology. The thirty-three years of Jesus Christ's earthly life constituted a very unique space-time event. It is recorded that Jesus miraculously altered the usual patterns of nature; that he told people their sins were fully forgiven; and finally, that he rose from the dead appearing to his disciples with a body that passed through matter. Yet, during this same life, he worked as a carpenter; he wept in anguish; he became physically fatigued; and finally, he suffered much physically upon the Cross. It is very difficult to conceive of Jesus fully forgiving sins in any human context, only God is capable of such action; conversely, it is very difficult to conceive of God becoming tired; tiredness is clearly a human attribute. Both God-like and human-like attributes are required to adequately comprehend the unique reality of Jesus Christ's space-time life. Furthermore, the appropriate categories, "fully God" and "fully Man," are clearly embedded in mutually exclusive language contexts. Thus we see that although the categories needed to describe this unique space-time event are logically mutually exclusive both are mutually necessary to the totality of Jesus Christ's earthly life: hence the validity of a complementarity interpretation in this case. I would suggest that the finite, limited nature of all language structures, embedded in ordinary human experience, may

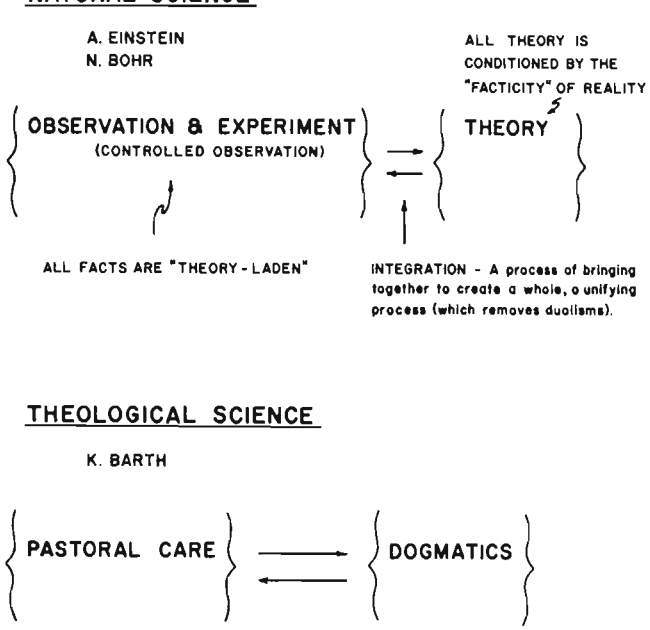

Figure 1. All Creative Science is an *integration* of praxis and theory. With respect to theological science, even a cursory reading of Karl Barth's monumental *Church Dogmatics* reveals Barth's deep concern that systematic theology and the everyday concerns of church people always be intimately interrelated. Following Michael Polanyi, *integration* is defined as "the natural unification of the constituent parts of a complex entity into a comprehensive whole, which is not replaced by an explicit integration or logical ordering of its analytically dismembered parts. Integration has to do with the spontaneous organization of natural coherences embedded in nature, which we grasp or understand only through non-analytical acts of knowledge such as indwelling. In this way we accomplish mentally, in bringing subsidiaries to bear upon a focus, what living beings do physically. Integrative knowing is a unifying mode of thought in which we seek to grasp something by penetrating its inner intelligible relations and wholeness without distorting fragmentation of it."[7]

require a complementarity paradigm in order to adequately "come-to-grips" with the holistic, genuinely paradoxical complexity that one confronts in probing the deeper levels of reality. However, as John W. Haas, Jr. points out,[4] one should carefully evaluate the appropriateness of the complementarity approach to each particular problem area in theology (and in science). As suggested by Günther Howe, two further theological areas where complementarity theory may apply are the emphasis on love and justice in Barth's exploration of time as belonging to finite creation and Einstein's concept of the finite universe.[5]

Lastly, Professor Nebelsick points out that dialogue between scientists and theologians can lead to beneficial mutual clarification and further understanding with respect to both science and theology, for the two disciplines interpenetrate each other in significant ways. The spirit of this interpenetration of theology and science is strikingly captured by the Greek word, *perichoresis*, used by early Christian theologians as they attempted to discern and grasp the way "in which the divine and human natures in the one Person of Christ interpenetrate each other without the integrity of either being damaged by the other."[6] The word indicates a sort of dynamic, mutual containing or mutual involution of realities, which is often spoken of as a *coinherence* (the root *chora* is also present in choreography, which describes the orchestration of dancers, indicating the root's dynamic aspects). Such a dynamic coinherence between theology and science would preserve the integrity of both disciplines while healing the breach that has opened up between them. Our age is dominated by technological and scientific achievement but strongly lacks a coherent sense of overall meaning (as strikingly indicated by the American public's dualistic uncritical acceptance of the legitimacy of both astrology and the findings of satellite-based astronomy) and the necessary moral leadership to use these achievements wisely. A deeper more clarified understanding of the *perichoresis* between theology and science could have a substantial healing impact upon our science-technology oriented society, for such a clarified understanding would restore the sense of purpose and moral guidance our society lacks. This understanding and subsequent healing can come about if both scientific and theological communities are willing to sacrificially commit the time and effort required for serious dialogue. Such extensive dialogue will succeed if each community trusts and respects the other's basic or core convictions while, at the same time, both communities honestly and openly articulate those areas where real divergences of understanding exist. Christian love manifesting itself in mutual tolerance and total honesty is one "leaven" that can guarantee the fruitfulness of such dialogue.

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W. Jim Neidhardt

Physics Department
New Jersey Institute of Technology
Newark, NJ 07102

CHIASMIC COSMOLOGY: A RESPONSE TO FRED VAN DYKE

I. Introduction

In my article in the previous issue of this *Journal*, I presented two fundamental arguments:

1) Salvation of the world through the Incarnation of the Word of God is made possible by the evolutionary origin of humanity, but not by "creationism." Thus evolution is theologically preferable to creationism.

2) Darwinian evolution is more in accord with the biblical picture of God's activity than is Lamarckian evolution.

I focussed there on the first of these, "the theological argument for evolution." Van Dyke's article, in that same issue of this journal, makes it necessary to discuss the second argument in more detail, for he argues that the specifically Darwinian features of evolution, "differential mortality and resource scarcity," are inconsistent with the scriptural view of God's work.

I welcome Van Dyke's paper. It is a worthwhile attempt to get at serious questions that have to be confronted if we are to get a modern theological understanding of what it means for God to be Creator and Redeemer. But Van Dyke and I come to rather different conclusions about the biblical answers to those questions.

First we need to clarify terminology. Van Dyke would place my approach under the heading "theistic evolution." I use that term in a more limited way for approaches which essentially superimpose the evolutionary picture upon a traditional picture of creation and fall. I distinguish between that and patristic views, the various approaches (classical liberalism, Teilhard de Chardin, process theology) which I lump under the heading "progressivism," and the approach which I take. One purpose in making such distinctions is simply to avoid the mistaken impression that there are no significant differences between theologians who accept evolution. In some ways, the differences between process theology and "theistic evolution" (in my sense) are at least as important theologically as the differences between creationism and evolution.

My approach has grown out of a particular theological tradition, that of Lutheran theology, and especially Luther's "theology of the cross." One *starts* from the cross and views the world from the cross. The cross is at the heart of who God is for us. Thus if Christ is present for us in the world, it is as the crucified one. God's presence in the world is "cross-shaped." The second century apologist Justin Martyr claimed as a prophecy of the cross of Christ the statement of Plato in the *Timaeus* that God placed the Logos "crosswise" (*echiasen*) in the universe.[1] Whatever one may think of Justin's quaint idea that Plato got this from Moses, it seems to me that it provides a good symbol. I use the term "chiasmic cosmology" for the approach which I've taken to science-theology issues in general and to evolution-creation questions in particular: it is Christ crucified who is shown to us in the universe.

II. How Does God Work?

There will be some points of detail on which I disagree with Van Dyke's paper, but I want to focus on a profound difference in our understandings of the way God works and the way in which God is revealed to us. Van Dyke argues that competition, death and extinction, essentials of the Darwinian understanding of evolution, cannot be the means through which God creates. "Death, shortage, and competition cannot represent, at one and the same time, both the activity of God and the consequences of human sin." While some nuances need to be handled with care, I believe that the basic idea of this sentence is quite wrong.

God creates out of nothing. That is, God brings about the work which God desires in spite of—in defiance of—the lack of any human, any creaturely, possibility. God does not bring forth being, life and salvation from what may seem to us to have clear potential for being, life and salvation. Rather, God brings them forth from their very opposites.

> God created the universe out of nothing. (II Macc. 7:28)
>
> God gave the child of promise to a couple laughably beyond the possibility of having children. (Gen. 17:17, 18:12)
>
> God created a nation out of slavery. (Ex.3:7–10)
>
> God restored the exiles whose hope for return was gone. (Ez. 37:1–14)
>
> God chose a virgin to be the Mother of God. (Lk. 1:34–37)
>
> God raised Christ from death. (I Cor. 15:3–9)
>
> God justifies sinners (Rom. 5:6–8)

These actions of God are brought together in Romans 4. We are shown there the faith of Abraham in the One "who justifies the ungodly" (Rom. 4:5), "who gives life to the dead and calls into existence the things that do not exist" (Rom. 4:17). God gives hope in hopeless situations.

Van Dyke asks, "Why don't we find in the biblical record evidence which would link the processes of selective death and resource scarcity with the creative work of God . . . ?" My answer is that, in an important sense, we do. The Bible does not give details about evolution. Scripture does not give the details of what went on in creation like a scientist's observation notebook. But scripture does set out clearly that God's work is brought forth from suffering, death and evil.

The center of all this work is what God does in Jesus. Because of this one who dies the accursed death (Gal. 3:13), blessing comes to the world. Life comes through death, forgiveness through condemnation. I would ask the reader to look again at the Bonhoeffer passage quoted in my earlier paper. By human standards, Lucretius[2] was right in saying, "Nothing can ever be created by divine power out of nothing." But God created the universe out of nothing. By human standards, dead people cannot rise. And Christ arose. This does not make sense to human beings who interpret the world according to their own standards of meaning. The cross is "folly" to them. But by God's standards, the cross is wisdom. (I Cor. 1:18–31)

This is why Luther made his fundamental distinction between "theology of glory" and "theology of the cross,"

condemning the former as a pseudo-theology and saying that only the theology of the cross actually corresponds to the way that God is revealed:

> The one who beholds what is invisible of God, through the perception of what is made [cf. Rom. 1:20], is not rightly called a theologian.
>
> But rather the one who perceives what is visible of God, God's 'backside' [Ex. 33:23], by beholding the sufferings and the cross.
>
> The 'theologian of glory' calls the bad good and the good bad. The 'theologian of the cross' says what a thing is.[3]

God does not work in the way that we expect God to work. It is in the cross, in suffering, loss and death, that God is revealed.

Does this mean that there is some good hidden in evil, life buried in death, so that God can extract the good from the bad? Does evil have some potential for good? No. *God creates out of nothing.*

Does this mean that God makes use of the destructive powers of sin, evil, and death? Yes. Does it mean that God is indifferent to whether good or evil is done in the world, and brings about life or death equally? No. "The soul that sins shall die," and "I take no pleasure in the death of him who is worthy of death" (Ez. 18:4, 32).[4] Again, a distinction made by Luther, related to that between "theology of glory" and "theology of the cross," is helpful. Luther distinguished between God's "proper work" and God's "strange" or "alien" work. God's proper work is work of love and mercy, bringing about life and blessing. God's alien work is condemnation and destruction.[5] The latter is done in order that the former may be brought about. To speak very anthropomorphically, God's proper work is "what God really wants to do." But often it is only when the way has been cleared by judgment and condemnation that God's fully life-giving work can happen. This is seen clearly in the work of Law and Gospel. The primary function of God's Law (its "theological use") is to convict sinners—"the law always accuses." The Law by itself cannot save (Rom. 3:20). But its condemnation drives sinners to the Gospel, in which they can hear God's forgiveness (Rom. 3:21–28).

This has been a somewhat lengthy excursus into Lutheran theology, but it seems to me necessary in order to deal with the matter at hand. I am not saying that all Lutheran theologians would agree with me about evolution,[6] that Luther was an evolutionist (which would be sheer anachronism) or that one does theology by just appealing to Luther. But the way in which Luther sets out biblical theology makes clear what it means to say that God creates out of nothing, and enables us to see on the mechanism of Darwinian evolution the "trademark" of all God's work. The Darwinian mechanism of evolution is precisely the kind of thing that the theology of the cross would lead us to expect.

Having said this, I want to emphasize that we should not pretend to have a full understanding of the relationship between human sin and the presence of suffering and death in the world. In my previous paper I discussed some possible ways of understanding the matter, but they are only possibilities. Thus the question of why there is evil in the world, and of how death for all creatures is related to human sin, is still something of a theological mystery. But that God creates out of evil is scriptural.

Van Dyke says of "theistic evolution," "Basic and distinctive Christian views of sin and death, and of the scripture's ability to communicate the attitudes and attributes of God, are so compromised that the resulting synthesis is, at best, questionably Christian." I can only say, "No." Creation out of loss and death is not the way we expect God to work. But it is Christian precisely because it carries the sign of the cross.

III. Further Details

I've dealt in the previous section with the fundamental theological difference between Van Dyke's approach and mine. Here I want to look at some matters of detail in his discussion.

First, there are important questions about the cosmic scope of creation and redemption. Van Dyke cites Isaiah 11:6–9, which speaks of the universal scope of the new creation. But how does this take place? "What has not been assumed has not been healed," and if evolution is wrong, what connection do lions and lambs have with the Incarnation?

Van Dyke cites such passages in order to show an original absence of death and destruction. Now the question of whether the Old Testament, in particular, contains the idea of identity between primeval time (*Urzeit*) and eschatological time (*Endzeit*) has been much debated. Childs' discussion[7] is helpful. He gives his opinion that "the evidence of an *Urzeit-Endzeit* pattern within Israel is overwhelming."[8] But Childs points out that some important qualifications are necessary. For our purposes, there are a couple of points which have to be emphasized.

God is going to do something definitely new. God will bring about a new Exodus (Is. 10:26, 43:16). At the same time,

> Remember not the former things, nor consider the things of old. Behold, I am doing a new thing; now it springs forth, do you not perceive it? (Is. 43:18–19)

It is not for nothing that scripture speaks of *new* heavens and earth (Is. 65:17, Rev. 21:1).

Secondly, as that reference to the new Exodus already shows, scripture does not speak simply of a return to a prehistoric paradise. God's saving acts in history are to be repeated. It is especially interesting that Israel's wandering in the wilderness is, in some sense, seen as the ideal time in the past, to which there will be a return (Jer. 2:2–3, Hos. 2:14–15). The eschatological significance of the Feast of Booths, commemorating the wilderness wanderings, is significant here (Lev. 23:39–43, Zech. 14:16–19).

We need to be careful not to try to make the Bible say more than it really does about God's original creation. Genesis 1:29–30 is not talking about abundance (as Van Dyke says) but about what is lawful for food. (The regulation

is, of course, changed in Genesis 9:3–4.) Traditional western pictures of the physical beauty, intelligence, *et cetera* of Adam and Eve, far above that of present-day humans, are simply not supported by scripture.

I did not deal with ethical questions in my previous paper, though I have discussed problems of evolution and ethics elsewhere.[9] I agree with Van Dyke that one cannot get biblical ethics from evolution itself. There is nothing within evolution itself to rule out something like Nazi ethics, and the only thing that Hitler did wrong from that standpoint was to lose. But I would also deny that a Christian who accepts evolution is bound to *try* to derive Christian ethics from within the evolutionary process. Evolution is *a* tool of God, whose will for our lives is most clearly revealed to us in Jesus Christ through the scriptures. That's where we get our ethics, not from what worked for our ancestors a million years ago. Again, God is doing something new in Jesus Christ. One sees that very clearly in scripture. "Eye for eye, tooth for tooth . . . " (Ex. 21:23–25) is a considerable advance on the primitive idea of unlimited retribution (e.g., Gen. 4:23–24). But God does not stop with "eye for eye." That level of ethics is again transcended in the Sermon on the Mount (Mt. 5:38–42).

IV. Conclusion

Van Dyke begins his paper with references to the common belief that Christianity and evolution have been "reconciled." It is to Van Dyke's credit that his paper calls attention to the fact that much of this reconciliation has been too cheap. It is not enough (although I believe it is true) to say "evolution is God's way of creating." A serious study of evolution as God's way of creating shows that it is not an easy way to follow. It is a dark way, sometimes hard to understand or accept. It is the way of the cross.

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[7]Childs, Brevard S. *Myth and Reality in the Old Testament*. Naperville, IL: Alec R. Allenson, 1960, pp. 72–83.

[8]Childs, *op. cit.*, p. 76.

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George L. Murphy

St. Mark Lutheran Church
158 North Ave., Box 201
Tallmadge, Ohio 44278

RESPONSE TO GEORGE L. MURPHY: A THEOLOGICAL ARGUMENT FOR EVOLUTION

I am impressed that Mr. Murphy inherently grasps that our goal in the discussion is not "reconciliation." Any Christian of integrity is primarily concerned with truth and with a faithful presentation of God's word, not with his or her standing with various vested interests. I also am in complete agreement with the first five points of his paper: 1) God's activity toward the world displays a unity, 2) God creates out of nothing, 3) God's redemptive work is the entire creation, 4) God's redemption is accomplished through the incarnation of His word, and 5) Scripture is to be understood christologically.

I will not spend valuable space defending a label, i.e., "creationism," rather than an idea. It is not true that evolution is the only theory which allows for the creation's redemption. Whatever individual Christians may say, the Bible does not give any credibility to the idea that humans are of a totally different physical nature than other created things. In fact, just the opposite is stated. Physically man is made from the dust of the ground, and to it he returns in death. But it is a major error in logic to conclude from that that, if man did not evolve from animal ancestors, then God cannot redeem His own creation. It is also important not to confuse *representation* with *assumption*. Adam was one man, but through him, as *representative* of the race, all sinned. The second Adam, Christ, *represents* all men but does not *assume* the *identity* of all men anymore than Adam did. Otherwise, we would be forced to conclude that Adam, Jesus, and I myself are the same person, which is ludicrous. Paul gives a better, and different, perspective than the idea of *assumption* by saying, "Through one man's disobedience many were made sinners, even so through *one* act of righteousness there resulted justification of life to all men." This is the familiar idea of federal headship, that Adam and Christ were representatives of the race. Such an idea does not require the concept of *assumption,* with all its attendant difficulties, to make redemption a cosmic event, nor does it require an ancestral link between humans and animals to allow Christ to redeem creation.

There is an unfortunate use of emotive terms and rhetoric which make agreement between biblical views and evolutionary theory more apparent than real. To say that God brings life out of death is not the same as saying that God creates through the process of death. The first saying means that God restores life to that which has died. Death, in this case, is an unnatural condition which God did not intend, but which He has power to overcome. The second means that God actively deals out death as the means to achieve His created work. That premise is a necessity for theistic evolution, but is biblically unsupportable.

Mr. Murphy's observations of a *mediated* creation are very interesting, and, perhaps, quite accurate. Unfortunately, they are given the appearance of agreement with evolutionary theory, an appearance which is quite misleading. To quote Mr. Murphy, " . . . The literal interpretation of Genesis 1 is that the creation of plants and animals is mediated, the elements having been given the power to 'bring forth'

these creatures when God so commands." This is a beautiful and biblical picture, much like that evoked when Aslan "sings" the creation into existence in C.S. Lewis's *The Magician's Nephew*. But it in no way constitutes agreement with evolution. The last thing an evolutionist imagines are fishes popping out of the oceans and trees springing up spontaneously from the ground. The idea of physical elements *mediating* the creation of species would hardly be received with enthusiasm by most biologists. Even the idea of the elemental generation of the most simple, sub-life forms has met with increasing controversy in mainstream science.

Mr. Murphy and I are certainly in agreement about the area of greatest difficulty to the theological support for evolution, namely evil, sin, and death. As Mr. Murphy himself indicates, the Darwinian agreement proposed provides no answer to these difficulties. My only suggestion to this portion of his paper is that he does not pursue his own argument far enough. Mr. Murphy recognizes, rightly, that the proposed existence of death in the world before the Fall poses a serious problem to his interpretation. But if we examine evolutionary theory in any kind of detailed, critical way, we find that is not the only problem. Evolution does not merely require death to exist, but requires it to be the primary creative mechanism. To use Mr. Murphy's argument format,

(A) God is Creator.

(B) Evolution is the mechanism of the Creator.

(C) Death is the primary mechanism of evolution.

(D) God's primary mechanism of creation is death.

Once we grasp this, the entire discussion of right and wrong roads in human development becomes largely meaningless. If death, suffering, and scarcity were part of the lot of, for example, animals, before the Fall, how does human sin have any meaningful consequences for them? If sin affects only the *meaning* of death, rather than death itself, it would appear to be without consequence to the non-human creation. But, as Mr. Murphy proves, this cannot be the case, for all creation is fallen. Therefore, all creation must be redeemed. But, if non-human creation is not fallen, why redeem it? To use Mr. Murphy's example, let us treat the Civil War as the Fall and slavery as death (the reader will see some parallels). Before the war, slavery legally existed in the United States. After the war it did not. The fate of slavery as an institution was a primary motivating factor for many who fought in the war. But to say that the war merely gave a new meaning to slavery after the war ignores both the facts of history and the rules of logic. In order for events to have meaning they must also have consequence. Mr. Murphy has proposed a Fall without consequence for the non-human elements of creation. Yet this view is supposed to give new meaning to old events. An event without consequences is a meaningless event. A Fall without consequences would be equally meaningless. Just as the Civil War had measurable consequences for the better, the Bible makes it clear that, for all elements of creation, the Fall had measurable consequences for the worse. To assert that the Fall had real consequences for all the creation is not a Flacian heresy. A fallen creation is no less God's creation. But it is a creation which longs for a redeemer, and which makes redemption a truly cosmic event, with measurable consequences for all creation.

There are other aspects of the question of death which bear examination. If selective mortality is a creative force on a continually evolving creation, how should we respond to such "creative" events. A wildlife refuge manager may one day look across a prairie marsh to see thousands of ducks dying of botulism. Logically, we know that the more resistant ducks may survive, thus genetically improving the species. But our "natural" response is likely to be to try to save as many ducks as possible. Should we assume that, by doing this, we are thwarting the creative activity of God? It is all very well to say that God brings life out of death, but that will be cold comfort in times of real personal dilemma. If we assign evolution to the role of primary creative mechanism, we *are* opposing the creative activity of God if we act to interfere in cases of selective mortality. Here is a case where the heart may be wiser than the head, and our natural opposition to death, even in wild creatures, may betray more of our "evolutionary," as well as spiritual, history than we realize. In fact, the sons of this age may be wiser than the sons of the kingdom in such cases. In my scenario, the official policy of the U.S. Fish and Wildlife Service is to save all possible ducks through all possible means, even to the point of giving individual injections of botulism antitoxin.

Mr. Murphy's first five points, that God's activity toward the world displays a unity, that God creates out of nothing, that God's redemptive work is the entire creation, that God's redemption is accomplished through the Incarnation of His word, and that Scripture is to be understood christologically, are eloquent statements of a truly Christian view of creation. However, all of them are better understood without evolution than with it. Evolution does not, in the most precise sense, display unity. Rather, it displays diversity. The longer the process goes on, the more unlike each other creatures become. Even apparently similar structures, like the eyes of a human being and an octopus, are not considered as having a common source in design, but are considered to be independent responses to separate selective pressures. In fact, the most clearly displayed unity of creation would have existed in the "Adam molecule" *before* the evolutionary process began. Once initiated, evolution can only widen the covers of the taxonomist's manual. More and more species, less and less similarity.

Evolution does not display an act of God's creating out of nothing. There is a theory, the theory of abiogenesis, which does state that life evolved from non-life but that is not the same as evolutionary theory. That is why the theory of evolution is typically called the theory of *organic* evolution. George C. Kent, author of the familiar college textbook, *Comparative Anatomy of the Vertebrates,* put it well when he said, "The theory of organic evolution is a single, simple, easy to understand, yet widely misstated theorem, which is: *The plants and animals on earth have been changing, and the ones around us today are descendants of those that were here earlier.* The theory does not state how life began, or how the universe began" (Kent 1978:430–431, emphasis his). If God created out of nothing, He most certainly must have used something other than the evolutionary process. Darwin's own concise but elegant description of evolution as

"descent with modification" always implies natural selection acting on preexisting forms and structures to produce new variations of those same forms and structures. But Darwin would have been the first to admit that natural selection is decidedly unoriginal, and never creates something from nothing.

Evolution does not display God's redemptive work toward the entire creation. The creative mechanisms of evolution require resource scarcity, competition, and death, precisely the things the Bible says God plans to redeem the creation from. If the presence of such conditions represent the creative activity of God, does that mean that their absence (as described in Isaiah 11) represents a cessation of God's activity toward creation? And if, as this conclusion implies, there are no conditions in creation which have not always existed, what consequences has it suffered from the Fall? If creation has suffered no consequences from the Fall, what is the point of redeeming it? The tragedy of making evolution the agent of God's creative activity is that we end by not taking the Fall and its effects seriously enough. In our efforts to respect the integrity of the creation, we actually demean the creation, its need for redemption, and its Redeemer; and make redemption less than the cosmic act the Bible requires. For this reason, Mr. Murphy's fourth and fifth points do not constitute a theological argument for evolution. If God's redemptive work is the entire creation, it is necessary that the entire creation be in fallen state, experiencing conditions and processes different from its original form. Finally, if scripture is to be understood christologically, it seems remarkable that Christ the Creator (John 1) should have such an unenlightened, antagonistic view of death, since He should have been intimately familiar with evolutionary mechanisms.

Mr. Murphy has shown some exceptional insight into the biblical nature of the creation. He has expressed these insights with remarkable clarity and power. However, we can better appreciate his perceptions without the attendant baggage of evolutionary theory. His excellent points are, in my opinion, a tremendous statement on the creation, but are anything but a theological argument for evolution.

Fred Van Dyke

Assistant Professor of Science
Fort Wayne Bible College
Fort Wayne, IN 46807

SIX DAYS, SIX AGES, OR . . . ?

Two questions that are repeatedly asked clearly deserve to be answered. 1) If the author of Genesis 1 did not intend to teach the creation of the earth in six days, why did he write as he did? 2) How else could he have said it so as not to seem to teach a six-day creation? Not only are these questions advanced seriously, but they would seem to force theistic evolutionists either to convert to recent creationism or to deny an inerrant Bible.

Considering the questions from a rigorously evangelical viewpoint requires that Genesis 1 not be taken in isolation. Genesis 2 is also part of the inspired record, which must be read as a whole. Genesis 5:1f, Exodus 20:11 and 31:17, Hebrews 11:3 and many other scriptures[1] also apply. However, for the most part they add no new information, although they may impose restrictions on the allowable interpretations of the first chapters of Genesis.

A careful look at the text of Genesis reveals some facts that surprise many people. First, few things are said to have been created: heaven and earth (1:1), fish and fowl (vv. 20f), and man (v. 27; 5:1f). The beasts of the earth and cattle were made (1:25), as were sun, moon and stars (v. 16), and the firmament (v. 7). Plant life was merely brought forth (vv. 11f). So to talk about the creation of plants and animals is to go beyond the express statement of Scripture. Genesis 2:4 does not change this. Hence, if one speaks of the six days of creation, it should be deliberate, not merely habitual. And one must be aware of the consequences of this alteration.

Further, in Genesis 1:20–31, birds were created on the fifth day, then animals were made on the sixth day before man and woman were created. But in chapter 2, verses 7–21, man was formed of dust before the beast of the field and the fowl of the air were similarly formed in a vain attempt to find a helper suitable to the man. It cannot reasonably be objected, in order to meet this difficulty, 1) that Hebrew verb forms do not coincide with those of English; or 2) that Hebrew narrative form is different.

Specifically, it is noted that the verb translated "formed" may be "had formed," since Hebrew does not have distinctions corresponding to the past and past perfect tenses of English, let alone the more elaborate verb forms of other Indo-European languages. Second, the ancient pattern often completes one aspect before picking up another simultaneous track, or one even earlier. Thus, completing the statement about man's formation in 2:7 by placing him in the garden (v. 8) before describing the way the garden came to be, is typical. One cannot get a time line from this sequence. However, to have the formation of man before the growth of any plant is consistent with v. 5, which specifies two reasons for the absence of plants: the absence of rain and the absence of a farmer. How can this be if plants were produced before man in chapter 1?[2]

The narrative is resumed in Genesis 2:15. Except for the repetition of Adam being placed in the garden (cf. v. 8), the narrative seems quite straightforward. He is given explicit orders about the trees in the garden, names the animals and birds (without finding a suitable helper among them), is put to sleep while God builds Eve,[3] whom he welcomes with delight and prophecy. The simple narration continues in chapter 3. What is striking here is the lapse of time between Adam's formation and Eve's construction, in contrast to the joint creation and instruction of male and female in verses 1:26–30.

The simplicity of the Hebrew verb structure must be acknowledged. The form translated "formed" in 2:19 may legitimately be translated "had formed." However, if this be done, consistency demands that "brought" be "had

brought," for it is coordinated with the same grammatical subject in a single sentence. None of the attempts to get around this objection that I have found are based on a parallel construction.[4]

It is clear from the narrative that Adam named every living beast and bird (2:18–20) before he was put to sleep so that Eve could be built out of his rib (vv. 21f). Further, there is no reason for Eve to be produced before all the cattle, beasts and fowl had been examined and found wanting as companions for Adam, "an help meet for him." Scripture is multiply emphatic that all were named by Adam. If we assume just the currently living species of birds and mammals and a dawn-to-dusk stint without meals or rest periods, Adam came up with a new name every three and a half seconds. If, as some recent creationists claim, the passage deals with the sole and total creation, the currently extinct species would also have paraded past him, increasing his task. Of course, one might argue that the four repetitions of *kol* ('all' or 'every') and the two implied distributives are not to be taken literally. But then the question arises, if God did not intend this to be taken literally, why is the statement so emphatic?

A pair of related suggestions have been advanced to meet the problems just noted: that the section is organized topically and that the section has only a local reference. The latter, while it simplifies Adam's task, seems to me to do so at an unacceptable cost. If the "all" of Adam's naming (v. 20, cf. 19) is local then the "every" of God's forming (v. 19) should be local also. And one may interpret the narrative as suggesting that the local assemblage had no mate for Adam, but there might be one beyond the confines of the Garden of Eden, or just over the next hill. This would give opportunity for a new twist to the Lilith legend with a non-Adamic mate for Adam.

The former suggestion, that this is purely topical, does not seem to fare any better. The events of chapter two, however we order them, have to fit into the temporal sequence of chapter one. I do not see that a topical arrangement changes the amount of time involved. Indeed, the suggestions suggest eisegesis rather than exegesis.

As I see it, we are faced with a dilemma. Reading the first two chapters of Genesis as seven literal days requires that Adam and Eve be created simultaneously and with a lapse of time, that Adam be created both before and after the birds and beasts, that Adam be instructed about food before Eve was produced and that they be instructed together, and so forth. Reading them as involving day-ages would require plants to grow before the sun and moon come into existence, the earth to antedate the solar system, and birds to precede reptiles in the historical sequence—in addition to eliciting most of the problems with the literal-day interpretation. Unless an alternative interpretation is found, it appears that we must accept divinely inspired nonsense, unless we adopt a mythic or other nonliteral interpretation. Is there a way out?

That the ancient record cannot be read as a description of a six-day creative fiat was recognized by St. Augustine, whose orthodoxy cannot be questioned. At the start of the fifth century, in *De Genesi ad litteram libri duodecim* (Genesis literally: twelve books), he suggests that the days of creation are not periods of time, but are rather a didactic arrangement to describe what was created completely and instantly. He based this interpretation on the Old Latin text of the apocryphal Ecclesiasticus (Sirach) 18:1: "He who lives forever created all things at one time." The Greek original may be rendered " all things without exception."[5] While we may not wish to base our interpretation of creation on the Apocrypha, we may follow the ancient insight.

There is a literal reading of Genesis 1 that does not conflict with Genesis 2. The very language, repeated six times, strongly suggests it. The more baldly literal translation of the unique Hebrew phrase gives "and was evening and was morning day one (second, third, fourth, fifth, sixth)." Since 'evening' is used in other Old Testament passages to specify the time of retiring[6] and 'morning' that for arising,[7] it appears that we are being told that the period spent in bed is the relevant day. This is the time that Daniel 8:26 gives as the time when a vision was given. This certainly fits our expectations, for what God did must be revealed: there could have been no observer.

It cannot be objected that the evening-morning merely refers to the Jewish day, which runs from sundown to sundown. Apart from the six repetitions in Genesis 1, the joining of these two words—in phrases clearly different from those in Genesis 1—is found only in connection with specific time,[8] with the possible exception of Daniel 8:14, where the sacrifices are in view, and Genesis 49:27, Job 4:20 and Psalms 30:5, where the use is figurative. The normal reference to a twenty-four hour period is the term for day (*yom*) used in Genesis 1.[9] Otherwise, the reference is commonly to night (*layelah* or *layil*) and day (either *yom*[10] or *yomam*[11]). The word for morning (*boger*) is coupled to one of the words for night when emphasis is on the dawn, when night is completed.[12]

So it appears that what is recorded is a six-day series of revelations of God's acts, followed by a day of cessation or rest.[13] This is followed by a different revelation specifically related to the human species.[14] This removes the problem of when God created the universe and all its residents from the interpretation. The revelation had to be given after the creation of man. But the revelation may have been given to Adam in the Garden of Eden or to Moses somewhere in Sinai. I imagine that it was given earlier rather than later, that Adam had the information.[15] But I cannot be dogmatic.

This interpretation eliminates the contradiction between the extreme age of the earliest life forms in the Precambrian Era and the record in Genesis 1. It also eliminates the problem of lining up what scientists know of the development of the solar system and the appearance of light three days before the sun was made. Finally, it eliminates the internal contradictions between the two revelations.

There is, however, one objection that, if it be sustained, makes this interpretation incompatible with a claim that Scripture is inerrant. Twice, in Exodus 20:11 and 31:17, it is

recorded that "in six days the Lord made the heavens and the earth." If 'made' is the required translation, the interpretations given by Augustine and by Wiseman and me are untenable. However, the Hebrew verb, *asah,*[16] is translated "showing" in Exodus 20:6 and "do" in verses 9 and following. Abraham did not make persons in Haran (Gen. 12:5). Nor did Mephibosheth make either feet or moustache (2 Sam. 19:24). It cannot be held that the laws (Es. 5:8) or the temple vessels (2 Chr. 24:7) were not made. And surely one cannot make to build (Josh. 22:6). In short, while the word may often be appropriately translated by 'make,' its use is far less definite. The Hebrew verb seems to be one of the least specific available. So the passages are equally compatible with the Lord producing, demonstrating, grooming, or acting in some other way. I am not suggesting that Exodus 20:11 be translated: " . . . in six days the Lord showed . . . all . . . and rested the seventh day . . . This is no more plausible than the naive phrasing that seems to suggest that God was tired by the effort of creation and needed to relax.[17] Perhaps the flavor of the verse can best be captured in English by " . . . in six days the Lord did the heavens and the earth, the sea and all that in them is, and ceased the seventh day."[18] There is thus no Biblical objection to the view that the days are times of revelation.[19]

It thus follows that the sequence God used to explain His activity cannot be used to determine the succession of His creative acts in nature. The first chapters of Genesis are equally compatible with the instantaneous appearance of everything in completed form or with the Creator's use of ages beyond human comprehension to bring the world to its present state. However, they are incompatible, on a careful reading, with the six-day fiat creationism advocated by many who have a high regard for Scripture. These chapters are equally incompatible with the commonly voiced alternatives, some sort of day-age interpretation. Indeed, close attention to the inspired text seems to turn the original question around: If God had intended to teach six-day creationism, why did He inspire the second chapter of Genesis? How else, short of inserting an explicit disclaimer, could He have made it clearer that Genesis 1 is not to be understood as the creative sequence?[20]

NOTES

1. These passages include Gen. 6:7; 9:6; Deut. 4:32; 2 K. 19:15; 1 Chron. 16:26; 2 Chron. 2:12; Neh. 9:6; Job 38; Psa. 8:3–9; 19:1; 33:6f, 9; 74:16; 89:11; 90:2, 95; 96:5; 100:3; 102:25; 104:5, 19f, 24; 115:15; 121:2; 124:8; 134:3; 136; 146:6; 148:4; Prov. 3:19; 8:22–31; Ecc. 3:11; Isa. 37:6; 40:18–31; 42:5; 44:24; 45:11f; 48:13; 51:13; Jer. 10:12f; 27:5; 32:17; 51:15; Zech. 12:1; Mal. 2:10; Mt. 19:4; Mk. 10:6; 13:19; John 1:3, 10; Acts 7:49f; 14:15; 17:24–29; Rom. 1:20, 25; 1 Cor. 11:9; 15:45; Eph. 3:9; Col. 1:16f; 1 Tim. 2:13; 4:3f; Heb. 1:2, 10; 4:4; 2 Pet. 3:5; Rev. 3:14; 4:11; 10:6; 14:7.

2. One attempt to bridge this gap requires an Aristotelian framework. Plants were produced in potency on the third day and actually later. But to tie an interpretation of Scripture to a philosophical technicality is unwarranted.

3. This is not the same verb, *asah,* translated 'make,' nor *yatsar,* 'form,' of Genesis 2:7, 8 and 19. *Banah* is usually translated 'build.'

4. Josh McDowell, *Answers to Tough Questions,* pages 186f, gives four passages which supposedly indicate this Hebrew usage. However, not one of his claimed examples has the two verbs with the same subject in the same sentence. I must assume that he has collected the best evidences, yet they clearly fail. He first cites Exodus 4:19 as referring back to verse 12. But he assumes that God spoke to Moses only once, whereas it could have been twice. Second, he cites 19:2, with a reference back to 17:1. But this seems the same sort of recapitulation for clarification that one finds in English. Exodus 17:1 takes Israel from Sin, where God supplied manna, to Rephidim, where the people immediately began to complain about the lack of water. Exodus 18:5 seems to take place at Sinai, so 19:2 makes the several moves explicit.

Joshua 2.22 repeats the same verb of verse 21 ("went" and "departed," respectively, in KJ). But its occurrence in verse 22 is not to be understood as "had departed," but as "went on." *Yalak,* the verb here, is the second verb in Judges 19:14, with this latter sense, as clearly as it has the former in verses 5, 6, 7, 8, 9, and 10.

The final reference, 1 Kings 13:12, is the only one in which there is a single sentence in the Hebrew. But it has a change in subject between the two clauses. While this comes closest, it does not show that two verbs with the same subject in the same sentence can be interpreted in this strange way.

5. This work, a major product of Augustine's mature period (along with *De Trinitate* and *De civitas dei*), was first translated into English in 1982 by John Hammond Taylor as *The Literal Meaning of Genesis* (New York: Newman Press, 2 volumes). As a consequence, it is not commonly cited by those who work from English sources.

6. See Gen. 29:23; 2 Sam. 11:2, 13; Es. 2:14; Prov. 7:9; Zeph. 2:7. The Hebrew is *ereb.*

7. See Gen. 24:54; 29:25; 41:8; Num. 22:13, 21; Jud. 19:27; 20:19; Ruth 3:13f; 1 Sam. 3:15; 2 Sam. 24:11; I Kings 3:21. 'Day' in Judges 16:2 is the same Hebrew word, *boqer.*

8. They refer to the two daily sacrifices in Lev. 6:20; I Chron. 16:40; II Chron. 2:4; 13:11; 31:3; Ezra 3:3. They refer to explicit time in Ex. 16:13; 18:13, 14; 27:21; Lev. 24:3; Num. 9:15, 21 (first pair only; cf. note 11); Deut. 16:4; 28:67; I Sam. 17:16; Job 4:20; Psa. 55:17; 65:8; Exek. 12:7f; Dan. 8:26.

9. See, for example, Gen. 7:4, 11f; 8:3, 4, 14; Ex. 12:18f; etc. It also means the period of light in Gen. 1:5, 14, 18; 8:22; 18:1; etc. It approaches a more indefinite notion like our 'time,' as in Gen. 4:3; 19:37f; 30:33; 32:33; 47:29; etc.

10. Gen. 1:5, 14, 16, 18; 7:4, 12; 8:22; 31:39, 40; Ex. 10:13; 24:18; 34:28; Num. 9:15f, 21; 11:32; Deut. 9:9, 11, 18, 25; 10:10; 1 Sam. 19:24; 28:20; I Kings 8:29; 19:8; Es. 4:16; Job 2:13; 17:12; Psa. 74:16; Eccl. 8:16; Isa. 38:12, 13; 62:6.

11. Ex. 13:21, 22, 40:38; Lev. 8:35; Num. 9:21 (second pair only; see note 8); 14:15; Deut. 1:33; 28:6; Josh. 8:8; Judg. 6:27; I Sam. 25:16; 30:12; II Sam. 21:10; I Kings 8:59; 1 Chron. 9:33; II Chron. 6:20; Neh. 1:6; 4:9; 9:12, 19; Job 5:14; Psa. 1:2; 32:4; 42:3; 55:10; 91:5; 121:6; 136:8f; Isa. 4:5; 28:19; 34:10; 60:11; Jer. 9:1; 14:17; 16:13; 31:35; 33:20, 25; Lam. 2:18.

12. Lev. 6:9; Num. 22:8 and 13, 19f and 21; Josh. 8:3, 9, 13 and 21; Judg. 19:25f; Ruth 3:13.

13. P. J. Wiseman, *Creation Revealed in Six Days: The Evidence of Scripture Confirmed by Archeology* (1948), comes to this same conclusion on different grounds. See the reprint in Donald J. Wiseman, ed., *Clues to Creation in Genesis* (1977), p. 206. I thank Dr. C. Markham Berry for calling this to my attention following the presentation of the original version of this study at the 1982 annual meeting.

14. P. J. Wiseman, *New Discoveries in Babylonia About Genesis* (1936), concludes this passage was written by Adam. See P. J. Wiseman, *op. cit.*, pp. 59f.

15. Wiseman gives evidence for this conclusion. *Ibid.*, pp. 56–59.

16. It occurs, according to Young's Concordance, 2629 times. Purists will note that, in the transliteration here and elsewhere, the quotation marks that indicate the unpronounced aleph and ayin have been omitted.

In addition to the passages cited in the paragraph, one may also note other usages in KJ:

"do": Gen. 3:13; 6:22; 7:5; 9:24; 16:6; 18:29; etc.
"put": 1 Sam. 8:16.
"use": Lev. 7:24; Ezek. 35:11.
of food:
"dress": Gen. 18:7f; Lev. 7:9; 2 Sam. 12:4; 13:5, 7.
"prepare": Gen. 27:17; Es. 5:4f, 8, 12; 6:14; Ezra 4:15.
of sacrifice:
"dress": 1 K. 18:23, 25, 26.
"offer": Ex. 29:36, 38f, 41; Lev. 5:10; 6:22; etc.
"prepare": Num. 15:5f, 8; Eze. 45:17, 22f, 24; etc.
"sacrifice": Lev. 23:19; 2 K. 17:32 (also "made").

17. There is, however, a problem with Ex. 31:17, as usually translated. It does not seem to match Psa. 121:3, 4 and Isa. 27:3, nor does it seem compatible with orthodox theology. I suspect that there is a problem with the translation, although there may be an error in the transmission of the text.

18. The shift of words in the several passages is interesting. God "kept sabbath" (*shabath*) in Gen. 2:2, 3, as did the people in Ex. 16:30 and the land in Lev. 26:34, 35. The resting (*nuach*) of God (Ex. 20:11) is that of ark (Gen. 8:4), animal (Ex. 23:12) and slave (Deut. 5:14).

19. Dallas E.Cain, in the interest section he conducted at the 1982 annual meeting, noted that this was one of a few interpretations of Gen. 1 (out of some 20 found in the literature) compatible with a high view of Scripture. In his evaluation, it had no marks against it. It had his "top consumer rating."

20. One may ask, if the basis of the common interpretations is so weak, how did they come to dominate fundamentalist and evangelical views? I think they grew out of a reaction against the claims of the higher critics and their followers. These latter claimed that Genesis was a pastiche of contradictory stories which must be read mythically or figuratively. In reaction, the conservatives contradicted these critics without realizing that they were getting into the fallacy of many questions. That is, they were misled by the form of the problem as it was given, by its external associations. As a consequence, they did not face the problem precisely. They were correct in insisting that God does not contradict Himself, either in His Word or in His works. But they did not consider the very important differences between Gen. 1:1–2:4 and 2:5–25. They were correct in insisting on a non-figurative reading. But, in their zeal for a literal reading, they failed to note that they erroneously assumed that the sole faithful rendering required that the passages be a description of the sequence of God's creative acts. They produced strained eisegetic interpretations to patch up the parallel between light and lights. They passed over the clear parallels between the firmament and its population, and between the earth and its population. Yet it is clear that the first triad of days is paralleled by the second triad. That this is a didactic or literary device should have been obvious. Yet over a dozen theories propounded by conservative students seem to do everything possible to avoid the evident. And now a strained interpretation has become the shibboleth of a large part of the American church: one who does not believe in divinely inspired nonsense is read out of the body of faith. As Paul would say, *mē genoito*.

David F. Siemens, Jr., Ph.D.

Professor of Philosophy Emeritus
Los Angeles Pierce College
Woodland Hills, CA 91371

J. J. THOMSON, ANGLICAN

It so happened that my first graduate course was given by one of the early (after 1895) research students at the Cavendish Laboratory. I asked the professor to give a talk to young people on "My Religion as a Physicist." He replied, "Although I attend church regularly, I just don't talk about it." He was following in the footsteps of his mentor, J. J. Thomson.

Joseph John Thomson was born December 18th, 1856, in Cheetham Hill, a Manchester suburb. His father, Joseph James, a bookseller and publisher, died when he was sixteen. His mother, Emma Swindells, lived until 1901. He and his brother, Frederick Vernon (younger by two years), used to spend their summer holidays with her. At thirty-four, he himself married, in the church of St. Mary the Less, a sometime physics student, Rose Elizabeth Paget, daughter of the Regius Professor of Physics at the University of Cambridge. They had two children, George Paget and Joan Paget. Their home became a social center—at first breakfast parties, later teas, finally dinners—all more a duty than a pleasure.

At fourteen, intending to become an engineer, he entered Owens College (Manchester University, 1880). There he studied with Osborne Reynolds and Balfour Stewart, who sparked his interest in physics. (He received awards in mathematics and engineering at the ages of sixteen and eighteen; he had no chemistry.) At twenty he entered Trinity College, Cambridge, where he obtained first a minor scholarship and sizarship, then a major scholarship, and finally an Exhibition. Four years later he became a Second Wrangler and Smith Prizeman; in the same year he received his degree and a fellowship at Trinity where for two years he taught eighteen hours per week. At twenty-six he received the Adams Prize for his essay on vortex rings. The next year he became Professor of Experimental Physics at Cavendish, succeeding the third Lord Rayleigh, who had resigned. (He was naturally clumsy with his hands and always had to have laboratory assistants.)

His whole life was one of great devotion to Trinity. In 1918 he was appointed its Master by the Crown, and in 1919 he resigned his professorship (Ernest Rutherford succeeded him), at which time he became an unsalaried professor. As an administrator, he was never very businesslike and only occasionally punctual in his correspondence (he never had a full-time secretary). Nevertheless, his interest in research and personal enthusiasm helped to develop one of the great physics centers of all time.

At twenty-six he published his first paper in the Philosophical Magazine (on the mass increase of a moving electric charge). The year following he was made a Fellow of the Royal Society. Not until 1893, however, did he become interested in the discharge of electricity through rarefied gases; he included a chapter on it in his "Researches on Electricity and Magnetism," a sequel to Clerk Maxwell's "Treatise" (1873). He encountered intrinsic difficulties with cathode rays (J. Plücker 1859). The latter, however, were minimized with the discovery of ionization produced by X-rays (W. C. Röntgen 1895). He and Rutherford produced a fundamental paper regarding this in 1896. The peak of his scientific career came in 1897–98, when he measured e/m (e charge, m mass) for "corpuscles" in cathode rays, from photo-electricity, and from thermo-electricity. Obtaining approximately the same values in each case, he identified the charge with the unit suggested by H. L. F. Helmholtz (1881), named "electron" by G. J. Stoney (1891), and used by J. Larmor (1894). Having determined e statistically, he concluded that m was approximately $1/1000$ the mass of a hydrogen atom. In 1903 he published a book on "The Conduction of Electricity in Gases." Two years later he began work on positive rays (E. Goldstein 1886), which provided a new method of separating different kinds of atoms and molecules with respect to their masses (cf. his book "Rays of Positive Electricity," 1913). In 1906 he was awarded the Nobel Prize in physics for his work on the conduction of electricity through gases.

A diligent researcher, Thomson was also an inspiring teacher. Although himself a mathematician, he preferred to employ intuitive visualization. For him theory was a policy—not a creed. He emphasized the educational value of reasonable research (advanced laboratory work, he feared, was often more difficult than research itself), and he regretted the lengthy preparation of abstruse, detailed exam questions. He deplored the ever increasing text-book load, which retained the traditional old texts while introducing the more exciting new ones. With regard to curriculum, he objected to the emphasis on learning classics at the expense of science,

and preferred small classes led by an intelligent and enthusiastic teacher to larger more formal settings. Typically he shunned noisy conferences in preference to quiet reading—although in 1893 he did organize the Cavendish Physical Society, a colloquium.

He himself was an excellent lecturer: he spoke clearly and audibly, and punctuated his lectures with numerical illustrations, citations from the history of science, and a few novel demonstrations. At forty he gave the Rede lecture at Cambridge, at fifty-eight the Romanes lecture at Oxford.

Thomson received many honors. In 1905 he became Professor of Natural Philosophy at the Royal Instutution. In 1919 he was made a member of the original University Grants Committee, and in 1921, President of the new Institute of Physics. He received twenty-two honorary doctorates (11 generic, 5 in law, 4 in science, 2 in philosophy), including the LL.D. from Princeton and Johns Hopkins and the D.Sc. from Columbia. His fourteen medals included three from the Royal Society (Copley, Hughes, Royal). He was President of the Royal Society, the British Association, the Cambridge Philosophical Society, the Faraday Society, the Junior Institution of Engineers, the Physical Society of London, and of the Association of Special Libraries and Information Bureaux. He was knighted in 1908 and awarded the Order of Merit in 1912. He died on August 30th, 1940, and was buried in Westminster Abbey near Newton and Rutherford.

J. J. had a diversified interest in people and life per se. Modest himself, he liked meeting all of the undergraduates, not just the clever ones. He enjoyed reading wholesome novels and good mysteries. Often he would be the only spectator from his own college to attend an intercollegiate Rugby match. He was a versatile conversationalist, who could talk on almost any subject barring music. He gave lively lectures which were more anecdotal than didactic, and preferred to arouse enthusiasm in his students than to merely impart knowledge. He was always accessible and hospitable, never seeming to be in a hurry, and was noted for his tact and kindness to his staff. He loved children and his family, and provided well for them in that he left a considerable fortune (albeit only one patent). Appreciation for the beauty of the natural world was not lost upon him, and he was wont to recommend scenery to young people. He liked flower gardens, and in his old age he mused that he would have liked to have been a botanist, perhaps a plant physiologist.

Like many of his countrymen, J. J. was reserved about his religion. He did not join his mother and brother in devoting much energy to parochial church work. The Masters of Trinity prior to him had all been in religious orders. As a professor, however, he did attend the Sunday evening college chapel service, and as Master, the morning service. He was a regular communicant in the Anglican Church. In addition, he showed an active interest in the Trinity Mission at Camberwell. With respect to his private devotional life, J. J. would invariably practice kneeling for daily prayer, and read his Bible before retiring each night. He truly was a practicing Christian!

Raymond J. Seeger

(NSF Retired)
4507 Wetherill Road
Bethesda, Maryland 20816

This is the eighteenth in a series on religious scientists.

BOOK REVIEWS

ORIGINS OF LIFE by Jim Brooks. Lion Publishing Corp., Belleville, MI (1985). 160 pages.

Origins of Life is a well made hardback with many excellent color pictures and diagrams of *National Geographic* quality but with a more academic text. The first half presents commonly accepted theories on the origin of the universe, stars, solar system, and planets. Chapters on the geologic column, radioactive clocks, and chance or purpose precede chapters on early earth conditions, chemical evolution theory and evidence, molecules in interstellar space, meteorites, life from outer space, and the fate of the dinosaurs. The book is seasoned throughout with short, appropriately placed references to God as Creator and concludes with a chapter on science and creation. Brief explanations of radioactivity, plate tectonics, DNA, the chemicals of life and other foundational information are presented in "boxes" for readers unfamiliar with these topics. A glossary, an index, and a short selection of helpful books and papers support further study.

Origins of Life is a very readable, brief, general summary of origins suitable for both scientists and nonscientists. Jim Brooks was generally objective in handling both science and scripture. He balanced statements of fact with the tentative and open nature of science. Ideas with little or no direct supporting evidence were appropriately referred to as speculations, inferences, extrapolations, possibilities, and probabilities. Dr. Brooks' background as a British geochemist was reflected in a world-wide selection of pictures and examples that focused on England, Canada, and Australia. This book complements other books, such as *The Mystery of Life's Origin* by Charles Thaxton *et alia*, which explore abiogenesis

Books Received and Available

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

D. Baker, *Beyond Choice: The Abortion Story No One is Telling*, Multnomah Press

J. Ellul, *The Humiliation of the Word*, Eerdmans

S. Ferguson, *A Heart for God*, Navpress

F. Gaebelein, *The Christian, The Arts, and Truth*, Multnomah

S. Gaede, *Where Gods May Dwell: On Understanding the Human Condition*, Zondervan

J. Gillies, *A Guide to Compassionate Care of the Aging*, Nelson

R. Gram, *An Enemy Disguised: Unmasking the Illusion of Meaningful Death*, Nelson

R. Hutchcraft, *Peaceful Living in a Stressful World*, Nelson

G. Jantzen, *God's World, God's Body*, Westminster

J. Kirk, *The Mind Polluters*, Nelson

R. Lundin, A. Thiselton and C. Walhout, *The Responsibilities of Hermeneutics*, Eerdmans

H. Malony and A. Lovekine, *Glossolalia: Behavioral Science Perspectives on Speaking in Tongues*, Oxford

B. Ramm, *An Evangelical Christology: Ecumenic and Historic*, Nelson

G. Rauch, *Handling Conflict: Taking the Tension Out of Difficult Relationships*, Servant

J. Talley, *Reconcilable Differences: Mending Broken Relationships*, Nelson

S. Travis, *Christian Hope and the Future*, IVP

J. Wenham, *The Enigma of Evil: Can we Believe in the Goodness of God?*, Zondervan

more thoroughly, but focus less on cosmological aspects of origins.

Brooks firmly believes that God is Creator and that the earth is very old but is not dogmatic or prescriptive about mechanisms. He presents four theories about the origin of life on earth: supernatural creation by God, spontaneous generation, universal life (panspermia), and abiotic synthesis. He wisely resisted the temptation to add to Genesis, which he did not discuss in detail.

In summary, Brooks has written one of the more readable, balanced, attractive treatments of origins. Some will wish for a citation of sources in order to explore certain positions in more detail. Most readers will be satisfied with the amount of information, level of detail, and number of alternatives considered.

Reviewed by L. Duane Thurman, Oral Roberts University, Tulsa, Oklahoma. 74171.

THE NATURAL LIMITS TO BIOLOGICAL CHANGE by Lane P. Lester and Raymond G. Bohlin. Zondervan Publishing House, Grand Rapids, Michigan (1984). 207 pages. Paperback.

This book is possibly the most sophisticated recent analysis of the theories of biological change from the standpoint of limited change. The authors, trained in the relevant disciplines, make a scientifically sophisticated case for an intrinsic limit to biological change. They begin with an excellent overview of modern genetic and ecological theory, continue with careful summaries of the "modern synthesis" and "punctuated equilibrium," follow them with thoughtful critiques, and conclude with their suggestions for an alternative viewpoint—change within limits. Their review of the literature, although necessarily limited, touches most of the major areas of theoretical and research interest in current evolutionary science.

Nevertheless, I feel the book has subtle problems, places where the authors' model of biological change influences both the presentation and interpretation of data and perhaps also their theology. Take gene duplication, for instance. If organisms are functions of their genomes, unlimited biological change requires unlimited acquisition of novelty in the genome via structural and regulatory sequence mutations. Gene duplication allows a gene's function to be maintained and mutated at once. On page 87, the authors present as a problem the loss of a gene's original function as it mutates toward new function. Later (p. 90), they discuss gene duplication without pointing out that the problem is thereby solved. On both pages 90 and 160 the possibility of a duplicate gene's mutating to fill a new functional role is denied, and only one example, that of hemoglobins, is cited. Other examples exist, however, such as the homology of the Trypsin group of digestive enzymes with the proteins of the clotting cascade. Similarly, on page 160 Campbell is misinterpreted to say that the gene descends into gibberish in order to reascend to new meaning, rather than occasionally *avoiding* gibberish in order to make a lateral transit into alternate meaning.

The concept of neutral mutations is discussed on pages 87 and 105. Most mutants are there said to be harmful, or occasionally negligible, but never different in function. In reality, the *majority* of likely substitutions involve similar amino acids and the *majority* of sites in most proteins are not functionally critical, hence the basis of the "molecular clock." Such mutations can change qualities such as enzyme pH optima, and might therefore "preadapt" an enzyme to function in a different environment. Interestingly, the authors view "molecular clock" taxonomic differences (e.g., in cytochrome *c*) as contemporaneous adaptive differences (page 174), rather than as neutral accumulations over time. However, homologous proteins of different species are so similiar that a very few minor substitutions could turn one into another. Thus, if their sequence differences are adaptative, a high probability of favorable mutations has been demonstrated!

The authors raise similar arguments against mutations of the regulatory genome, suggesting that due to those sequences' critical nature, changes are likely to be "overwhelmingly destructive." True, complex effects might thus be easily produced, but slight changes in recognition sequence might only slightly change rates of a protein's synthesis. Surely here too there will be a continuum of change.

In this largely unknown area the authors locate their

suggested mechanisms for limits to biological change. The limits consist of a common developmental and regulatory pathway inherited from the "prototype" (the author's term for the first parents of a created kind). They suggest that such patterns on the DNA can be complex enough to "unroll" into a wide variety of species under the pressure of recombination and natural selection. In the meantime, mutations occur, gradually "fuzzing" the initially perfect adaptations, but are largely removed by the "cybernetic" effect of natural selection. They urge an intensive investigation to identify the original kinds (prototypes) on the basis of common developmental pathways.

This proposal has several problems. First, how extensive could the hidden diversity of the original "prototypes" be? After all, annelids and mollusks both develop via trochophore larvae. Could God have hidden all the forms of both phyla in one primordial organism? Quite a Chinese box! How can there be an objective measure of which levels of developmental pathways could have been encoded in common DNA, and which could only have been due to common ideas in the mind of God?

Second, if natural selection acts "cybernetically," one needs to consider the critical parts of cybernetic systems. The central element is a preset norm to which the system condition is compared and returned by system mechanisms. In this proposal, that norm must be the "limit" written in DNA language on the chromosomes. However, natural selection compares an organism with the *environment*, not with the internal DNA program. If the system is cybernetic, the prototype norms of a population must be written upon their environment, not in their genes. If so, change becomes the norm.

In any case, the concept of absolute limits to biological change presupposes that the encoded limits themselves will remain unchanged. Environments change constantly, hence the need for "tracking" DNA mutates. How are the "norm" sequences themselves prevented from mutating? If they do, would not natural selection cause the organism to change to match the mutated norm? Can you have absolute limits to biological change if the limits themselves are encoded on a mutable medium? The *limits* can evolve. If they can't where are they located? The advantage of a "platonic ideal" prototype in the mind of God is that it is immutable. Unfortunately, it also can not be investigated.

I'm afraid that the major problem revealed by the authors' view of biological limits is an inadequately biblical theology. Instead of a presently active creator who is "sustaining all things by his powerful word," we are presented with an absentee craftsman who has placed a material caretaker, the cybernetic limit mechanism, within each organism's DNA to rule over it and sustain its created pattern. Mutations are seen as products of random natural forces, attacking the creation order, rather than part of the "all things" which "in him" "hold together." Even the process of "unpacking" the hidden variation of the "prototype" seems to need only autonomous natural processes in order to create descendent species. This is not a theistic view of origins. It is pure deism. Worse, the biological world which God preprogrammed seems to be a sort of materialistic Platonism, in which each "prototype/ideal" is encoded into DNA, and bodies are projections of those "ideals" forced upon rebellious chaotic (mutating) matter.

On page 179, the authors state that a theistic view of origins will affect one's world view (and thus one's science), just as the acceptance of any form of evolution will. Theism, however, *is* a world view, a global view of the nature of reality. What is evolution? The book seems to imply that it is simply the idea of a common ancestry for all life, a proposed description of history. So would be the creation (sudden abiotic appearance?) of "prototypes." Each predicts certain patterns of data, but as the authors rightly point out, the meaning of data for us depends on our presuppositions. "The inability to recognize our own set of presuppositions can have devastating effects." Consider these two presuppositions: "The ordinary laws of nature are—or are not—due to the continuous free action of God." If the law is autonomous, an evolutionary history must be completely autonomous; i.e., it would comprise a situation equivalent to that of materialism. Likewise, if law is autonomous, "prototype" creation would be deism. God would be proscribed from acting on organisms after their initial fashioning. In contrast, if law is God's free and continuous action, He could call "prototypes" into existence, hold them in stasis, and cause them to change at any time, to any extent, and by any method (including mutation) He so chooses. "Shall what is formed say to him who formed it, 'Why did you make me like this?'" Clearly, the necessary link of an evolutionary scenario to a materialistic world view depends upon the unbiblical presupposition of the autonomy of matter and natural law. The authors are right. "The single most basic presumption is the existence or nonexistence of God." But which God will we presume? The remote craftsman/spectator of the deist, or the one "in whom we live and move and have our being?"

And yet, this presuppositional critique probably applies equally to most of us in the twentieth century, enveloped from birth in a world view which presumes that the autonomy of material processes is self-evident. It is hard for us to believe that good science can be done without such a presupposition. But it was, for three hundred years. The God of all providence is a faithful God.

> Thus we rise to a conception of both Divine power and Divine goodness; and we are constrained to believe, not merely that all material law is subordinate to His will, but that He has also (in the way He allows us to see His works) so exhibited the attributes of His will as to show himself to the mind of a man as a personal and superintending God, concentrating his will on every atom of the universe." (Adam Sedgewick, about 1840)

This critique should also not be taken as a statement that an

internal or external stasis mechanism isn't possible (under God's direction!). Indeed, the concept of mechanisms for stasis is one of the hottest debates in evolutionary theory (see *Quarterly Review of Biology*, Vol 61, No. 2, 1985). The real difficulty most investigators have with punctuated equilibrium is not the concept of "rapid" change (possibly at speciation), but rather the multi-million year stasis between changes. The authors' proposals indeed ought to be tested most thoroughly. Perhaps we can yet discover in what way God has chosen to create.

Reviewed by David L. Wilcox, Department of Biology, Eastern College, St. Davids, Pennsylvania 19087

METAPHYSICS: Constructing a World View by William Hasker. InterVarsity Press (1983). 132 pages, incl. bibliography. $4.95.

Christians active in the scientific exploration of reality probably devote little of their working time to metaphysical speculation. Yet, these are concerns of genuine and deep interest to them if they wish to develop genuinely thoughtful, articulate, and coherent perspectives on the reality they investigate and in which they live. What sort of reality does the world have? Does the picture of the world given by modern physics undermine our belief in the reality of everyday objects? How is God to be understood as relating to the world? As absent, or as identical with the world, or as its Creator and Sustainer? Are human actions really free? How does the deterministic picture assumed by the sciences impinge on notions of freedom and dignity when applied to the human person? What is the relation of mind and body? Are minds real and distinct existences or merely the workings of physiological brains? In *Metaphysics*, these foundational metaphysical questions—and others—occupy the attention of one of evangelical Christianity's most skillful and incisive philosophers.

Hasker, professor of philosophy at Huntington College, Indiana, is deeply involved in the contemporary philosophical scene, actively engaged in philosophical conferences and contributing to journals, working largely in metaphysics. The book itself is part of a new series edited by C. Stephen Evans, until recently of Wheaton College, now of St. Olaf College. This series should be taken note of by Christian intellectuals in all disciplines. It includes David L. Wolfe's book *Epistemology*, Arthur F. Holmes' *Ethics*, and Evans' *Philosophy of Religion*.

In chapter 1, Hasker introduces metaphysics, that branch of philosophy in which we ask such questions as "What is real?"; "Which realities are ultimately real, and which are only derivative;" "What are the basic constituents of reality?"; and "Are the constituents identified by science all of the 'ultimate reals' that conspire to make up things?" Metaphysics also asks what the place of human beings in the broader context of reality is.

Answering metaphysical questions, according to Hasker, is primarily a matter of giving good reasons for what we believe and for the assertions we make. Reasons are good if they can be shown to be based on other things we know to be true. Hasker gives two basic rules for doing metaphysics. First, we may take as premises for a metaphysical argument anything we know or have good reason to believe to be true. Second, no belief, no matter how firmly held or apparently well supported, is beyond the appropriateness of challenge or questioning. That means that philosophy is, in Hasker's words, a "completely non-dogmatic subject. Nothing is accepted merely on authority."

This, of course, raises questions for the Christian who works in metaphysics. After all, doesn't Christianity tell us about the world; can we have a branch of study, such as metaphysics, which does not assume Biblical presuppositions? For Hasker, "in the Christian's philosophical work, he is concerned not with the validation of the truth through Divine revelation, but with what can be said about them as well as about other things on the basis of ordinary human methods of understanding and inquiry." Just as does the ordinary believer, the Christian philosopher holds to a belief in the incarnation of God in Jesus Christ, and does not need to establish this truth as a conclusion of a philosophical argument.

After the first chapter introducing metaphysics, he discusses freedom and necessity in light of the deterministic challenge to free will and human personality. In the third section he talks about the mind-body relationship, defending his own emergentist form of dualism. Emergentism holds that the "soul field" emerges as a result of the organization and functioning of the brain and nervous system. In his chapter on the world, he discusses idealism (reality is ultimately mental, not physical), scientific critique of realism (the material world exists independently of consciousness), and the consequences of scientific realism; and opts for what he calls the scientific picture of the world, which he calls "one of the major accomplishments of our civilization." Hasker says that "science may not provide a complete explanation of human existence, but it provides important insights into human life and behavior which cannot be ignored."

In the chapter entitled "God and the World," Hasker talks about the relationship between the Christian concept of God and metaphysics. He discusses naturalism (the world without God), pantheism (God as identical with the world), panentheism (God including the world), and opts finally for theism (God as the distinct Creator of the world, who stands apart from and alongside his creation).

In conclusion he asks whether there can be a Christian metaphysic, and admits that his book does not provide a system of Christian metaphysics. He rather sees the book as helping to focus some of the issues with which Christian metaphysics must deal. Any Christian metaphysic first of all must speak of God as the supreme, ultimate reality, the sovereign and sole creator. Secondly, a Christian metaphysic must speak of creation, that God has bestowed being on other entities besides himself, including the heavens and the earth. And lastly, a Christian metaphysic must speak of man as being in the image of God. Human beings are different from other animals and other entities of the world because we are in God's image. Hasker concludes by providing options for how Christian metaphysics may proceed.

Hasker's *Metaphysics* is highly recommended as a treatment that is introductory, yet technically accurate and professionally competent. It should serve as a stimulus for further study and reflection as we attempt to integrate our scientific, philosophical, and faith commitments.

Reviewed by Dr. David B. Fletcher, Department of Philosophy, Wheaton College, Wheaton, Illinois.

SCIENCE, ACTION, AND FUNDAMENTAL THEOLOGY: Towards a Theology of Communicative Action by Helmut Peukert, trans. by James Bohman. MIT Press, Cambridge, MA (1984). 364 pages. Cloth; $35.00.

This is a profound and difficult book—an informed analysis of the problem-laden search for normative foundations of human thought and action. First published in 1967 as *Wissenschaftstheorie Handlungs-theorie—Fundamentale Theologie*, the volume presents Peukert's attempt "to develop a fundamental theology from the theory of communicative action" (p. xxiii).

As this last term implies, Peukert depends on a theological transformation of Jürgen Habermas' theory of communicative action. For the philosophically adept, then, the place to begin is with Habermas' *Theory of Communicative Action*, volume 1, *Reason and the Rationalization of Society, and volume 2, System and Lifeworld: A Critique of Functionalist Reason*, translated by Thomas McCarthy, and published in 1984 by Beacon Press. This two-volume *summa* includes, clarifies, and extends much of the previously published theoretical work by Habermas. For those new to the body of "critical theory," McCarthy's exegesis of *The Critical Theory of Jürgen Habermas* (MIT, 1978) is an indispensable introduction. *Habermas: Critical Debates*, edited by John B. Thompson and David Held (MIT 1982), and R. J. Siebert's *Critical Theory of Religion* (Mouton, 1985) are also useful. Peukert's construction of a fundamental theology also involves appropriating the work of Rudolf Bultmann, Karl Rahner, and Johann Baptist Metz. More of this later.

Though the historiographic model of unremitting "warfare" between theology and science is no longer tenable, it remains true that over the past few centuries an increasingly dogmatic and positivistic scientific mentality has declared open season on most everything to do with religion, from presupposition to practice. In the twentieth century the high priests of science have tended to reduce theology to some version of social functionalism or psychological projectionism. Scientific metaphysicians have often claimed to have demonstrated their denial of any legitimate status—intellectual or social—for theology. Peukert takes non-theistic, scientific challenges to theistic belief-systems seriously. Granting the validity of its own premises and principles, the autonomy and integrity of the sciences must be respected. It is with a real body of knowledge, practice, and attitudes concerning the world that theology must speak. Once this dialogue begins, Peukert contends, theology will discover that scientific rationality has reached certain limits that challenge from within the credibility of science's claims to exclusive truth and objective omni-competence. It's not that the late nineteenth-century God of science is dead, or even limping, but that science (and the world it studies) can now be seen as a thoroughly human product. Recent history, sociology, and philosophy of science now recognize the presence within science of constitutive social and ideological elements, of unexamined and gratuitous presuppositions, and of what could be called "transcendent" intersubjective concerns that skew its own self-understanding. Peukert stresses the move in philosophy of science and linguistic analysis toward developing some theory of communicative action as a foundation for their own methodological and productive operations. Ordinary language, with its goal of intersubjective communication and action is seen as the ultimate basis for any working discipline. Peukert argues that even the introduction of metatheories and metalanguages (always a popular past-time among theoreticians) must be related via some "hermeneutical circle" back to ordinary language and "communicative action."

Peukert regards the theological renderings of Heidegger's existentialism and Kantian transcendentalism as significant resources for the construction of a fundamental theology for our time. Thus, Appendices I and II are devoted to analyses of the work of Bultmann and Rahner, respectively. However, as Peukert states in his Introduction, he is seeking to situate his fundamental theology in the context of political theology. This intention inevitably exposes limitations in both existential and transcendental interpretations of history and human subjects. It is here that Peukert turns to Metz's reading of fundamental theology as an eminently practical and political enterprise that seeks to be socially relevant and responsible by securing theoretically and normatively the foundational categories of political theology (e.g., history, work, solidarity, liberation).

Along with Metz, then, Peukert is working to make fundamental theology more historically concrete and politically practical. In a systematic way, and at a basic level, theology must be aligned with the interests of the oppressed and the poor, in solidarity with those who are pushed to the margins of society through institutionalized violence and injustice. Given these commitments and the necessity for interdisciplinary dialogue, Peukert argues that it is Habermas' critical theory of communicative action that is best equipped to establish the insights and methods of political theology in a new, more practical, fundamental theology.

Science, Action, and Fundamental Theology is divided into two major parts. Part I, which concerns modern developments in linguistic theory and philosophy of science, is a difficult, technical, and complex beginning to a difficult, technical, and complex book. Here, Peukert covers the move of scientific naturalism away from the anti-theistic bias and logical positivism in early Wittgenstein and the "Vienna Circle" (chapter 1), through the collapse of the "verification principle" and the implications of Gödel's "completeness theorem" (chapter 2), through various transformations in the philosophy of empirical science, including Popper's principle of "falsification" (chapter 3), up to "speech-act" theory,

Chomsky's linguistics, and the "turn to pragmatics" in late Wittgenstein (chapter 4).

The upshot of this movement is the recognition that the search for normative foundations of scientific rationality requires a theory of "communicative action" that accepts the basic value and importance of ordinary human language and interpersonal activity. The author's point is that science has introduced questions of history and social relations into its quest for foundational self-understanding. This turn of events in philosophy of science and language, Peukert argues, has special significance for sociological method (chapter 5), for the reconstruction of Lorenzen's concept of "life-world practice" and the Erlangen School's proposed "constructivist theory of science" (chapter 6), and for theories of communicative action (chapter 7).

Part II concerns the appropriation of Habermas's work in the articulation of a fundamental theology. Peukert sees fundamental theology and philosophy of science coverging upon a theory of communicative action (chapter 8). He is critical of any attempt to develop fundamental theology in opposition to, or even in isolation from, the concerns of scientific theory and method (chapter 9). One reason for this is his belief that theology requires some theory of communicative action for its own analysis of social relations.

In chapter 10 Peukert offers a critique and a comparison of the communicative action theories of Mead, Apel, and Habermas, ending with a rejection of all claims to theoretical self-sufficiency. The ideals of communicative action—"mutual recognition," "universal justice," "unrestricted community" and the like—run into difficulties when faced with the limiting case of "anamnestic solidarity" (a notion related to Benjamin's "empathetic memory"). The fact that "those human beings who have sought to act in solidarity, to whom we owe the very possibilities of our own lives, have been annihilated without blame or guile" makes anamnestic solidarity paradoxical (p. 231). Indeed, it marks "the most extreme paradox of a historically and commnicatively acting entity," for "One's own existence becomes a self-contradiction by means of the solidarity to which it is indebted. The condition of its very possibility becomes its destruction" (p. 209). Reaching the limit of communicative action theory, Peukert proceeds to theologically transform that theory in the service of fundamental theology.

In the eleventh and final chapter Peukert argues that Judeo-Christian belief is concerned with the reality of paradoxical "limit experiences" and with "the kinds of words and acts still possible in the face of those experiences" (p. 215). Fundamental theology "can and must be developed as a theory of this communicative action of approaching death in anamnestic solidarity and of the reality experienced and disclosed in it" (*ibid.*). Turning to the Bible, Peukert shows how the Exodus and exile traditions, the prophetic texts and gospel parables tell the stories of people who lived in "anamnestic solidarity" with the dead, defeated, and downtrodden. It is with the narratives concerning Christ's Passion, however, that we reach the summit of this solidarity, as well as the most critical question of God's reality and goodness. "If the one who in his existence asserts God for others is himself annihilated, is this assertion then not refuted? How can we still talk about God at all?" (p. 225). The New Testament, of course, deals with the despair of Good Friday by proclaiming the glory of Easter Sunday. While cries of "Christ is risen!" answer the agony and scandal of the Cross for believers, something more intellectually rigorous is required for philosophers, something more politically empowering for faithful activists. And so fundamental theology must devise an interpretation of Jesus' resurrection that opens up for people a way of relational existence-in-solidarity through liberating social action. Thus a theological theory of communicative action must somehow be wedded to political theology and to Christian theories of society and history (pp. 242–244). This fundamental theological work is still unfinished.

All this seems strange to English-speaking, Evangelical audiences unfamiliar with the often insular world of Germanic critical theory and philosophical and political theology. Any science-and-religion students who were disappointed with Wolfhart Pannenberg's *Theology and the Philosophy of Science* will probably not appreciate *Science, Action, and Fundamental Theology*. Still, many readers will find this an important and basic, if demanding, book for understanding the relations of philosophy of science to language and action, and the relations of theology to all of the above, and to society and politics.

My major regret is that Peukert was unable to consider the most recent literature in historical sociology of scientific knowledge, nor to discuss the current work of such liberation and political theologians as Juan Luis Segundo, José Míguez-Bonino, Gustavo Gutiérrez, Dorothee Sölle, Elizabeth Schüssler Fiorenza, and Rosemary Radford Reuther. This latter group of writers especially provide biblically-grounded and politically sensitive critiques of previous, ideologically-loaded hermeneutics and "fundamental" theologies.

Reviewed by Paul Fayter, Institute for the History and Philosophy of Science and Technology, University of Toronto.

THE CONCEPT OF GOD: An Explanation of Contemporary Difficulties with the Attributes of God by Ronald H. Nash. Academic Books, Zondervan (1983). 127 pages.

> This book is an invitation to think about God. It is an exploration in philosophical theology that focuses on classical and contemporary discussions of the divine attributes, especially as difficulties with those attributes are believed to raise doubts about the coherence of the concept of God. The days when philosophers were content just to ask if God exists are gone forever. Of course, they will continue to discuss the traditional arguments for God's existence. But in recent years, the attention of philosophers has been directed to an entirely different and more fundamental set of issues. The question today is not "Does God exist?" but "Is it logically possible for God to exist?" (from the author's Preface)

Panentheism, or process theology, sees severe problems with the classical Christian theistic position (which is also

described in the book as the Thomistic position). Professor Nash provides a very helpful introduction to the motivation behind both positions, and the major tenets of each. He then discusses particular attributes of God from the Thomistic "package" in successive chapters, to clarify and then to reinterpret them as necessary.

The chapter on omnipotence concludes that there is no contradiction in affirming that God is essentially omnipotent. Two chapters on omniscience result in the conclusion that statements in this area have to be carefully worded, but that there is no inherent problem in reconciling divine omniscience and human freedom. A chapter on eternity terminates without a conclusion as to whether God is timeless (exists outside of time) or everlasting (in time, but without end); Nash believes that theism could accommodate itself to either interpretation. The chapter on simplicity is certainly not simple, but concludes that this is not something that Christian theology must affirm. The chapter on immutability concludes that there is no reason not to affirm this attribute, even though humans "can make a difference to God." The final chapter, "Theism Revisited," affirms that the traditional theistic position should be modified slightly, but can be held against objections of process theology. The "modifications" proposed for the "traditional" view are certainly compatible with biblical revelation.

This book is easy to read. A great deal of useful material is packed into a small compass. I highly recommend it.

Reviewed by Dr. David T. Barnard, Director of Computing Services, Queen's University, Kingston, Ontario, Canada.

THE NATURE OF DOCTRINE: Religion and Theology in a Postliberal Age by George Lindbeck. Westminster Press, Philadelphia, PA (1985). 144 pages. Paperback, $9.95; hard cover $16.95.

The Nature of Doctrine addresses questions which are fundamental both for theologians and for all who are concerned with the relationships between theology and other disciplines. The basic concern, as the title suggests, is "What is doctrine?" Lindbeck analyzes the usual answers to this question, and goes on to argue for a post-liberal "cultural-linguistic" approach to this fundamental concern.

Lindbeck's study has its origins in his participation in ecumenical dialogue, especially those dialogues in which he has represented the Lutheran position in discussions with Roman Catholics. Such dialogues have often resulted in joint statements to the effect that considerable agreement has been reached on previously divisive issues, while each party to the dialogue maintains that its own position has not changed substantially. How can that be? Perhaps our difficulty in understanding such a result of doctrinal discussions stems from an inadequate understanding of what doctrine is.

One traditional approach stresses the cognitive aspects of religion and regards doctrines primarily as propositions about objective realities. This is characteristic of, for instance, traditional Roman Catholic theology and Lutheran or Reformed orthodoxy. On the other hand, liberal theology often concentrates on the "experiential-expressive" aspect of religion, and doctrines are regarded as "noninformative and nondiscursive symbols of inner feelings, attitudes, or existential orientations" (p. 16).

Neither of these approaches is able to deal well with that puzzling result of ecumenical dialogue, agreement without change. For the propositionalist, two doctrinal positions—that is, two propositional schemes—which disagreed in the sixteenth century must continue to do so forever. Agreement could be reached only by capitulation or compromise in which at least one of the parties changes its doctrinal stance. On the other hand, in the experiential-expressive approach, doctrinal constancy is of secondary importance, and religious accord must take place at the experiential level to be of real significance. Lindbeck thus finds both of these understandings of doctrine, as well as attempts to combine them such as those of Rahner or Lonergan, inadequate.

The alternative which the author proposes is a "cultural-linguistic" one, in which religions are understood as being similar to languages. Doctrines are then neither propositions which refer directly to objective reality nor symbols of experience, but "communally authoritative rules of discourse, attitude, and action" (p. 18). This theory may therefore be described as a "regulative" one. In this view the ecumenical creeds, for example, are not so much collections of correct propositions or expressions of Christian experience as they are rules about how Christians must speak of the fundamental matters of their faith. Lindbeck points out that this is not at all a new idea. Non-theological (e.g., sociological) studies of religion have often taken this view of their subject. In addition, the appeal of orthodox theologians to a "rule of faith" (*regula fidei*) is very ancient.

Different rules about, for instance, "the locus of infallibility" in the Church (pp. 98–104) may be in apparent contradiction. But it may be possible to resolve the conflicts by noting carefully in what situations the different rules are intended to apply. Thus Lindbeck's initial concern, that of making sense of ecumenical dialogues, can be dealt with by a regulative theory. That of course does not, in itself, mean that it is the superior theory of doctrine, and the author goes on to examine the adequacy of the different theories with some care.

Lindbeck's discussion is thus concerned not with the validity of various doctrines, but with the adequacy of different ideas of what doctrines are. The analysis is first carried out on a theoretical level (chapters 3 and 4). Chapter 5 then tests the regulative theory against its rivals by considering specific areas of Christian belief—the Trinity, the Incarnation, Marian dogmas and infallibility. The purpose of this discussion of specifics is not to determine which doctrinal positions are correct but to see how well the different theories of doctrine function in allowing the different positions to be expressed. "Can the theory make sense of these doctrines and yet not decide the substantive issue of whether they should be accepted?" (p. 91). Lindbeck's conclusion is that a regulative

theory of doctrine functions as well as, and in some ways better than, the alternatives.

In some ways Lindbeck's approach may be more congenial to conservatives, often accustomed to a propositional approach, than it is to liberals. The book's subtitle suggests a clearly felt need to go *beyond* liberal methodology, but that is not the same thing as going *back* to propositional orthodoxy. We might compare this with the situation in biblical studies, where the need to go beyond purely analytic historical criticism (as with recent attempts toward "canonical criticism") should not be confused with attempts to return to pre-critical views of biblical inerrancy.

Those accustomed to a propositional understanding of doctrine (and this probably includes most people concerned with the science-theology interface) will be particularly interested in the question of religious truth and in the distinction between ontological truth and intrasystematic truth. The "Excursus on Religion and Truth" (pp. 63–69) needs to be studied carefully in this regard. The cultural-linguistic approach allows the possibility that statements like "Jesus is Lord" are ontologically true—that is, that they are correct propositions about objective reality. But this is the case only when they are "used to mold lives through prayer, praise, preaching, and exhortation" (p. 69). *Doctrinal* statements, on the other hand, are "grammatical" statements about the proper use of the religious language. The point is not at all that objective truth is unattainable, but that, in a regulative theory of doctrine, doctrinal statements are not necessarily the most important ones that can be made.

Lindbeck's treatment of basic methodological questions of theology has some important implications for any kind of apologetic concern, including that of presenting Christianity in the context of the modern scientific world view. If the regulative approach is correct, the Tillichean "method of correlation" of identifying modern questions and then translating the gospel response so as to address those questions is a questionable procedure. Instead, one "seeks to teach the language and practices of the religion to potential adherents" (p. 132). How one is to "target" groups like those concerned with questions of faith and science is a question that Lindbeck does not address, although he does see serious practical problems in implementing his "catechetical" approach.

The Nature of Doctrine will reward the efforts of those who are willing to do some hard thinking about the character of the theological enterprise. It can help theologians, and all who are interested in theology, to get a better understanding of just what that enterprise is about.

Reviewed by George L. Murphy, Pastor, St. Mark Lutheran Church, Tallmadge, Ohio.

AN EYE FOR AN EYE: the Place of Old Testament Ethics Today by Christopher J. H. Wright. InterVarsity Press (1983). 224 pages. $5.95.

Christopher J. H. Wright believes that the whole Old Testament is relevant for modern ethical decisions. He rejects the separation of ceremonial and civil law from moral law, and contends that all of Scripture is useful today. *An Eye for an Eye* is his development of a way to understand the Old Testament, which avoids the perils of trying to remake the modern world in the image of ancient Israel, on the one hand, or spiritualizing away the concrete application of the Old Testament, on the other.

First, Wright presents a framework of Old Testament ethics, in which God is presented in covenant relationship with a people and with the land. He depicts this as a triangle, in which the covenant relationship can be seen with emphasis on God (the theological angle), the people of Israel (the social angle), and the land (the economic angle). He believes this three-fold relationship serves as a paradigm for knowing God's will in the world. The "existence and character [of Israel] as a society were to be a witness to God, a community" (p. 43). So God's promises and demands in His relationship with Israel can be studied in order to find patterns and principles to aid in ethical decisions now.

The second part of the book deals with themes in Old Testament ethics. This is a general application of the perspective presented in the opening chapters, but is not a detailed treatment coming to specific conclusions. Wright deals with economics, politics, justice, law, society, and culture, and the place of the individual in society. It is interesting that the individual is dealt with only in the last chapter, and, even then, as a part of the community. He believes that "the individual aspects of the Old Testament theology and ethics cannot be appreciated apart from an understanding of the community that God called into being in his election and redemption of Israel" (p. 197).

An Eye for an Eye is well written and coherent. It deals, in a satisfying way, with the whole person and the whole of life. While presenting an interpretation of God's will from creation, it takes into account the results of the fall, and the process of redemption. It indicates an approach to the Old Testament consistent with Paul's dictum that "all Scripture is inspired by God, *and useful*" (II Tim. 3:16). Wright has suggested the need for another book, to facilitate a detailed application of his paradigm to specific issues in the modern world. I, for one, hope that Wright himself will do that, since his treatment of the framework and major themes of Old Testament ethics is so satisfying to me.

Reviewed by Joseph M. Martin, Professor of Missions, Edward Lane Bible Institute, Patrocinio, M.G., Brasil.

ETHICS: APPROACHING MORAL DECISIONS by Arthur F. Holmes. InterVarsity Press, Downers Grove, IL (1984). 132 pages. $4.95.

This book is part of the Contours of Christian Philosophy series, edited by C. Stephen Evans. In a general preface he explains that the series consists of "short introductory-level textbooks in the various fields of philosophy." Holmes states (page 10) that this book in particular "is a Christian introduction to ethics, to both ethical theory and moral application. Ethics is about the good (that is, what values and virtues we should cultivate) and about the right (that is, what our moral duties may be)."

Four chapters "examine some widespread views that appear incompatible to a Christian ethic." Cultural relativism sees moral beliefs and practices as grounded in human needs and social conditions, and thus denies universal moral absolutes; ethical emotivism sees moral language as expressing or arousing emotions, so truth and falsehood are not applicable categories for moral terms; egoism considers the consequences of acts for oneself, and utilitarianism considers consequences for people at large. All of these are examined and found wanting for various reasons.

Three chapters then outline a proposed Christian ethic. Four "ingredients" are distinguished: particular cases, moral rules that apply to various areas, underlying principles, and theological or philosophical bases (presuppositions). Holmes argues that we gain moral knowledge via "biblical and material indications of God's purposes for us," or special and general revelation. Finally, the basis for obligation is God's nature and will. Thus, "moral language therefore refers ultimately to God's love and justice in relation to what he proposes for his creation."

Four chapters apply this ethic to various moral issues. Human rights, criminal punishment, legislation of morality, and sex and marriage are considered from a Christian perspective.

The final chapter, "The Ethics of Virtue," discusses what we should *be* as opposed to what we should *do*. For a Christian, ultimate recourse is to the grace of God that "builds within us the virtues of godly character."

The book is concise and cogent, and can be recommended as an introduction to Christian ethics.

Reviewed by Dr. David T. Barnard, Director of Computing Services, Associate Professor of Computing and Information Science, Queens University, Kingston, Ontario, Canada.

THE CREATION OF WEALTH: A Christian's Case for Capitalism by Brian Griffiths. InterVarsity Press (1984). $5.95.

Much has been written on economics and its relation to Christianity and ethics. Like the science and faith literature, such material often centers on inappropriate questions addressed by writers unfamiliar with both the method (theory) and results ("facts"), in this case, of modern economics. Religious and political convictions, orthodox or otherwise, tend to predominate in discussion. Of course, men who do not necessarily have a background in economics are involved daily in economic activity, and so economics is often more closely linked to political and social views than to the "science" of economics itself. Accordingly arguments concerning economics, not necessarily edifying, readily arise.

Griffiths, an economist and business school dean, and former central banker, for the most part escapes such general criticism in his book, which, as indicated by the title, deals with the question "Is Capitalism Christian?" He is explicit in denying that this is a meaningful question: the Bible does not outline an economic system-*cum*-Utopia, though it does describe appropriate *individual* behavior. He similarly takes up other related questions, in chapters on the economic, theological, moral and ideological dimensions of the "income generation." On the whole Griffiths accomplishes the task he sets for himself, though his discussion of economics is filled with many inaccuracies, poorly framed or dubious arguments, and careless statements—ironic given his background.

To give some examples of his economics, in his second chapter he argues that in practice the Western economies are inherently more efficient. In economic theory, faultless planners produce the same results as a faultless market; in the real world they do not, but different systems do have different strengths and weaknesses in the face of sin. He does not attempt to ask or answer the question which this implies, but instead focuses on only one of many criteria, that of per capita GNP growth. He also compares extreme cases, biasing his results. Hence while his conclusion may be proper, his arguments do not support them; some use of the tools of comparative economics would have been appropriate. But in general he is successful in sidestepping the "capitalism" versus "socialism" debate, noting that changing the system does not remove the source of problems, that only the Cross provides a way. Other examples of poor economics in the book are Griffiths' discussion of development, where he follows Lord Bauer on the role of investment, in contradiction to all attempts at growth accounting, and implicitly claims the irrationality of the peasant, in opposition to the Nobel prize work of Schultz. (To his credit he does have one or two interesting observations, such as the possible dependency of measures of income distribution on the demographic profile.)

Another weak area is his discussion of the importance of public (British) morality for an economy. It is tempting to blame economic problems on declining morals, but the interrelationships are unclear, and I have seen no evidence to indicate that current morals as they relate to economics are worse than their historical average, however great the contrast with the early post World War II era. Weber, to whom he refers, was concerned with the origins of "capitalism," not with its spread or current strength; and it is easy to find examples which would indicate that good morals have not been enough to bring about prosperity, nor non-Christian morals (e.g., Japan, California) enough to prevent it. He

would do better to expand his overly short list of economic reasons for Britain's poor performance.

His subsequent chapters are much better, and in places stimulating. His discussion of stewardship is good; he points out that the condemnations of the prophets were of the immorality of the rich, not of wealth itself. His handling of the ethics of "competition" correctly notes that the secular and the economic use of the term are quite different, and that economic self-interest (which means "efficient" behavior) is not immoral, though the goals to which it is directed may be. His critique of libertarian thinking is pointed: "the Bible does not condone a society of freely consenting adults." Finally, his tracing of the religious stance of the classical economists—starting from the Deism of Adam Smith—was both new to me, and thought provoking. It could readily be extended to the current equivalent of Smith's "Invisible Hand," general equilibrium theory. Despite widespread faith in this theory, equilibrium does not exist outside of the artificial Arrow-Debreu world, while even given existence (and endowment transfers), equilibrium would by the Arrow Impossibility Theorem not be desirable. Faith in economics, like faith in science, is dubious on its own merits, and certainly at odds with belief in the Lord.

Reviewed by Michael Smitka, New Haven, Conn.

FREE TO BE DIFFERENT by Malcolm Jeeves, R. J. Berry, and David Atkinson, edited and with Foreword by John R. W. Stott. Eerdmans (1985). 155 pages. $8.95.

Many twentieth century men and women seem to be preoccupied with demanding their rights and expressing their freedom to do what they want when they want. On the other hand social and biological scientists have been attributing much, if not all, of our behavior to our heredity and to our past and present environments. The age old controversy of freewill versus determinism is still with us and still far from settled. Based on their 1982 London Lectures for Contemporary Christianity, Malcolm Jeeves (Psychologist), R. J. Berry (Biologist), and David Atkinson (Theologian) have put together an insightful analysis of our present understanding of the problem.

In the first part of the book, Jeeves discusses environmental conditioning and concludes that "there is ample room for freedom within a deterministic science," but that, as Christians, our ultimate confidence and hope is in our acceptance by God through His grace. Berry gives us an up-to-date description of the deterministic role of our genes, but emphasizes how these genetic factors are often readily influenced by our environment. Furthermore, we can often choose our environments and cannot blame our misdeeds on either our genes or our environment. Atkinson attempts to answer the question, "What is the relation between God's grace and human freedom?" Grace is a God-originated word that refers to His creation and providence, His covenants, and His redemption. Such grace conditions our behavior in relation to God, to others, and to biological and physical circumstances.

In the second part of the book each author examines a specific case in which there is confusion between freedom and responsibility. Jeeves discusses the interplay of science and religion and concludes that religious beliefs, experiences, and behavior vary with numerous local, cultural, transient, and superficial factors. The essential continuity among Christians through the ages has been the centrality of Christ (Colossians 1) and the requirement that commitment be accompanied by appropriate behavior. I especially appreciated his reference to the "long-living scholarly space visitor who was given a research grant to make periodic visits to the planet Earth to study the behaviour of Christians living there." He visited Jerusalem (37 AD), Nicea (325 AD), Ireland (c. AD 625), England (1840), and Nigeria (1980); it is intriguing to think of how drastically different Christian behavior has been!

Berry discusses some of the problems with freedom and responsibility in regard to the biology, psychology, and theology of sex. After emphasizing that sex is not simply genetic, but also behavioral and hormonal, he concludes:

> The doctrines of predestination, of original sin, and of the primacy of Satan in this world, appear to me to be vastly nearer the truth than the "liberal" popular illusions that babies are all born good and that the example of a corrupt society is responsible for their failure to remain so.

He then proceeds to discuss sexual deviation, particularly homosexuality, in some detail. Perhaps because Berry was discussing an area of biology/psychology with which I am not too familiar, I found this section a bit confusing in spots. If I understand him correctly, he is concluding that we should view homosexuality (the condition) as a form of immaturity, to be dealt with as such, and not simply condemn it as a deliberate choice of evil. If this is a plea to understand the homosexual condition without approving the homosexual act—and I think this is one of the things that Berry is saying—then the author has given us a helpful introduction to a most serious problem in society today. He concludes the chapter with a good defense of heterosexual monogamy and the familiar, but all too often unheeded, prayer: "O God, give us strength to change those things we can change, the patience to accept those that we cannot change, and the wisdom to know the difference, for Jesus Christ's sake."

In the last chapter Atkinson discusses conscience as moral sense developed by both nature and nurture. He emphasizes that in both the Old and New Testaments there is the implication of a sense of morality and justice for all people. Furthermore, development of conscience involves maturing from mere external morality, with conscience only as a judge, to a personal morality in which conscience is both a judge and a guide. Within the bounds of Christian freedom we are free from the condemnation of the law, from other people's norms, from petty little do's and don't's, and from the past. However, our freedom of conscience must be limited by our dependence on God, by respect for our neighbor's conscience, by recognizeable differences, and by the requirement that we support the weak.

Two statements in the Epilogue summarize the challenge of the complex subject dealt with in this book:

> Our tendency is to blame the environment for our failures and take credit for our successes. At the same time, we tend to attribute total responsibility to others for their beliefs and actions, while lacking the sympathy to acknowledge the factors which have helped to make them the sort of people they are. The truth is that all of us are responsible within limits.
>
> But perhaps above all, we ought to regard our differences as a challenge and an opportunity—a challenge to become conformed to Jesus Christ rather than to the world, and an opportunity to contribute uniquely to God's purposes. For we are not automata, able to do nothing but react mechanically to our genes, our envirommment, or even God's grace. We are personal beings created by God for himself . . . What is true of us is equally true of others. We rejoice in our variety. We affirm with enthusiasm the unique temperaments and gifts which God has given to others as well as to ourselves, all to be used in His service.

This is a challenging, provocative, and worthwhile book. I recommend it, but you will certainly want to read it carefully—and more than once—to grasp the full impact of the issues discussed.

Reviewed by Wilbur L. Bullock, Zoology Department, University of New Hampshire, Durham, NH.

BRAVE NEW PEOPLE: Ethical Issues at the Commencement of Life, rev. ed., by D. Gareth Jones. William B. Eerdmans Publishing Company, Grand Rapids, MI (1985). 207 pages. Paper; $8.95.

The eighteenth century cleric, George Berkeley, once observed . . . "We are indeed (to our shame be it spoken) more inclined to hate for those articles wherein we differ than to love one another for those wherein we agree." *Brave New People* and the reaction to it, especially in Christian circles, has demonstrated that the above conclusion is still valid. The author of this book must have been aware that the topics addressed were controversial but was not prepared for the vehemence of some readers. In its preface, the revised edition addresses the explosive responses to the first edition (1984, IVP). This Journal has also served as a corner of the arena (see *JASA*, 37 No. 3, Sept. 1985). Professor Jones holds an anatomy professorship at Otago University, New Zealand and identifies himself as a committed evangelical Christian deeply concerned with the ethical issues and decisions that society faces today.

In chapter one Jones identifies this situation as a revolution in which the Christian (as well as the non-Christian) created in the image of God is faced with moral responsibility. The fall that fractured humanity tainted all existence including modern biomedicine even though biomedicine is a useful tool. Jones reviews some historical dilemmas of science and points out that scientists are beginning to realize that scientific enterprise is not morally neutral. Ethical guidelines are required when scientific knowledge is applied. Christianity has the perspectives that are sorely needed to bring moral order to that which might otherwise become chaos. The author moves from general principles in chapter two to specific topics in the next five chapters: improving the quality of life; new techniques and the beginning of life; new beginnings to human life; tampering with heredity; and the ethics of therapeutic abortion.

Jones points out that although control has been at the heart of all modern medicine, the degree and precision of this control is escalating rapidly. The strides made in understanding such genetic diseases as PKU and Tay-Sachs are leading to the improvement of quality of life in many instances. The beginning of life and the contemporary questions, directions of research and biotechnology surrounding this event occupy the middle section of the book. Fertilization and conception, *in vitro* fertilization (IVP) and embryo transfer (ET), two variations of artificial insemination—husband (AIH) and donor (AID), cloning, and the moral and ethical questions surrounding the above topics are discussed. Jones concludes at this point: "People are not just an assembly of genes. Everyone is important; everyone has a dignity because of who they are in the sight of God . . . . Love of one's neighbor and, supremely, love of God are more significant than a fortuitous (or even partially directed) combination of genes."

In his most lengthy and most controversial chapter, "The Ethics of Therapeutic Abortion," Professor Jones, like Eve's mythical counterpart Pandora, received considerably more from his investment than was intended or expected. In the preface to the revised edition the author pleads with his readers to read from page one onwards and not to isolate chapter seven from its context. In this chapter he discusses the fetus and compares the stances that can be taken regarding the personhood of the fetus. He is aware that many other Christians interpret the data differently. He moves logically to consider perspectives on abortion, citing, for example, Joseph Fletcher, the Roman Catholic position, Paul Ramsey and Helmut Thielicke. A section on Biblical guidelines is followed by one expressing the most controversial of his positions, "Possible grounds for therapeutic abortion." The door he leaves ajar for himself here, as well as in the section "Abortion for genetic reasons," has admitted a host of antagonists. The *JASA* article cited illustrates the intensity of this reaction. Dr. Jones would reluctantly consider abortion as an admissable procedure, for example, in the case of Lesch-Nyhan syndrome or of Tay-Sachs disease. He does acknowledge that we do walk along a knife-edge relative to such decisions.

The book concludes with the chapter "Human Technology and Human Values," the first section of which is entitled, ironically in this case, "Towards an uncertain future." Jones observes that the topics addressed in the book, both developed and incipient, are part of the world in which we Christians live, and that the questions and dilemmas must be addressed in a Christian fashion. A suitable focus would be the task of remedying defects in order to diminish human suffering. He calls upon the biomedical professions to recognize their accountability to society. In the final two parts of this chapter, "Compassion and forgiveness," and "Individual uniqueness,"

the author urges us to apply Biblical guidelines. Jesus, when confronted with sin and human ills, moved in the direction of compassion and forgiveness rather than toward astringent condemnation and judgmental rebuke.

Professor Jones is to be commended for his courage and for causing us to face our responsibility as Christians to bring Scripture and our God-given minds together. Even though this results in a spectrum of positions and interpretations, Christian love and respect for the conclusions of others must be the mark of our discussions rather than an uncharitable sharpness toward one another regarding "those articles wherein we differ."

Reviewed by Frederick D. Shannon, Department of Chemistry, Houghton College, Houghton, NY 14744.

LIFE IN THE BALANCE: Exploring the Abortion Controversy by Robert N. Wennberg. Wm. B. Eerdmans, Grand Rapids, Michigan. (1985). 192 pages. paper; $7.95.

There are few books on controversial ethical issues—especially a complex issue such as the abortion debate—that grip the reader's interest and stimulate interaction with the material as well as this book by Robert N. Wennberg, Professor of Philosophy at Westmont College in Santa Barbara, California. Time and again the author cuts through the confusions of rhetoric, the misleading implications of naive thinking, and the temptation to present an emotional, ideological position, in order to provide the reader with a thought-provoking and well balanced analysis of the various theories and ethical positions that have been proposed to deal with the abortion issue. By publishing this book together with the recent reissuing of D. Gareth Jones' *Brave New People*, Eerdmans has made a major contribution to the abortion debate. Both books deserve serious reading and consideration by all Christians.

In three initial chapters Wennberg sets the stage for the discussion to follow, in order to achieve his purpose of providing a systematic moral evaluation of the abortion issue, combining the most effective contributions available from professional philosophy with a theological tradition that is orthodox and biblically based. Growing out of a course on "The Morality of Killing" given at Westmont College, the book argues that "biblical and theological considerations do not *narrowly* limit the positions open to us," and seeks to formulate its arguments in a form useful not only to evangelical Christians but also to the secular community.

He points out that consideration of the implications of an ethical theory is one of the first steps in evaluating it. In particular, if a person is morally compelled to reject the implications of a particular theory, then it is also necessary for him to reject the theory that leads to those implications. Similarly, if one is led to act in a certain way in response to authority, one must be sure that the action does not conflict with one's "persistent and deeply felt moral convictions." In all such considerations, however, the Christian community must consistently maintain that abortion is a moral issue, not simply a social or utilitarian issue.

Wennberg explores the principal factors that have contributed to making abortion such a serious social problem today: (1) great improvements in safety with a concomitant decrease in the seriousness of the procedures, (2) the number of significant reasons for which women may be led to seek an abortion, and (3) the standing fact that abortion involves ending the life of what is at least a potential person. The author promptly avoids some of the confusing circumlocutions that confound discussions of abortion. He is clear from the start that the fetus at any stage is indeed alive, and constitutes unquestionably a case of human life: abortion terminates a human biological life.

In several places in the book the author emphasizes the difficulty of maintaining any essential difference between a fetus before birth and an infant after birth. Both are "subcortical" organisms, i.e., it is not until the tenth day after birth that the neocortex, that part of the brain responsible for the higher mental functions, shows signs of change. Thus the fetus and the infant have similar claims to life since both are subcortical creatures, but at the same time efforts to build a case on fetal behavior like thumb-sucking, feeding response, and the like may founder since the same responses can be found in an anencephalic, which has no chance of developing into a rational being.

No discussion of abortion can be complete without an evaluation of such questions as, "Is the fetus a person?" and "what is the role of the 'soul' in these considerations?" Although he acknowledges that the answers to these questions may be significant, the author also suggests that they may not play the ultimate role often ascribed to them, i.e., "the abortion issue would not be settled by a simple determination of whether the fetus is a person." One of the problems in using the concept of "person" revolves around the prickly question of definition—whether one who has the potential for rationality is intended, or one who has the actuality of rationality.

> To be sure, the biological basis for personal life is developing as the fetus grows, but personal life itself does not emerge in the womb at all, nor will it begin to emerge until some time after birth, when the socialization process begins . . . If an acquired rational capacity is the mark of personhood, then infants are not persons. Thus whereas both fetuses and newborn infants possess *biological* human life, neither one yet possess *personal* human life. (p.35)

In the development that follows, Wennberg essentially equates the terms "human person" and "image of God," and presents a useful analysis of the meaning of those terms. He provides a thoughtful analysis of what is meant by speaking of a fetus "having a soul" and concludes that one may well conclude that a soul is not some immaterial part of a human being, and that the contention that souls are intrinsically immortal is essentially non-Christian. This portion of his discussion, particularly in view of the "gradualist" position he later advocates, would be assisted if he did not speak continually of souls as something persons "have," but rather of something that persons "are," systems properties of the whole human being. His conclusion is that "the question of whether

fetuses have immortal souls is essentially irrelevant to the abortion debate."

The author then considers in detail the various theories that have been advanced to relate the "right to life" to some decisive moment such as conception, implantation, human appearance, viability, beginning of brain development, attainment of sentience, and birth. Such "decisive moment theories" are in contrast to "gradualist" theories, which claim that becoming a human person with a strong right to life is a gradual process extending over an appreciable period of time. In the course of this discussion, Wennberg deals forthrightly with such key biblical passages as Psalm 139:13–16 and Jeremiah 1:5, often supposed to provide key insights into the nature of the fetus and the permissibility of abortion, and concludes that "these verses, then, do not teach—either directly or by implication—that the zygote or fetus is a person, an individual fully in the image of God."

The author also deals effectively with the "fallacy of the continuum," the argument that since a newborn infant clearly has the right to life, and since there is no clear-cut moment of change as one moves backward in time to the moment of conception, then it follows that "there is no difference between a newborn infant who has a right to life and a newly fertilized ovum." His treatment of each of the "decisive moments" is always to the point, clearly setting forth the positions on each side and driving to the heart of the matter.

Three chapters then examine the major principles that have been proposed to provide guidelines for abortion considerations: the actuality principle, the potentiality principle, and the species principle. The way in which he unravels the complexities of each of these principles, deftly showing their strengths and weaknesses, is nothing short of beautiful. As a reviewer I am tempted to describe many of the vital insights, but, alas, review space is short and I must leave this discovery to the reader. When all is said, the actuality principle (the right to life comes only when full personhood has been actualized) leads inevitably to the conclusion that infants do not have a right to life, a conclusion totally incompatible with the Judeo-Christian tradition. This consideration leads to the key conclusion,

> Indeed, *the only way to have a morally permissive position on abortion is to deny that infants have a right to life*, for as soon as one holds that infanticide is intrinsically objectionable, abortion will inevitably be rendered problematic and morally risky. (p. 91)

The potentiality principle affirms that "a right to life belongs not only to persons but to all who in the course of the normal unfolding of their intrinsic potential will become persons." After carefully laying out a path between the various problems associated with this principle, Wennberg finally arrives at what he calls "the gradualist variant of the potentiality principle." It is also not free from all problems, but it moves in the direction that seems most consistent to the author.

> It holds that the right to life gradually becomes stronger as the newly fertilized ovum develops into a newborn infant, that there is no decisive all-or-nothing moment, that just as there is a continuous and gradual life of physical development from conception to birth (and beyond) so there is a continuous and gradual development in the right to life. This means that as the pregnancy progresses the reasons required to justify an abortion have to become increasingly more substantial. (pp. 112, 113)

Finally the author considers the species principle, which specifies the same strong right to life to all members of the human species. This he concludes, after his usual careful analysis, to be deficient since it gives full moral standing to those "with no potential whatsoever for personal existence."

Wennberg then examines the various considerations necessary for actually making a decision concerning abortion. These include the degree of the woman's responsibility for the pregnancy, the extent of the burden the woman will have to bear as a result of her pregnancy, and the degree of fetal development. He then explores the possible grounds usually advanced to argue for an abortion. He distinguishes between excusing an abortion and justifying an abortion. Throughout he is careful to be clear as possible about what we mean by "the right to life" and the grounds for it.

He recognizes that moral decisions concerning abortion are not synonymous with legal decisions and he provides a penetrating and helpful analysis of the difference between these two kinds of decisions. Certainly the political debate focuses on whether abortion should be legalized or criminalized. He explores a dimension of the problem not often discussed:

> It would seem, then, that the advocate of restrictive abortion legislation not only has to show that the fetus has a right to life but also has to show that the right to life includes the right to use another's body for life-sustaining purposes against that person's will. (p. 155)

This leads him to a careful analysis of Judith Jarvis Thomson's "Case of the Famous Violinist" and its relevance for abortion questions. One of his conclusions is that this illustration "serves to undercut an assumption that often leads to an uncompromising anti-abortion position—namely, the assumption that if fetuses have a person's right to life, then abortion is murder." From this approach the author argues strongly that we ought to use moral persuasion to decrease the incidence of abortion, but not legal coercion.

Finally Wennberg provides a summary and some reflections on the various dimensions of the issue. He holds that conception marks "the beginning of moral standing, the beginning of a right to life, the beginning of a unique center of emerging value." This right to life increases in strength as the fetus grows and develops, following the gradualist thesis. Such a position does not demand moral neutrality with respect to abortion, but rather is fully consistent with a view that sees abortion as morally objectionable. He rejects the common argument that "abortion involves a conflict between the woman's right to bodily self-determination and the fetus's right to life," because the fetus's right to life does not entitle it to the continued use of another's body to sustain that life. While recognizing that the moral argument is often kept socially alive because of the debate on the legal argument, still Wennberg feels impelled to conclude that we must uphold both the morally objectionable nature of abortion and the right of the pregnant woman to make the abortion decision.

It is clear that a genuine concern for the issues involved in abortion leads one to recognize the intricate complexity of a

justifiable and authentic evaluation of those issues. The author is well aware that he has provided no simple set of answers. But this is exactly the best thing he can possibly do; by cutting away the false arguments and the misleading caricatures, he opens the way for Christians dedicated to following Christ in faith to face the issue in their own lives, in the lives of others, and in the society in which we live.

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

THE PRESENT-DAY CHRISTOLOGICAL DEBATE by Klaas Runia. InterVarsity Press (1984). 120 pages. $5.95.

This short book, part of the series Issues in Contemporary Theology, is an expanded paper originally presented at a conference of the Fellowship of European Evangelical Theologicans in 1980. Runia gives an overview of Christology as it stands today. In doing so, he also provided a good introduction to modern liberal theology. He starts from the orthodox foundations of Nicea and Chalcedon, which affirmed that Jesus was "very God and very man" and one person with two natures, human and divine. In defending orthodoxy, Runia calls attention to present-day shifts from it:

1. An emphasis upon Jesus' humanity without a corresponding affirmation of his divinity
2. The argument that the orthodox creeds are in terms of Greek philosophical categories and not those of the Bible
3. The attempt to make Christ more relevant to our age by means of a *functional* rather than an *ontological* Christology

In a survey of recent developments, the theological positions of some recent contributors are presented beginning with that of Karl Barth. He held to orthodox Christology, including its ontology in Greek categories, and in an "essential" versus an "economic" Trinity—in which God is triune in his very essence and not in manifestation only. Barth influenced post World War II developments insofar as they did not return to the 19th-century liberalism which had demythologized the Bible by elimination.

Instead of cutting out myths, Rudoloph Bultmann reinterpreted the New Testament existentially, driven in that direction by the difficulty of extracting factual history about Jesus from the mythological form of the writings. This led to a dichotomy between the Christ of faith and the historical Jesus. But the question, "Who do men say that I am?", still persists, and re-emerged in the sixties in two forms:

1. Post-Barthians going beyond Chalcedon
2. Those abandoning Chalcedon, returning to New Testament data, and expressing Christology in contemporary modes of thought

In the first category are Wolfhart Pannenberg and Juergen Moltmann, both nearly orthodox but differing in their emphases. Pannenberg begins with the historic Jesus and emphasizes the humanity of Christ. Moltmann develops a World War II prison-camp theology, a "theology of the cross," asking, "Who is God in the cross of the Christ abandoned by God?" For Moltmann, the death of Jesus is not the death of God but rather is death in God.

In the second category are, first, Roman Catholics Schoonenberg, Schillebeeck, and Kueng. Protestants included are Flesseman, John Robinson, and Hendrikus Berkhof. Their Christologies are presented and evaluated. The major aspect of their abandonment of Chalcedon is in the switch from "true God, true man" to "man only." Finally, and most recently, Runia turns to the debate over the book, *The Myth of God Incarnate*, which nearly returns to the old form of liberalism, but with the interesting difference that the confessions of some of the authors strongly resemble those of pious evangelicalism!

Runia then analyzes the trends and makes several points:

1. " . . . the confession of Christ as Savior and the Christology which a person holds *are not simply identical*" though they are related.
2. The new Christologies, in emphasizing the humanity of Christ, can be corrective of an unacknowledged docetism in popular evangelicalism.
3. Functional Christology, emphasizing revelation and avoiding incarnation, fails to deal with the central question of who Christ is. It separates God's revelation from his nature.
4. The human versus divine (or "from below/from above") categories must not be opposed but both must be adequately accounted for in Christology. In our time it may be preferable to begin with the historic Jesus, but the ideas of preexistence and incarnation are also biblical and must be included.

The final chapter explains and justifies the ontological concepts of Chalcedon (for example, distinctions between person and nature are explained), and would be a good introduction to another recent book Runia recommends by Gerald Bray—*Creeds, Councils, and Christ*.

This book provides a good introduction to both trends in liberal theology and to the patristic creeds, from an orthodox perspective, and is presented in a succinct yet pithy form.

Reviewed by Dennis Feucht, West Linn, Oregon.

HERMENEUTICS, INERRANCY, AND THE BIBLE: Papers from ICBI Summit II edited by Earl D. Radmacher and Robert D. Preus. Zondervan Publishing House (Academie Books), Grand Rapids, MI (1984). 921 pages. ISBN 0-310-37081-7

The International Council on Biblical Inerrancy (ICBI) is a coalition of Christian scholars who believe that the reaffirmation and defense of biblical inerrancy is crucial to the life and

vitality of the Christian Church. This book contains the papers, and responses to those papers, prepared for the ICBI Summit II (held in Chicago on November 10–13, 1982). Contributors to this volume include Carl Henry, J. I. Packer, Gleason Archer, Henry Morris, S. Lewis Johnson, Roger Nicole, James Montgomery Boice, John MacArthur, and Norman Geisler.

A variety of important topics are covered. These include the relationship of theories of truth to hermeneutics (the "science" of interpretation, usually used with biblical interpretation), the implication of the Scriptural author's intention regarding biblical interpretation, the role of the Holy Spirit in the hermeneutical process, homiletics (the art of preaching) and hermeneutics, and the role of logic in biblical interpretation. The impact of philosophical presuppositions, the adequacy of language for communicating divine truth, and the trustworthiness of Scripture in areas relating to natural science are also addressed.

Each of the papers treats its subject cogently and carefully, facing critical issues candidly, and provides a great deal of insight about the subject. There are two responses to each paper. Authors of the responses are paired so that they provide reflections upon the paper from two significantly different perspectives.

The serious reader will find a mine of valuable materials in this book. Unfortunately, neither the book as a whole nor the individual papers are indexed, so it becomes somewhat difficult to pinpoint all that pertains to the particular subject without reading the work in its entirety. Nevertheless, there is probably no other book at this time which covers the same scope of materials on the subject of biblical inerrancy and interpretation with the depth of evangelical scholarship found in this book.

Reviewed by D. K. Pace, The Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland.

KNOWING GOD'S WORD by Stanley A. Ellisen. Thomas Nelson, Nashville, TN (1984). 294 pages. Paper; $9.95.

This book is one which I wish would have been available when I first became a Christian over fifteen years ago. The author is professor of Biblical Literature at Western Baptist Seminary in Portland, Oregon and in his preface states his commitment to providing a simple guide to the content, movements and personal application of the books of the Old Testament.

Each of the four Old Testament divisions has been introduced to help one appreciate the various types of literature. The individual books are then introduced and sketched with a symmetrical and interpretive outline. Many chronologies and historical listings are included to set people and events in clear perspective. A final feature is a section labelled "Unique Contributions" for each book in which the author shows the individual importance of the book and how it harmonizes and contributes to the whole of the Bible. Helpful bibliographic lists of commentaries, a ten-page glossary of terms and brief sections on selected topics such as the Hebrew calendar, highlights of the intertestamental period, and guiding principles of Biblical interpretation provide added helps for the reader. This book is highly recommended in that it achieves the goals of the author and provides an excellent guidebook to the Old Testament.

Reviewed by Fred Walters, Dept. of Chemistry, U. of S.W. Louisiana.

HOW TO READ PROPHECY by Joel B. Green. InterVarsity Press, Downers Grove, IL (1984). 154 pages.

InterVarsity Press is to be commended for the How to Read series—books "designed for non-professionals who want a professional understanding of Scripture." And Joel B. Green has made a useful contribution to the series.

It is Green's contention that all prophetic Scripture, and he includes the apocalyptic literature in this dictum, was intended in the first place as a message to the original recipients. God did not send meaningless encoded messages to them for our benefit. The corollary of this is that the meaning of Biblical prophecies for our day is to be drawn out of the meaning the prophecies had to their original hearers or readers. "The cardinal rule for applying Scripture to our situation is easily asserted: the significance of a passage for us must flow from its meaning in its context" (p. 37).

Green believes that prophecy requires a special kind of hermeneutic. "Prophecy and apocalyptic . . . are unique literary forms that require appropriate methods of interpretation. They are not straight forward proverbial sayings, nor pedagogy in college-lecture format, nor news stories in the Sunday morning paper" (p. 66). His approach leads him to disagree with such authors as Lindsey, DeHaan and Pentecost. He cites some of their writings, but does not give a detailed rebuttal of their positions. His purpose is to present his readers with a way of understanding prophecy, and he mentions other positions not in an attempt to counter their assertions, but rather as a teaching tool to enable readers to grasp his position.

The book suffers from the brevity of treatment given the various issues raised. But that is inevitable in a short book written in a popular style for "non-professionals." It is, I believe, well suited to its purpose. And it offers bibliographical information for those who want to delve deeper into the subject.

Reviewed by J. M. Martin, Professor of Missions, Edward Lane Bible Institute, Patrocinio, M.G., Brazil.

JESUS, SON OF MAN by Barnabas Lindars. William B. Eerdmans Publishing Company, Grand Rapids, MI (1984). xi and 244 pages. Paper; $9.95.

This book is a serious study of the Son of Man sayings in the New Testament. These sayings were not messianic either in Jewish or Hellenistic thought, but they became messianic in Christian writings. Lindars tests the hypothesis that the phrase "Son of Man" has messianic meaning in the authentic statements of Jesus and concludes that it does not.

He maintains the position that when Jesus referred to himself as Son of Man, he was not using a title, and that the phrase neither carried any christological or messianic meaning nor did it bear any relationship to the visionary figure of Daniel 7. On the positive side, the author then argues convincingly that a correct understanding of the Son of Man sayings may provide the reader with a new grasp of Jesus' own understanding of his mission from God.

The manner in which Lindars understands the saying itself may be culled from the following illustrative translations of biblical texts:

> Whoever speaks a word against *a man* may be forgiven but whoever speaks against the Holy Spirit may not be forgiven. (Matt. 12:32)
>
> For as Jonah became a sign to the men of Nineveh, so will *a man* be to this generation. (Luke 11:30)
>
> But that you may know that *a man* has authority on earth to forgive sins—he said to the paralytic—"I say to you, rise, take up your pallet and go home." (Mark 2:10)

In each case the underlined generic *a man* translates the Greek words for Son of Man.

Lindars concludes that the real significance of the saying lies in the way in which the sacred authors and community of believers came to interpret it. He writes:

> . . . the early history of Christology consists in putting into relation with Jesus, now understood to be the exalted Messiah, more and more of the messianic concepts of the time. He absorbs, but also transforms, an ever increasing range of ideas connected with the Messiah and the new age. Part of this process is the application to him of the figure of the Danielic Son of Man. So the Son of Man, as traditionally understood, belongs to the development of Christology, which took place in the burst of creativity which accompanied the emergence of Christianity in the post-resurrection period. (p. 189)

Lindars has written a complex, scholarly text in a style accessible to all serious readers.

Reviewed by William J. Sullivan, S.T.D., Associate Professor of Religious Studies, St. John Fisher College, Rochester, New York.

CLASSICAL APOLOGETICS: A Rational Defense of the Christian Faith and a Critique of Presuppositional Apologetics by R. C. Sproul, John H. Gerstner, and Arthur Lindsley. Zondervan Publishing House (Academie Books), Grand Rapids, MI (1984). 364 pages. ISBN 0-310-44951-0

This substantive book is devoted to the premise that Christianity is rational. That Christianity involves much more than simply rationality is evident, but Christianity's rationality is not always so evident. The authors of the book believe that a Christian's capacity to love God and serve Him is inseparably linked to his understanding of the character of God. Thus, this book is concerned with a most important topic for Christians.

The book provides an increased appreciation for the role of apologetics in the life of the Church. Many think apologetics to be of little value because they think of it only in terms of evangelism. And it is true that no one is ever argued into the kingdom of God. Conviction and conversion is the province of the Holy Spirit. But, as the authors of this book point out, apologetics can act "as a bulwark against unbridled antitheistic ideologies and their cultural impact. Man's general welfare is enhanced by a cultural consensus in which Christianity and its values are deemed credible. Apologetics is a useful tool to shut the mouths of the obstreperous."

The book is divided into three major parts. The first is a prolegomenon dealing with the problems and methods of apologetics. The second section addresses theistic proofs and the authority of Scripture. The third section is devoted to a critique of presuppositionalism in apologetics, and deals extensively with the thought of Cornelius Van Til.

The book is well organized and adequately documented. It contains much stimulating material. However, the book presumes extensive, perhaps excessive for the general reader, familiarity on the reader's part with a number of apolgetical writers.

One point made convincingly and strongly by the book is that creation itself can teach man some things about God, in contradiction to the conclusion of Immanuel Kant that philosophically we can know nothing about God, nor even prove (or disprove) His existence. The arguments presented are ones which Christians having contact with those in the academic community should comprehend.

Many Christian students and faculty members on college and university campuses will find the first two sections of this book extremely valuable in preparing them for discussions with their colleagues.

Reviewed by D. K. Pace, The Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland

CHRISTIANITY MADE SIMPLE: BELIEF by David Hewetson and David Miller. InterVarsity Press, Downers Grove, IL (1983). 159 pages.

Christianity Made Simple: Belief is the first in IVP's Christianity Made Simple series which will also cover ethics, Jesus, and the Bible. The authors make it clear that *Christianity Made Simple* should not be confused with "Christianity made *easy*." However, it is their conviction that the Christian faith can be "at least simply explained." Even though "God's personality must be highly complex, his plans for the world unbelievably intricate, his influence on us mysterious and incredibly subtle . . . God himself in his relationships with us is plain and straightforward."

This abundantly illustrated handbook attempts to explain the basic areas of revelation, God, creation, conversion, sanctification, the church, prayer, and judgment. The general format and attention-grabbing style is well done. And *Belief* properly attempts to place right doctrine in the context of concrete events in order to facilitate making Christianity "simple."

For example, *Belief* charges that much scientific research performed today becomes so preoccupied with the handiwork of God's wisdom that "it revels in its discoveries for their own sake and honours the created rather than the Creator." An illustration of this is given of a scientist analyzing da Vinci's painting of Mona Lisa and saying, "It's nothing but 7 lbs. of pigment, 4 lbs. of fabric, 16 feet of molded wood, etc." The different claims to truth are also amply illustrated by a set of panels, each containing the authority of a major world religion: the Vedas ("Truth is one, but the sages speak of it in many different ways"); Buddha ("My teachings point the way to attainment of the truth"); Mohammed ("The truth has been revealed to me"); and Christ ("I am the truth").

And yet, *Belief* frequently makes Christianity "simple" by merely dismissing much of the intellectual tension in divine mysteries. The doctrine of the Trinity is stated as "the Father incomprehensible, the Son incomprehensible, the Spirit incomprehensible. But there is only one incomprehensible, though three incomprehensibles. Do you understand?" One yet three at the same time and in the same respect is not a mystery, it is a contradiction. We agree with the authors that God "is not a mathematical problem for which we must find a solution." But God is not a square circle either.

The old illustration of the Trinity—steam (gas), water (liquid), and ice (solid)—unfortunately illustrates a modalistic view of the Godhead. Moreover, a modalistic conclusion is stated: "the same substance in three forms." Agreed, all finite examples of an infinite Being will be "imperfect," but illustrations which are clearly unorthodox should be avoided.

The question of pantheism is raised in the study guide and "answered" with a Scripture reference—without adequate rational reflection. The controversy over predestination is brought up in the wrong category (that of "Sanctification" rather than of "Conversion"), and no data is offered the reader in order to deal with the problem. In the section entitled, "A Spoiled Universe," it is rightly said that "as man had been creation's downfall, so a man—Jesus—would be its Saviour." But the inevitable question is left unanswered: "Why blame us for Adam's mistake?"

Hewetson and Miller may object to these "apologetic" criticisms. Apologetics may have been outside the scope of their book, but can a book which proposes to *explain* the major doctrines of the faith *exclude* apologetic concerns? A book of this kind will more than likely be purchased by neophytes in the faith or even unbelievers who are considering the claims of Christianity. *Belief* cannot merely offer the *understandability* of Christianity without defending its *credibility* as well.

The desire to be relevant and effective communicators can tempt us into misrepresenting the more complex areas of Christian truth. Perhaps it is time we admit that although some things in Christianity *are* simple to understand (e.g., how to be saved), other basic yet important doctrines are not (e.g., the Trinity, election, the incarnation, imputation, etc.). An intelligible understanding of such doctrines can only begin through rigorous study. Is that so bad?

Reviewed by J. Yutaka Amano, Probe Ministries, Richardson, Texas.

RUNNING FROM REALITY by Michael Green. InterVarsity Press, Downers Grove, IL (1983). 127 pages; $3.50.

Michael Green has written yet another book on the theme he treated in *Runaway World*, published in 1968. *Running from Reality* is an apologetic work, designed to show that Christianity is not just another attempt to escape from the pressures of the world, but that it is rather the source of power to face the world and deal with its problems.

The book is not written to serve as a manual for Christians who deal with agnostics, although it could be used for this purpose. Rather, it is a respectful and sensitive treatise specifically addressed to agnostics.

After affirming that escapism is rampant in the 1980's, Green addresses the question, "Is Christianity a crutch?" Yes, he says, "in one sense Christianity is a crutch. It is for people who are fractured" (p. 13). But he denies that "it is puerile, illusory, an imaginary solace for the neurotic" (p. 14). The argument he uses to back up his admission and his denial is the solid presence of Christianity in history. Therefore, he argues, it is not an illusion of those looking for solace. Indeed, its fruit in history is consistent with its claims—lives transformed by the Gospel.

Six chapters are committed to examining the historical evidence for the claims of Christ, concluding with a call to the reader to respond in faith. Faith is defined as "self-commitment on evidence" (p. 63). An interesting array of sources is cited—secular and Jewish historians, archeological finds, and the Bible—culminating with an emphasis on Jesus' resurrection as the cornerstone of Christianity.

Four chapters are devoted to answering objections to Christianity. The longest deals with alleged conflicts between science and the Bible, in which Green demonstrates areas of harmony between science and Scripture. He proceeds to talk of the difference between scientific and personal knowledge. Finally, he adopts the idea that nature and the Bible are both truthful, because God is the author of both, and demonstrates that evolutionary theory does not necessarily conflict with the Bible. He accepts a remote date for creation.

The closing chapter calls on the reader to "lay the book down now . . . and come back to the Lord" (p. 123). This orientation, he says, will not lead to a dull insipid life, but to the exhilaration of running with Jesus. It means the discipline of training, the endurance of going on to the finish line to receive the victor's wreath. He ends by saying, "What a magnificent prospect for runners who finish the race!"

This is encouraging reading for Christians. It is helpful to Christians as a tool for evangelization. But it also has the potential for bringing to faith those who may in fact be running from reality. Keep some copies on hand for your agnostic friends.

Reviewed by Joseph M. Martin, Professor of Missions, Edward Lane Bible Institute, Patrocinio, MG, Brazil.

THE CREATION CONTROVERSY: Science or Scripture in the Schools by Dorothy Nelkin. Beacon Press, Boston (1982). 242 pages. $9.95.

Although it was published in 1982 I had not heard of *The Creation Controversy* prior to reading it, and so had no preconceptions about its content. According to the author's preface, this book is the report of a study sparked by the appearance of creationism on the scene as a curious social phenomenon. Dorothy Nelkin, a sociologist involved in science commentary, has produced another example of the "us versus them" literature that typifies the "controversy" today. A rather transparent guise of objectivity says more about the author's biases than the actual circumstances under investigation. She is admittedly interpreting the controversy from the point of view of one who sees science as that which is "grounded in reality" (p. 29). The implication is that religion has no objective reality. The book's publisher, Beacon Press, a Unitarian-Universalist organ, might also give a clue to the religious perspective expressed therein.

Author Nelkin fails to clearly separate those who totally reject evolution as a theory and those who specifically oppose naturalistic explanations for origins and evolution. The A.S.A. is classified as one of the "creationist" organizations (p. 77). There is some distinction made between the A.S.A. and creation scientists per se, but there is really no appreciation shown for the Affiliation's scientific integrity.

Various chapters discuss the characters and motivations behind public opposition to evolution. Textbook censorship and the now infamous Arkansas court case are dealt with in detail. Another major facet of Nelkin's report is her review of the MACOS project (p. 47–51, 121–136, and 169). MACOS stands for *Man: A Course of Study*, a 1960's attempt to teach elementary school social studies with naturalistic evolutionary assumptions about the psychosocial makeup of humankind. The project was funded through the National Science Foundation and played to very mixed reviews. MACOS materials were produced and distributed in the early 1970's, and although "acclaimed by teachers, parents, and students" (p. 124), the curriculum was essentially discredited by 1975 due to protests in school districts and consequent pressure on the NSF. The strong emphasis on situational ethics and denial of any moral absolutes was more than the public or the government overseers were willing to tolerate. Dorothy Nelkin depicits the whole scenario as a clash between rational science and conservative religion/politics.

The last chapter, "Science and Personal Beliefs," distills the world view expressed throughout the book. It comprises a championing of the purity and pragmatism of a science free from attachment to nonscientific influences. Creationists are seen as having wrongly imposed their external values on science. However, science has supposedly proven its dominion in predicting human behavior. These assumptions give rise to the conundrum of a "value-free" science, created by men with values, which accurately depicts the behavior of value-laden men. (See p. 189 where this apparent contradiction appears). Since when have the physical or social sciences really been successful in defining the mind and soul parameters of human values? How much has naturalism contributed to the improvement of our nonphysical lives?

I recommend *The Creation Controversy* only to those who cannot get enough of the controversy. In this case, you are in for another variation on the anti-spiritual mindset.

Reviewed by Jeffrey K. Greenberg, U. of Wisconsin - Extension, Geological and Natural History Survey

LETTERS OF FRANCIS SCHAEFFER edited by Lane Dennis. Crossway Books (1985). Cloth; $15.95.

I admit it. I'm a Francis Schaeffer fan from way back. When I was only a freshman in college I cut my intellectual teeth on his book *Escape From Reason*. Years later I worked my way through all of his books, which now number more than twenty-two. I teach a class at Toccoa Falls every January using one of his books and a series of films he did.

Most of his books deal with the reasonableness of Christianity and the deficiency of anything other than Biblical Christianity. He discusses almost every topic one can imagine, including history, art, literature, philosophy, science, law, democracy, church government and even modernistic tendencies in some evangelical circles.

But once, back in 1970, he departed from his standard

approach and released a more or less devotional book entitled *True Spirituality* (actually it was written in 1955). As much as I appreciate his other books, it remains my favorite. In *True Spirituality* he deals with personal issues in a pastoral and practical manner. I have used the lessons I learned from that book many times in my life.

Now that Francis Schaeffer has passed on I did not expect to add another book to my Schaeffer bookshelf. But I was pleasantly surprised a few weeks ago by the release of *Letters of Francis Schaeffer*, edited by sociologist Lane Dennis. Dennis, also a fan of Schaeffer, wrote his doctoral dissertation on L'Abri Fellowship, Schaeffer's organization in Switzerland.

Lane Dennis uses both his research expertise and Schaeffer's last instructions as guides in putting the book together, and the result is very well done. The book is generally chronological, beginning with letters written in the 1950's when Schaeffer's organization was being started. These early letters detail Schaeffer's struggles with the loveless fundamentalism of which he was a part. Schaeffer broke with the denomination associated with Carl McIntire, yet maintained a spirit of humility and love in the process:

> I do not think we can . . . fight without any restraint even against the World Council of Churches—let alone in dealing with those who differ from us in our own work—and then expect the Lord to bless our efforts.

In another letter Schaeffer continues his thought:

> I am sure "separation" is correct, but it is only one principle. There are others to be kept as well. The command to love should mean something . . . I will push and politick no more . . . The mountains are too high, history is too long, and eternity is longer. God is too great, man is too small . . .

Schaeffer also expresses doubts about church organizations in his letters:

> . . . so often organization becomes a means to an end in itself. So often it takes so much energy to turn over all the machinery that the work never gets finished. And so often we put the machinery in the place of the Holy Spirit.

A second section of *Letters of Francis Schaeffer* deals with spiritual reality in daily living, more or less an extension of his pastoral approach in *True Spirituality*. Indeed he refers to the latter book many times in his letters. There are no dramatic revelations in this section, but he does touch on some subjects which are given little or no space in his other books. He counsels others regarding depression, admitting that he battles this problem occasionally himself. Schaeffer also deals with the problem of suicide and disturbing memories of sins committed before becoming a Christian.

I was particularly interested in Schaeffer's ideas on how to choose a church. He suggests that the church one attends must be orthodox in doctrine, but should also be a community where people care for one another in the whole spectrum of life. Just having a preaching or activity center is not enough. Schaeffer also maintains that a good church must meet the individual's needs. What should a person do if no such church exists locally? He suggests joining a distant church that does meet the criteria, even if it means one cannot be a regular attender.

Other topics in the second section include eternal security (he believes in it), the Catholic church (he doesn't believe in it), baptismal regeneration (he doesn't believe in that either), and the unforgivable sin (he describes it as the person who continually refuses to accept Christ).

The third and final section of the book includes letters on marriage, family, and sexual relationships. Much of this section is devoted to sex-related issues as considered from a conservative viewpoint.

The editor states that Schaeffer changed in his view of divorce, but it took some looking to find the change. Initially he allows for divorce and remarriage on the basis of desertion or adultery, suggesting that those who become divorced should not hold a position in the church until some time has elapsed. A few years later he adds that divorce before becoming a Christian is "under the blood," but that the new Christian should attempt reconciliation before marrying another person. Still later he discusses non-biblical divorce by a Christian, which Schaeffer states requires repentance followed by investigation by the church "to determine what the situation then was." Yet in his comments a casual attitude toward divorce is always seen as deplorable.

He is sensitive and loving as he writes to those who engage in adultery and homosexuality, yet he is uncompromising in presenting the Biblical viewpoint on these issues. He feels birth control is fine, but insists that all married Christians should have at least one child. Schaeffer is not sure if masturbation is sin or not, but concludes that if it is he is sure God will forgive it. Letters on dating, sex in marriage, premarital sex, marriage with an unbeliever, age and marriage, and sex roles are included. Finally, Schaeffer counsels a couple that nothing in the Bible prohibits interracial marriage, but that they may encounter difficulty with outsiders as a result.

While the book as a whole is well done, there is some repetition which could have been reduced by further combining the letters. Also the price seems excessive—$15.95 for a 264 page book.

This book is a fine addition to any Schaeffer library, detailing his ideas on many subjects not covered in his other books. If you know little about Schaeffer or his works, this is probably not the place to begin. Yet you may want to pick up *True Spirituality* and follow it up with *Letters of Francis Schaeffer*.

Reviewed by Donald Ratcliff, Toccoa Falls College, Toccoa Falls, Georgia

Letters

Only Four C's for the Christian?

Dr. Bube's comments on the common conflict among the claims of the church, the state, and the employer (*sensu lato*) on a Christian (*JASA*, December 1985, p. 229–231) are well taken. However, I believe he has focussed unnecessarily narrowly on the modern industrial corporation as "bad guy" in his analysis. Perhaps his proximity to the madness of Silicon Valley has colored his analysis somewhat. Although the idolatry of the worship of money and power is a common, obvious problem in the corporate setting, other types of employment offer their own pitfalls, lumpable as the temptations of "the world." For instance, consider the predicament of the 1980's junior faculty member at the college or university of your choice.

The competitive scramble for tenure (read success) in many cases translates into what I, and probably Dr. Bube, would consider excessive time devoted to work. In my limited (four year) adventure into the corporate world before entering graduate school, it was my observation that, in terms of overtime demanded, my professional industrial co-workers as a group fared about the same as, or somewhat better than, successful college and university faculty, although they had less control over when the overtime occurred. What about other groups that are prone to vocational over-committment, such as police, doctors, pastors? The danger is more widespread than Dr. Bube suggests; not just in corporations, but in many other institutions and situations, especially in the U.S. It is not only the Christian corporation executive, but also the Christian tenure committee person who must consider what is a reasonable expectation and what is too much; the Christian doctor, as well as the Christian adhesive chemist, must weigh when professional goals and the desire for advancement should give way before other committments. Any Christian who is temperamentally inclined or socialized to value professional competence and "success"—money, power, reputation, prestige, indispensibility, security, or whatever—must guard against making an idol of occupational demands. In some ways it is even harder to put limits on occupations whose goals are, or seem, more idealistic than making money.

Edith Hoffman Konopka
Department of Geology and Geophysics
University of Wisconsin
Madison, Wisconsin

The Editor Responds . . .

As a faculty member of a state university for nearly 40 years, I believe the writer of this letter is right. When I started teaching, there was a competitive scramble (called "publish or perish") which put pressure on family time, church involvement, and even university teaching time. Some of this resulted in, among other things, divorce and/or denial of tenure. However, many of us, probably most, have survived and prospered. For most of my teaching years I have so enjoyed the lot our God has given me that I have sometimes felt guilty getting paid for it!

However, now the situation is very different. The prospects for the "1980's junior faculty member" is appalling. I have been particularly disturbed by the practice of temporary, non-renewable appointments. These allow administrators to hire at low starting salaries with minimal or no "benefits." Then, after they have been "used" for one to three years they are out. Often their teaching loads have been so heavy they have not even had time to publish their doctoral dissertations and hence are not marketable for tenure track positions. These people are forced to move elsewhere as much as anyone in the modern corporations. These moves, likewise, strain family and church relationships.

Furthermore, even if they can obtain a tenure track position, their subsequent tenure is not merely on the basis of "publish or perish," but of "get out there and get the big research bucks (government or industry)" if you want to get tenure. So instead of spending time on teaching, family, church, or even research, the time is spent writing grant proposals. I know all this—and I am sure others know it too—from the frustrating and even tragic experiences of some of our students as well as of the temporary appointees who have passed through my own department. All of this means that maybe we should add a fifth "C"—college—to Dick Bube's list of the conflicting demands which are involved in the determination of Christian priorities.

Wilbur L. Bullock

Further Reflections *on "The Participatory Nature of Modern Science and Judaic-Christian Theism"* (JASA, *36, 2, June, 1984, pp. 98–104)*

The notion of "observer-created reality" held by many competent quantum physicists (as the article acknowledges) is one of a number of possible interpretations of the theoretical structure that successfully explains quantum phenomena. I suggested that the phrase "reality is partially created by the observer" would better describe the interactive role that external reality and observers play in quantum physics. However, a simpler and more precise terminology is *observer-conditioned reality*.[1] Quantum mechanics does imply that the Universe is participatory with respect to human observers in the sense that all knowledge is, in principle, *observer-conditioned. Observer-conditioning* means that the experimental environment selected by the human observer imposes fundamental conditions (limits) on what is actually observed. In this context a realistic perspective of reality is still possible, for the measuring instruments interact with the quantum object independent of the presence of actual human observers. Quantum reality may be defined as a belief in an external world modified by measurements but existing by itself. However, one must accept that in this external world:

a) Measurements of certain observables will always be blurred as a consequence of limits imposed by Heisenberg's *Uncertainty Principle.*

b) Quantum objects are related wholistically. There is a degree of nonseparability that does not exist between objects of "classical" reality. Today many beautiful experiments have confirmed this quantum "wholeness."

With this in mind, the article's main point remains valid. The anthropic evidence with respect to the Universe's physical parameters, and quantum mechanics' recognition that understanding of quantum "objects" is always *observer-conditioned*, together reinforce the notion that humankind participates in fundamental ways in the Universe's very existence and evolutionary development. Such participation has explanatory power in the context of Judaic-Christian theology and, I must admit, idealist philosophy[2] (which should be argued against on other grounds).

Lastly, let me suggest that even if the anthropic "fit" of basic physical parameters is explained in terms of a new supertheory,[3] that theory will represent a remarkable correlation between human mental structures and the Universe's intrinsic physical structures.

Any such supertheory will be so mathematically *beautiful* that humankind's ability to discover abstract mathematical structures capable of faithfully "mirroring" physical reality again suggests human participation in that both the physical Universe and human observers participate in a remarkable intelligibility. Such intelligibility, from a theistic perspective, is a creaturely reflection of the transcendent intelligibility of the living God. This created intelligibility enables humankind, as priests of creation, to fulfill their unique individual and communal roles in the redemptive plan of the loving, Creator God who continually sustains all.[4]

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[1]Richard H. Bube, "Reality According to Quantum Mechanics," *JASA*, Vol. 36, No. 1, pp. 37–38 (1984). Fritz Rohrlich, "Facing Quantum Mechanical Reality," *Science* 221, No. 4617, pp. 1251–1255 (1983). F. Rohrlich, "Reality and Quantum Mechanics," talk given at N.Y. Academy of Science meeting: *New Techniques and Ideas in Quantum Measurement Theory*, The Vista Hotel, New York City (Jan. 21, 1986).

[2]Ernan McMullin, unpublished lectures—"The Anthropic Principle I & II," Loyola College, Baltimore (May 31–June 1, 1985).

[3]Heinz R. Pagels, *Perfect Symmetry—The Search for the Beginnning of Time*, Simon and Schuster (1985).

[4]Thomas F. Torrance, "Man, Mediator of Order," *The Christian Frame of Mind*, The Handsel Press, pp. 19–47 (1985). Harold P. Nebelsick, Lectures in *Systematic Theology I—Basic Christian Doctrine*, Lousiville Presbyterian Theological Seminary, Louisville (Fall term, 1985).

W. J. Neidhardt
Physics Department
New Jersey Institute of Technology
Newark, New Jersey

More on the Book of Mormon

Recently the *JASA* published some fine material by Thomas Key relating to the Book of Mormon (BOM). This was eventually followed by an interesting exchange of letters between Mr. Ellis Davis and Key. I do not think the issue should snowball within the pages of this journal. Yet, as an evangelical theology student doing some research in the area of Mormon studies, I find that the discussion as published does require finalizing comment.

Two preliminary points will be treated, followed by a third concluding point. First, Key might have enhanced his discussion through interaction with scholarly LDS material. As early as the 19th century, B. H. Roberts, a notable Mormon scholar, anticipated several of the points which Key makes. The import of Roberts' admissions regarding BOM difficulties has not diminished over time. Some current LDS scholarship is no less open, and supports Key's observations. See for example, George D. Smith, " 'Is There Any Way to Escape These Difficulties?': The Book of Mormon Studies of B. H. Roberts," in *Dialogue: A Journal of Mormon Thought*, Vol. 17, No. 2, pp. 94–111.

On the other hand, there are also LDS scholars who have attempted to argue against the sorts of objections which Key raises against the authenticity of the BOM. Deserving of interaction by Key might have been the following: Hugh Nibley, *Lehi in the Desert and the World of the Jaredites* (Salt Lake City: Bookcraft Publishing Company, 1952); C. Wilfred Griggs, "The Book of Mormon as an Ancient Book," *Brigham Young University Studies*, Vol. 22, No. 3, pp. 259–278; John W. Welch, "Chiasmus in the Book of Mormon," in John W. Welch, ed., *Chiasmus in Antiquity: Structures, Analyses, Exegesis* (Hildesheim: Gerstenberg Verlag, 1981); and Noel Reynolds, ed., *Book of Mormon Authorship: New Light on Ancient Origins*, BYURSCMS, (Salt Lake City: Bookcraft/BYU Religious Studies Center, 1982). Much more is, of course, also available to the interested researcher.

Second, Mr. Davis states that he is unaware of any discrepancies between the BOM and other LDS scriptures. I do not doubt at all the sincerity of his statement. It is common outside of LDS intellectual circles. Most Mormons are simply not aware that Joseph Smith's early theology, reflected in the BOM, evolved in radically different directions later in his life. This is apparent in such later documents as the Book of Abraham in the Pearl of Great Price, and in the King Follett discourse. Davis should consult the works of scholars within his own religion to become current on this, such as Thomas Alexander, "The Reconstruction of Mormon Theology: From Joseph Smith to Progressive Theology," *Sunstone*, Vol. 5, No. 4, pp. 55–64; Blake Oster, "The Idea of Pre-Existence in the Development of Mormon Thought," in *Dialogue: A Journal of Mormon Thought*, Vol. 15, No. 1, pp. 59–78.

Summarily on this point, it should simply be noted that the BOM nowhere supports such currently taught Mormon doctrines as the plurality of Gods; God as a finite, corporeal being; the Trinity as a material, tri-theistic society of Gods; eternal progression (the doctrine that humans may advance to Godhood by obedience to LDS teachings, just as Elohim and other Gods have done); the doctrine (not currently practiced) of polygamy; the Aaronic and Melchizedek Priesthoods; the Temple Endowment and baptism for the dead; and so on. Support for these are found only in the later works of Joseph Smith, which contradict the monotheism of the BOM.

Mr. Davis, as well, is not aware of contradictions between the Bible and the BOM. There are significant ones, however, such as 2 Nephi 25:23, which states: "Be reconciled to God; for we know that it is by grace that we are saved, *after all we can do.*" This, I fear, is not biblical soteriology.

The third, and last, point has to do with the relevance of this discussion to the issue of scriptural inerrancy. Key's entire discussion presupposes that factual error within the text of an alleged scripture tends to mitigate against any claimed revelational status. There are, however, evangelical scholars who believe that scripture need be infallible *only* with regard to salvific truth. Inerrancy, it is claimed, has to do only with the central, salvific intention of scripture. Scripture is to be considered inerrant, even when factual error is admitted, if it accomplishes its saving purpose. The "inner testimony of the Holy Ghost" is sometimes given a central role as well. I will simply say that given the criteria suggested by the various evangelical "errantists," I have seen not one which can stand against the revelational claims of the BOM. If the criteria for the authenticity of an alleged scripture are that it function as a witness to the gospel of Jesus Christ, that it be related to an experience of the inner testimony of the Holy Ghost, and that it have some claim to historical truth while admittedly containing errors of fact, then the BOM will be irrefutable. I commend Key, therefore, for at least being on the right methodological track.

Ron McCamy
5462 Ruthwood Drive
Calabasas, CA 91302

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