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The Biblical Insights of Michael Polanyi

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In my first two talks I have tried to emphasize some fundamental connections between Christianity and the scientific enterprise. These connections are not only historical and philosophical, but *spiritual*, in the sense that both Christian faith and science are concerned with man's *proper* and *effectual* response to an external reality constituted by the sovereign acts of God and sustained by His faithfulness as Creator and Redeemer. Of course the scope and aims of science are very much narrower than the full range of reality encompassed by Christian thought and life, but they do have their proper place within that range. I have argued that the truth potentially accessible to science forms a part of one continuous fabric of truth as a whole, and is not dualistically disjoint from it in some methodological or autonomous fashion; and I have tried to show that the dualistic views are incompatible with the dynamic origins of science in Christian culture and with the continued vitality of scientific tradition. Such a proclamation of the spiritual roots of the scientific enterprise is not merely a pious platitude or vague generality: specifically it requires us to take science as an enterprise far more seriously, and to be ready to pursue some of its lessons far more broadly, than the Church traditionally has been willing to do. This is especially relevant, and I have emphasized it, in relation to understanding the nature of knowledge and knowing—a problem of great importance for Christian theology. (I therefore suggested that those of us who are jointly involved in the practice of these two "outworn creeds" may have valuable contributions to make to this subject.)

Objective External Reality

Scientific inquiry and scientific knowing are obviously concerned with what we should call "*an objective external reality*," or so at least our culture believes today; it illuminates the nature of the problems with which I am concerned in these talks if we remind ourselves that such an assumption was *not* so obvious in earlier ages, and that it may not be so obvious in the future. The emergence in

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modern thought of an extreme subjective existentialism —a fundamentally anti-biblical view of spiritual realities—has forced us to recognize that a proper Christian theology also claims reference to an objective external reality. Therefore a correct understanding of what is meant by "objective knowledge" becomes essential for theology.

Nor is it merely of academic interest to have an understanding of, and commitment to, the value and meaning of science as an activity whose goal is truth. It is directly relevant to a proper Christian response to changes now developing in culture, which threaten both Christianity and the scientific tradition it has nurtured as "outworn creeds." Critiques of the character and value of science can be vitally supportive to Christianity and to the communication of the Christian gospel, provided they are inspired by a sense of the fundamental harmony between science as an activity and Christian faith and life, rather than by some assumed conception of antithesis between them. Conversely, it may ultimately happen that the dynamic creativity and vitality of the scientific tradition can be sustained only within a conscious affirmation of the *open-horizoned universe* seen by a "naive realist" philosophical view of science—the sort of view held within the Christian cradle of the enterprise—and not by the *closed*, autonomous, deterministic views developed in some modern philosophies of science. In this connection I recall a very forcible statement by Michael Polanyi, who was talking at the time about the idea of objectivity. He said that if, in the end, we came to view science as a closed, tautological thought system of formal relations between totally impersonal "facts," and an "objective" account of the world as one from which man's personal perception, participation, and perspective had been completely removed, then he himself was convinced that the book of Genesis gives us a more meaningful *and objective* view of our origins and responsibilities than any such "theory" ever could.

This remark of Polanyi's does not represent a "leap" into existentialism, but a radical reappraisal of the concept of objectivity. Polanyi was keenly aware that science as an enterprise grows from essentially spiritual roots, and, therefore, a right understanding of what science is, as a knowing of reality, must be compatible with, and can even give us some comprehension of, the nature and context of our creaturely awareness of an even greater Objective Reality. Focussing this in biblical terms, I would suggest that such an understanding could help us to grasp that man may hear and be responsible to the voice of God, *as the fullest possible exercise of his creaturely powers of rationality and objectivity*, not as an irrational denial of those powers by some mystical "leap of faith." This view is in agreement with that attributed to Luther, who denied that faith is essentially mystical, but described it as *the normal response of an awakened man to the voice of God*. I think Polanyi undertook his studies on a philosophy of personal knowledge as an activity directed toward recovering such an understanding of ourselves and our responsible calling as men.

In calling this paper "The Biblical Insights of Michael Polanyi," I am acknowledging my profound debt to his pioneering and, in many respects, foundational achievements, for a philosophy of personal knowledge. After much thought about the problem of reconciling the joint realities of my scientific and Christian knowledge, I had myself reached the conclusion that a resolution of it must come to grips with the fact that *all* knowledge, even the knowledge we all most confidently call *objective*, belongs to persons and must *be held* by them. It was at that point that I came in contact with Michael Polanyi's writings and discovered how much of the groundwork for a systematic exploration of that idea had been done by him.

Three introductory remarks need to be made at this point.

Polanyi Does Not Present a Total Philosophical System

Firstly I should emphasize that one should *not* view Polanyi's discussion of personal knowledge as exhaustive or complete, or as constituting a total *system* of philosophy in the formal sense. Many mistaken critiques of Polanyi's ideas are based on this misconception. It may be more appropriate to see Polanyi as having initiated or influenced a movement or school of thought. I remarked earlier that Polanyi himself saw his work as only the beginning of a task, to which he expected and indeed invited others to contribute; he conceived of a "society of explorers" pursuing more systematically and in depth the problems and questions raised by the approach he pioneered. Such an attitude, of course, was the only one appropriate to his view of the nature of knowing and discovery; he did not see knowledge as a static formal deposit, but as a dynamic entity inseparable from *the process of knowing and learning by persons*.

It follows that not all aspects of Polanyi's thought are equally valid or valuable, and some of his conclusions do not necessarily follow from an acceptance of the general framework of a "philosophy of personal knowledge." In particular, I am not at all satisfied with his description of religious meaning, which I think falls short of an adequate idea of its *objectivity*, and I think his view of Christian faith fails to take enough account of the biblical doctrines of revelation and the Word of God. But his conclusions on this subject are *not* necessary consequences of his epistemology in general, and it is the latter to which I wish to draw your attention. The most significant of his epistemological ideas can be fully acquired only through a careful reading of most of his major work, *Personal Knowledge*.[1] Some general ideas and a sketch of broad

philosophical implications as he interprets them can be picked up in the shorter books such as *The Study of Man*,[2] but it is really only in *Personal Knowledge* that a careful development and rooting of his idea of knowing—especially in its understanding of science and discovery—is to be seen. Somewhat complementary to *Personal Knowledge* (and, I think, best appreciated *after* reading it, not *before*) is Richard Gelwick's short and readable volume, *The Way of Discovery: An Introduction to the Thought of Michael Polanyi*.[3] Dr. Gelwick gives us a good idea of the scope and potential for development in Polanyi's thought, and incidentally provides an excellent survey of the contributions of a number of thinkers working within the general context of the philosophy of personal knowledge. However, it would be a mistake to read Gelwick *instead* of Polanyi, since he is again interested mainly in broad implications, and does not immerse us in the intimate, first-hand involvement with science as Polanyi does in *Personal Knowledge*. It is *because* readers of this paper are scientists, and can better understand Polanyi than most people, that I particularly commend *Personal Knowledge* to you.

Polanyi's Work Not Explicitly Based on the Bible

Secondly, in speaking of "biblical insights of Michael Polanyi," I am not saying that he himself was working either consciously or explicitly from a base of biblical conceptions as a starting point for his thought. Polanyi *was* very much aware of the affinity of his outlook to a Christian faith, and in his writing he makes it clear that real participation in, and commitment to, the intellectual values and ideals of the scientific tradition ultimately also entails participation in, and commitment to, the moral values and ideals of the Judaeo-Christian culture which sponsored that tradition. Moreover he shows that this conclusion is no abstraction but is deeply practical—for example, in his analysis of the siren lure of Marxism for contemporary intellectuals. Beyond that, Polanyi himself lived within a context of Christian belief and worship, though as I have said I was not satisfied with the *philosophical* account he gives of it in *Personal Knowledge*.

My reference to the "biblical" character of Polanyi's insights expresses my own identification of some of his conclusions as being fundamentally congruent to certain important biblical principles. I was brought up in an evangelical family and had the opportunity of a deep exposure to the content and ideas of Scripture. When I began to think about philosophical problems, or even to cope with general ideas about scientific work, it became very evident to me that certain recurrent themes and ideas, which in Scripture have their immediate application to fundamental spiritual issues, also have a "mirroring" or congruent relevance in relation to questions and problems encountered in man's relation to reality at lesser levels. This is because many of these principles or ideas focus on epistemological issues, that is, the nature of real knowing and its functional manifestation. Because I generally had come to expect that a sound epistemology must ultimately correlate in this way with biblical ideas, I became particularly interested in Polanyi's ideas when I found such a correlation at many essential points, as well as a very realistic account of science and discovery as it is actually experienced.

Polanyi Leaves Open the Possibility of Divine Revelation

Thirdly, *concerning the question of revelation*: For a biblical theology, no discussion of the problem of knowledge can be complete without considering this question. Christianity (or the Judaism of the Old Testament) does not claim to be a "natural" religion. Scripture clearly affirms that without a revelation of the Word of God we could have no significant knowledge of God to discuss. I have not forgotten that by any means, but as I said earlier, I do not propose to discuss this important and difficult topic in these lectures. In fact, although I do have some general ideas about it, I do not yet have, even for myself, what I would regard as a satisfactory account of the subject.

Is Polanyi's approach to the problem of knowing compatible with a doctrine of divine revelation? As you know, most philosophy either ignores or even explicitly rules out the possibility of revelation, and I have earlier mentioned the influence of Descartes on this. In this respect it is most significant that *the epistemology of personal knowledge necessarily leaves as an open question, the possibility of a revelation of just the sort which Scripture affirms*: that is, a revelation, *not* by an "inner illumination" so that we know

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God's *thoughts* mystically or intuitively, but a revelation in *Word,* communicated to us in the form of creaturely data in the world in which we live; an Incarnation in flesh and blood, and words, which are from God, but are spoken in language and context accessible to our creaturely powers of intelligence and rationality.

This is not to say that Polanyi explicitly proposed or even adequately considered such a possibility, but his approach to epistemology necessarily leaves it open. He was primarily concerned with man's response to the external world, and the manner in which that response reaches out to comprehend it. For Polanyi, an initial paradigm of knowing is that of the intelligent creature responding to *silent* clues in his environment, which puzzle him with a problem, and ultimately form for him an awareness of a larger circle of meaning, within which they fit as significant elements; in other words, man as problem-solver. However, Polanyi recognized that with the acquisition of language, man is not only able to create abstract thought as a tool of comprehension, but he also transcends the *solitary problem-solver* context and begins to participate in *shared* contexts of meaning and awareness with a *community* of like-minded and responsible persons. Within this *public domain* created by articulate language, the possibility then exists that the awareness of new problems and larger realities may be produced not only by "silent clues" in nature itself, but also by the communication of ideas through language. This means not only that we can educate one another, share our conclusions, and pass on our understanding of reality from one generation to the next, but also that we may provoke new insights by a heuristic stimulation of one another in sharing our awareness of problems and their nature—just as I am trying to do here. But then it is obvious that we cannot exclude the possibility that significant awareness of new realities can be *created*, not only by man's speaking to man, but by the voice of God speaking also in human words to man; and this is how the Scriptures describe God's revelation of Himself to us.

Polanyi was concerned with our human *potentiality* as creatures to know reality around us, and with the justification for our belief in, and commitment as persons to, levels of intelligent awareness, responsibility, and *objective reality* transcending a purely material experience of the world. He was trying to show that the biblical idea of man as made in God's image—with all the conceptions of moral as well as intellectual responsibility that may involve—is rationally comprehensible as an *objective reality*, provided we take a more authentic look at knowing itself. Figuratively I suppose one could say that Polanyi takes us to the Garden of Eden and shows us a man with the *potentiality* to know spiritual realities objectively and intelligently; but he says nothing about whether God is speaking to the man, or not, and (as far as I am concerned) his later discussion of religious meaning does not come to grips with the question. Of course, insofar as my concern is with a biblical, evangelical theology, I have to go beyond Polanyi, and affirm that God has spoken, and is speaking, in His Word. Ultimately, the evidence that *He is there* is that *He is not silent*.

However, the other side of the coin has equally to be considered, and it is this that makes Polanyi's study of knowing relevant to the problem of religious knowledge. If God's revelation of Himself to us is communicated in the form of data in the external world—data of the same kind as we acquire from our experience as creatures of the world around us, and from personal communication in words with our fellow men—then the specifically epistemological issues to which Polanyi addresses himself in the philosophy of personal knowledge have also a bearing on our understanding of what God has revealed. The important fact that a divine revelation is the real *source* of our knowledge does not eliminate the purely epistemological problems of communication, interpretation, and comprehension, nor does it impart a special status of rational certainty to our knowledge itself. We walk by faith; the truth is divine, but it is held by earthen vessels, human and fallible.

Selected Key Principles from Polanyi

Rather than attempt a systematic sketch of "the epistemology of personal knowledge" in the time remaining, I have chosen to select certain key principles, insights, or implications in such an epistemology, which I perceive as being strongly resonant with, or congruent to, principles and insights indicated in Scripture as it deals with our knowledge of spiritual realities. Where these principles appear in Polanyi's thought, the primary application is to the epistemology of science, and, if you wish, you could take my remarks as implying that Scripture has a great deal to tell us about how "knowing" really works in relation to any level of reality; but, equally well, where (as I think) Polanyi has given us a very accurate appreciation of knowing in respect to science and discovery, the clear illumination so provided can shed a helpful light on our understanding of what Scripture is saying about knowing God in our lives. It is these "resonances" which for me provide the token for confidence that a discussion of knowing as a whole along such lines is the right way to proceed—in spite of many unsolved problems or questions remaining. I do not know of any other epistemology which even comes close to this general approach in terms of suc "resonance."

Biblical thought provides no basis for the idea of an abstract knowledge of spiritual truths; knowledge is always held by somebody.

The Function and Meaning of Theories

Biblical thought provides no basis for the idea of an *abstract* knowledge of spiritual truths; knowledge is always *held by somebody*, and, moreover, there is always an implicit question raised as to the functional and practical consequences of knowledge for those who have it. St. Paul, writing to Timothy, contrasts his teaching with the aimless

speculations of some whose real motivation was self-serving: ". . .whereas the *aim of our teaching* is love out of a pure heart, a good conscience, and sincere faith." To Titus he describes it as "the truth which is in agreement with godliness;" to the Romans, and others, he constantly emphasizes the idea that a knowledge of the truth consistently requires obedience, i.e. functional application. Paul is undoubtedly the "theoretician" of the New Testament; others, such as James and Peter, are even more outspoken in their insistence that faith and knowledge produce practical effects. Yet it would be a mistake of the most naive sort to assume that theology is of no importance. In terms of specific content, logical structure, sheer complexity and richness of detail, Christian teaching goes far beyond any other system of religious beliefs. This fact is not an incidental result of the mingling of the gospel with the Hellenistic intellectual tradition, but is a feature also of New Testament teaching—Paul really *was* a "theoretician."

One of the dominant themes of the Pastoral Letters to Timothy and Titus is the idea that *specific doctrine* is the *basis* for practical living, and no one who has a serious acquaintance with the major epistles of Paul would fail to recognize the systematic and detailed character of his theology—or the fact that this theology *is* the real basis for Christian practice. It is only very immature believers, and people who have no personal knowledge of Christianity, who propose that the practice of Christianity may go forward without a grasp of its doctrinal "theory." Moreover, just as in science, the more fully developed our experience of reality becomes, the more complex and structured and subtle is the theory that goes with it. In my first talk I mentioned the joint emphasis of evangelicalism (as a vital form of Christianity) on a highly specific theological content and on the need for personal application in practicing commitment. Difficulties for Christianity always arise when theology is divorced from practical function—whether emphasis is placed on theoretical *or* experiential elements.

In science we also know this tension between theory and experiment, whether we look at debate in the history and philosophy of science, or look at the practitioners of science. Most of us know examples of the theoretician who endlessly manipulates sterile formalisms without physical insight, or the experimentalist who mindlessly measures and observes without having any clear understanding of where he is going!

What is the function and significance of a theory? Michael Polanyi opens his exposition of the epistemology of personal knowledge by showing us how belief in, and commitment to, scientific theories as potentially true, has always been a crucial element in scientific discovery. Futhermore, he emphasizes that in most instances what commends a theory to us in the first place is the sense of a rational holism it is able to convey. At some points one might almost think that Polanyi is a rationalist, intuitionist, or philosophical idealist, because he so heavily emphasizes the determining role played by theories in the process of actual discovery; and he documents that emphasis very well. Yet, as the discussion continues, it becomes obvious that what is important is not merely the theory itself as an abstraction, but the fact that there are persons who seriously entertain it as a way of looking at the world; it is their actions within the framework of commitment which bear fruit. Polanyi is saying that even in science there is no such thing as knowledge in the abstract; it is *knowledge* only when someone personally holds it and acts consistently with the integrating vision of the world it provides.

Polanyi's answer to the question about the function of a theory emerges when he links our personal exercise of judgment and perceptive abilities in the practice of science, to the practice of inarticulate, perhaps unspecifiable *skills* and *arts*. What is commonly identified as "knowledge" is merely the *articulate* part of what we really know; underneath the surface is a whole domain of *tacit* knowledge, involving our personal participation in a skillful but inarticulate performance. Knowledge must always be personal because we can never completely isolate the articulate from the tacit components. Knowing is a skill, an art, and its confirmation and justification necessarily entail its functional application in further skillful performances relating to the reality known.

Theoretical systems function by integrating for us the particulars of our experience into a meaningful whole, whose global significance is revealed not by the particulars themselves but by the relationships which they take on within the system. By manipulating the conceptual symbols in the theory, we can "manage" an understanding of these relations and of the whole, just as a map enables us to "manage" a new geographical environment. Theories are linguistic and conceptual tools; we *indwell* them for the purpose of envisioning a complex reality, just as we *indwell* a hammer for the skillful performance of nailing with it. In such an "indwelling," we do not pay our *focal* or direct attention to the tool itself; rather, by committing ourselves to it, we see *through* it to the aspect of reality it brings into focus for us, just as we "feel," when competently hammering, not the end of the hammer in our hand, but the head of the hammer hitting the nail. But a tool must really be appropriate to the reality of focal concern; if it isn't, our commitment to it will not lead to success but to a confidence-destroying disfunction. I may be deeply committed to my pair of pliers *in lieu* of a hammer, but the fact that it is *not* a hammer may turn my commitment into bruised fingers.

Time does not permit me to range over the many insights and ramifications which Polanyi develops in linking our conceptual and linguistic skills and the abstractions they enable us to create, to our personal participation in the performance of inarticulate skills; but I think this approach makes more sense than any other in explaining the paradoxical fact that while, on the one hand, knowledge can only *be* knowledge when it is functioning within persons who *hold it* or *indwell* it to produce practical consequences as the end result, yet on the other hand a valid theoretical understanding is of *determining importance* in the direction and development of function. Logical empiricism fails to grasp this, since it supposes that empirical facts, approached blindly, provoke theories. Looking back at this same tension between Scripture's insistence on the aim of knowl-

edge as *function in persons*, and its primary emphasis on the need for a valid and adequate doctrinal basis, we can now appreciate that the two emphases necessarily go together because they are simply a realistic account of how it is that persons can acquire a functioning relationship to an external objective reality.

No doubt it will have occurred to some of you that this view seems rather close to the "operationalist" philosophical views of Mach, Duhem, Bridgman, etc., views which I have criticized Professor Clark for holding. Part of my answer to that would be to repeat again my previous critique, namely, that a claim that "a theory can never really be true"—even potentially—undermines in a subtle fashion the nature of our *commitment to it*—like talking (as Paul Tillich did) about "the God behind God." Then I also pointed out that *ontologically* we are really obliged to *call* "true" that which has an ultimate functional authority for us, even though we know we run the risk of being mistaken. But now I will go further and point out that, after all, "what is sauce for the goose is sauce for the gander." If we accept operationalism as an adequate epistemology of science, then I can see no reason why we must not accept it as an adequate epistemology of Christian faith and life; I have just shown the close parallel of epistemological function between the two. *It is because I do not find operationalism acceptable as a view of Christian theology and its role in our lives, that I abandoned operationalism as a view of science, and it was my encounter with the thinking of Michael Polanyi that finally forced me to that conclusion.*

Faith and Commitment as Dynamic

"*Faith is the substance of things hoped for, the conviction of things not seen*" (Heb. 11:1). Familiar as this verse is, we tend to let it roll smoothly off our tongues rather than think carefully about what it says, which at first seems either very surprising or else nonsensical. To retranslate: "Faith brings to substantial, actual realization things that are at first only hoped for; it creates a clear and convincing focus on things we cannot yet see." The first half of the sentence sounds perilously close to the view of some five-year-olds that "if you believe in something hard enough it will come true," and the second half sounds like "if you believe in something long enough, after awhile you will be quite sure about it." We laugh at this—because we all know just how silly we should be to trust such naive maxims. Cheer up; the writer of the letter to the Hebrews is no five-year-old. Yet I never really felt intellectually satisfied about this text until Michael Polanyi showed me what it really means by describing just how this principle functions as the dynamic element in scientific discovery (oddly enough, he never seems to have referred explicitly to this remarkably appropriate text.)

To make it clearer for all us academics, here is a third, technical rendering: "the indwelling of a true theory by persons responsibly committed to it leads *functionally* to the eventual *manifestation* and *confirmation* of realities which at first are only vaguely intimated, or but poorly perceived." If you read *Personal Knowledge*, you will find a thoroughly fascinating account of precisely this remarkable phenomenon. I referred in an earlier talk to the story of the Copernican revolution, which illustrates the principle very well. For those who were committed to it, the Copernican hypothesis provided an integrating vision of the heavens; it was only within the framework of such commitment that previously unanticipated elements could be brought into clear focus, and the relevant activities conceived and sustained, which ultimately brought the truth of that vision to its full manifestation. For more than 150 years—until Newton's laws of motion were discovered—it could not be said convincingly that the factual evidence confirmed the Copernican, and refuted the Ptolemaic, view. Yet during that long period faith in the validity of the Copernican hypothesis sustained a chain of labors which finally vindicated it.

If we accept operationalism as an adequate epistemology of science, then I can see no reason why we must not accept it as an adequate epistemology of Christian faith and life.

The point, of course—one to which the writer of the Letter to the Hebrews is very sensitive—is that manifesting a hidden truth in hostile or indifferent circumstances is a laborious, time-consuming, and costly business, and one will not be able to sustain the effort required, unless he really is committed to a serious belief that the reality in question exists. In my own career as a theoretician I have experienced the validity of this principle in several specific problems, where belief in the existence of a certain type of solution to a physical or mathematical problem provoked imaginative responses or new insights, and sustained long periods of laborious and often fruitless search until at length one line of work ended in success. I am sure many others of you have also had similar experiences.

Of course, our Scripture text about faith takes it for granted that what is being believed in is true. It is certainly not saying (as the five-year-old does) that *faith as such* produces results, but that it is faith which sustains fruitful activities, when it is directed toward valid objects—and, without such faith, even a true theory remains barren and ineffectual. Again, it is partly for this reason that we must entertain of any serious theory that it is potentially true. In science, as in religion, I hope there is none among us who really believes that "to travel hopefully is better than to arrive;" as C.S. Lewis acutely said, "If that were true, and were known to be true, who would ever start out upon a journey?"

It would be very fascinating if we had time to think a bit about spiritual and intellectual *hope*. According to our text, "things hoped for" are antecedent to faith, and perhaps we could infer they are in some manner stimulants to faith.

"Hope" in the New Testament does not mean wishful thinking, but a strong sense of anticipation of unheralded and certainly unspecifiable possibilities. Spiritual hope is not ultimately directed toward a seen object ("hope that is seen is not hope"); it is properly and ultimately *hope in God*.

In his discussion of the power of a scientific theory to call forth our respect and commitment, Polanyi points out that we exercise only partly specifiable criteria of rational beauty or excellence, which we are able to apply to a large extent tacitly or inarticulately—and, we expect the truth to be beautiful. We use words such as "symmetric," "elegant," "fruitful," etc., to convey our sense of appreciation to our fellows, but these adjectives will not stand up to logical scrutiny. Our sense, and the collective tradition, of beauty—and hence the character of our tacit criteria—is capable of change and development; but unmistakably it is a sense of beauty which moves us to prefer some theories to others, and even to heuristically commit ourselves to them, even though as yet we have no clear conception of their consequences. Now it is a surprising thing that this general expectation regarding reality is *not* disappointed far more often than it is rewarded, but on the contrary it seems to have a real power to evoke creative vision within the human mind. I wonder if here, too, we may really be talking about hope? However, I am only speculating!

Commitment and Doubt, Proof and Manifestation

Why is it that Scripture is so little concerned with rational proof and rational certainty? The usual answer is that the cultural mind-set of the biblical writers does not really focus on the concepts in question. This is obviously quite true, but at the level of our present discussion we are entitled to think that there are also reasons of *substance*: after all, divine revelation was given in the context of such a culture, and, moreover, we may assume that revelation had a profound influence upon that culture, as is evident in the Old Testament. Furthermore, sound scholarship should help us get the idea out of our heads that the Hebrews were fanciful romantic-visionary types to whom such concepts as proof and argument would never have made any sense. On the contrary, when we compare them with the peoples among whom they lived, and against whose cultures the religion of the Old Testament was in constant opposition, the Hebrews seem rather to be a most prosaic, hard-headed sort of people, skeptics who think gods are just blocks of wood, who do not believe the natural world is the body of God, and who are inclined to be impressed by material evidence here and now and by such things as the historical fulfillment of prophecy—in short, just the sort of people who are interested in "proof."

I believe the substantial answer to the question is that there is a demonstration of objective reality which is more complete and more convincing than formal or rational proof, something I shall call "manifestation." The biblical view, I think, is that a genuine and complete solution to a problem regarding objective reality cannot merely be *thought,* it must be manifest in *concrete function* and in a transformation of the world which displays that function. Any purely abstract solution is thus, by its very nature, *not* the reality it attempts to describe, but a signpost or symbol which points beyond itself to implied function and consequences. I specifically exclude pure mathematics and formal logic from this general claim. These subjects are peculiar because, at one level, they are their own manifestations; and at another level, we do not know whether or not they have the reference function in respect to some other, unknown reality.

To develop the idea of *manifestation* remember that in the domain of skills we encounter objective realities which are not formally proved, but only manifested. While we think in many cases that an abstract explanation may be possible, our conviction that the reality in question *exists*, in no way depends on this; it stems from the experience of manifestly skillful performances. Glassblowers, for example, are paid very good wages to practice their skills and they *manifest* very clearly that they have a real, objective knowledge of what can be done with glass, *by achieving it.* It is simply nonsense to say that such knowledge is not objective—though it is certainly *personal* knowledge!

At the other end of the spectrum we have the manifestation of spiritual realities with which Scripture is concerned (in this discussion I have the convenience of assuming your tacit agreement that these are objective realities, too). Scripture continually reminds us that the convincing demonstration of a knowledge of God is manifest in a person's character and the transformation of life in himself and his environment. Psalm 1, for instance, is a poetic celebration of this principle. It appeals by analogy to a homespun, familiar example, comparing the mighty tree that can grow from the life within a seed on one hand, with the transience of chaff, which is merely the outer husk of what was once potentially an equally vital life. Here the Psalmist tells us that we are dealing with *objective reality*, not with some inner, private experience; he is telling us *not* about the *feelings* of a man rooted in God, but that such a person is *in fact* a reality in the landscape, recognizable, and recognized, by others.

In our culture, the achievements of science itself in the transformation of modern life are the clearest possible illustration of a *manifested* solution to a real problem. In my essay "The Spiritual Dimensions of Science"[4] I tried to dramatize this in certain ways. One way is to imagine the dialogue which might ensue between a contemporary physicist and a medieval philosopher, assuming we could transport the latter to our own time and show him all our beautiful machines which function as embodiments of physical principles. There are two points to make: (a) We may well feel that there are potential meanings to the question "what is the nature of physical things?" which we have in no way even considered in science, but I am pretty certain that our visiting philosopher would consider that we have an *objectively real* knowledge of the answer to that question—an answer demonstrated in our manifest authority over physical phenomena. However, (b) we would probably have a very tough time getting him to understand our idea of natural or physical laws. He would

be tempted to ascribe our powers to magic or occult, immediate knowledge of some sort. We would have to work hard to persuade him that they are direct applications or expressions of a systematic, highly structured true understanding, which we find it possible to talk about in a new discourse of remarkable depth and complexity. I rather imagine that in the end we would explain what a physical theory is by epistemic analogy with the only highly structured theoretical system our visitor would be acquainted with, namely, Christian theology.

This last point again makes it clear that the biblical preference for *manifestation* rather than formal proof is not equivalent merely to a primitive pragmatism or to some sort of operationalist philosophy. The difference lies in the view taken of the significance and role of theories, which I talked about earlier. Although *manifestation* is the ultimate goal of all knowledge, this does *not* imply that theories are irrelevant or can be dispensed with, or are arbitrary conveniences made up to fit the facts *a posteriori*. On the contrary it is precisely their claim to be *true and faithful accounts of an objective reality* which is at stake, and which is vindicated by the ongoing development of manifestations based on that reality. Scripture points us to a world to come in which "knowledge" shall cease, or "*come to an end,*" *because we shall know even as we are known*, but it is equally clear that, for our present creaturely hold on spiritual realities, articulate, rational, structured theoretical knowledge is indispensable, a knowledge communicated in words and language. "Let the *word* of Christ dwell in you richly, as you teach and admonish one another in all wisdom. . ." says Paul to the Colossians.

Michael Polanyi's understanding of the role of theories and indeed of all articulate communication is compatible with this scriptural outlook. Through the means of language man, who seems otherwise a creature like the other creatures, *out of the ground*, not only extends his creaturely grasp on the environment in which he is placed, but shares and sustains this in the community of his fellows. Language involves the same skills of perception and manipulation that appear in the inarticulate knowledge we have, but by combining these skills in the domain of abstract symbols, allows us to become aware, and to sustain awareness, of larger wholes and contexts of meaning in which we are also placed. This is the effective means by which man's ascendancy over the dumb creatures is achieved; but it is also at the same time his introduction to entirely new dimensions of responsibility—objective realities to which man is not only able but *obligated* to reply in both word and actions.

Man's interest in *the truth* arises because he consciously recognizes his freedom to choose. He has learned that when he chooses responsibly according to the light of what is seen abstractly as true, he may acquire the power to direct the future to ends otherwise not attainable, to express his freedom in creative and open ways. This freedom is not autonomous or arbitrary; paradoxically, it is *a freedom which comes from obedience and commitment to the truth*. Man is placed in a setting of realities not of his own making, and over which he has, *a priori*, no mastery; yet, by being responsible to the authority of a true vision of these realities, he fulfills his creative potential and renders *actual*, by manifestation, things which otherwise would not appear or come into existence. In this process, it is his *responsible commitment*, or *faith*, which is the dynamic element: this faith is directed consciously to a reality, *which is outside himself* and is therefore *objective*. The concept of the *true* or the *objective* is nothing more—*but also nothing less!*—than the declaration that there *are*, in fact, realities to which we and all our fellow men can and should consistently, collectively, and responsibly be committed as the authority for our choices, thought, and actions.

It follows that the claim that any articulate statement or proposition—let us call it "*P*"—is *true*, is an affirmation that we have manifested, are manifesting, or are committed to act and choose so as to manifest, the reality of which "*P*" speaks. The reference to *truth* emphasizes the universal character or *objectivity* of that reality, that is, we place our responsibility also on our fellows. But the statement "*P* is true" is not itself another statement, "*Q*", whose truth or falsity can be determined (except in certain simple mathematical and logical systems, and then merely as a formal statement of tautological consistency). "*P* is true" is really functionally equivalent to the statement "I believe *P*," and there is not the slightest additional "proof" I can bring to show that "*P*" *is* true, apart from the responsible thoughts, words, choices and actions consistent with "I believe *P*"—and which, *presumably*, I am already engaged in, in manifesting the reality of which "*P*" speaks. That is the limit of my creaturely powers and responsibilities.

Such a conclusion is not a despairing proclamation of "the final subjectivity of all claims to know." On the contrary, it is the affirmation that a knowledge which is personal can nevertheless be objective. When we are forced to recognize that all the knowledge we possess, even of the most incontrovertible objective realities, involves our personal participation in responsible commitment, then it is absurd to conclude that objectivity knowledge cannot exist; the proper conclusion is the opposite one, i.e., that "objectivity" is not the removal of personal involvement but its *responsible exercise*, and this was the conclusion that Polanyi pointed to.

In passing I'd like to draw your attention to an attitude which has currently become fashionable, almost to the point of being a cliché, in academic and literary circles; I even saw a reference to it in a horribly confused article in our local newspaper the other day. This is the view that even the claims of science to objectivity have been debunked, and the usual source for this view is taken to be the writing of Thomas Kuhn;[5] in fact the word "paradigm" has become a badly overworked buzz-word among pseudo-intellectuals lately. No doubt people in the liberal arts have their own reasons for resenting the long age of idolatry of science and are happy to be iconoclasts, but it really displays a gross ignorance of science and the progress *in manifestation* of scientific knowledge to assert such an extreme and absurd conclusion. The problem which Kuhn really poses for us is the fact that the knowledge we actually possess in science—which is assuredly "objective"—was reached by a heuristic, often revolutionary process which

has entailed passionate personal involvements and commitments. However, it is Polanyi, and not Kuhn, who has drawn the proper conclusions from that fact. (In fairness to Kuhn, I'd note that he calls himself not a philosopher but an historian of science, and that he carefully refrains from the silly conclusion that such knowledge is not objective.) It is a bizarre absurdity to hear some sophisticate say at a party, as is common nowadays, that the claim of science to objectivity has been destroyed—when all around him in the room are the concrete manifestations of that knowledge in devices and material creations upon which he implicitly relies! Surely it is the evidence of a deep spiritual perversion that modern man prefers to affirm the total *subjectivity* of all his ideas rather than grapple with the religious implications of a knowledge which, though personal, is nevertheless still *objective*, and potentially *true*. If we treasure the values of the scientific tradition at all, we must regard such attitudes with an implacable hostility.

We have to recognize that the *theoretical possibility of doubt* always exists whenever there is knowledge—even for our most soundly practiced commitments. The awareness of a potential risk is the necessary complement of all true knowing. This is quite obvious in the case of a skillful performance: the more elaborate the achievement in view, the greater also the risk, and the awareness of risk, entailed in its fulfillment. This helps us to understand the fact that it is modern Western man, *manifestly* in possession of far more objective knowledge about the material world than any other civilization previous, who is also far more obsessed with the intellectual problem of doubt; to some extent, a slightly puzzled frown is the inevitable accompaniment to the solving of real problems! But—as Scripture continually affirms—it is faith, and not doubt, which forms the positive dynamic in knowing and discovery, and Polanyi clearly shows us that this is the case in science.

Attention is necessarily focussed on what is meant by *responsible* commitment. Polanyi believed that the intention to be "responsible," both individually and as members of a human community, was the only criterion which we could impose upon ourselves in the effort to grasp objective truth, and he speaks a great deal about what it means to be responsible in commitment; time doesn't permit me to explore his comments on the subject. However, let us note two points:

"Responsible commitment" may be seen as a *necessary*, but not a *sufficient*, criterion for *true knowledge*. Polanyi belongs to that philosophical tradition which seeks to identify *necessary* conditions for our knowledge to be objective but does not allege that we can possess *sufficient* conditions; the best we can do is *manifest* the truth we believe we have. I think this view is biblical because it accepts our creaturehood.

Secondly, important understanding of what responsible commitment is like is provided by a more careful study of the ideas of *indwelling* and of *focal and subsidiary awareness*, which Polanyi develops at some length, and to

The claim that any articulate statement or proposition is true, is an affirmation that we have manifested, are manifesting, or are committed to act and choose so as to manifest the reality of which this statement speaks.

which I referred only briefly in the illustration of indwelling a tool, such as a hammer, for the purpose of achieving a task. Our commitment to a tool is always given to it *for the purpose of reaching through it to a reality or achievement beyond it*. In the case of a theoretical system, I indwell it *as a means to reaching beyond it* to reality which I believe to be there. My commitment is never *merely to the system itself* as an object of *focal* attention; rather I entrust myself to the vision of reality the theory creates for me, in a heuristic effort to see "what is truly there." Certainly one meaning of responsibility-in-commitment is the notion that if the result of such commitment is a continued fumbling, or a series of unremittingly contradictory experiences, one may be led to abandon the theory in favor of alternatives with more evident tokens of promise. The man who goes on hammering with pliers when a hammer lies nearby is not merely mistaken, but *irresponsible*, in his commitment. Unfortunately—as Kuhn has certainly shown—the history even of science is all too full of such irresponsibility.

But there is a theological implication in this conception of responsible commitment as *a reaching through* and *beyond* our ideas: to what—or to Whom—is our commitment then finally directed?

The scientist of the simple-minded, naive realist sort will surely reply: to that which is really "objectively true," the "objective reality," on which my knowledge seeks constantly to lay hold, and by the experience of which it must necessarily change and develop. The practising faith of science is a faith ultimately in the *order*, *consistency*, and *intelligibility to man* of the creation in which we find ourselves placed, and at its purest that can never be faith in man but faith in a dependable Creator.

But equally, the Christian will surely reply that his faith is not in his theological picture of God, important as that is to supporting his real knowledge of God. C.S. Lewis put it so well: "I pray, not to whom I think Thou art, but to Whom Thou knowest Thyself to be." Faith, though vitally expressed in our indwelling of doctrinal knowledge, and requiring theological and rational logical structure for its proper function, always reaches out beyond all theology: it is faith ultimately in God Himself.

Some of you will probably feel that I have painted far too rosy a picture of knowing, that I have not made adequate allowance for the tragic effects of sin in producing error, falsehood, and delusion. This is probably true, but as I have been writing this essay, two incidents from the Old Testament have been running through my mind. I think

they reveal the attitude of Scripture to the question of how, and whether, truth wins out over error, when there is a human being prepared to be responsibly committed. The first incident is that grim old story of Elijah and the prophets of Baal, and for me the key phrase is Elijah's emphasis on manifestation: "And the God who answers by fire, let Him be God." The second story is the account of Moses and the magicians of Egypt before Pharaoh. The possibility of a limited success based on false premises is acknowledged: "the magicians also cast their rods on the ground, and they also became serpents. *But Moses' rod ate up their rods.*" For me that remark in its humor and subtlety conveys something of the light-hearted confidence and freedom with which the Christian can approach the discovery of truth whether he is learning it from the study of creation or from careful attention to God's Word. We believe that for those who really want it to, the truth will become manifest in due course.

[1]Michael Polanyi, *Personal Knowledge*, Routledge and Kegan Paul, London (1958); paperback ed., Harper Torchlight Books, New York (1966).

[2]Michael Polanyi, *The Study of Man*, Routledge and Kegan Paul, London (1958).

[3]R. Gelwick, *The Way of Discovery: An Introduction to the Thought of Michael Polanyi*, Paperback ed., Oxford University Press, New York (1977).

[4]W.R. Thorson, "The Spiritual Dimensions of Science," an essay in *Horizons of Science: Christian Scholars Speak Out*, C.F.H. Henry, Ed. Paperback edition, Harper and Row, New York (1978).

[5]T.S. Kuhn, *The Structure of Scientific Revolutions*, University of Chicago Press, Chicago (1962).

Truth and Epistemology in Science. . .

RESPONSE TO WALTER THORSON'S ASA ADDRESSES

Dr. Thorson's talks (See *Journal ASA* 33, March, June, September (1981)) have been most interesting and stimulating to me. He has been most generous (and patient) with me as we have discussed some of the issues together. In fact, we have resolved most of our misunderstandings and are down to basic disagreements (friendly, of course).

Besides our being brothers in the Lord, there is much we agree about. There are a number of statements in particular I would like to highlight from Dr. Thorson's addresses. From the second address:

> We acknowledge that creation has an *external, objective* reality, not determined by our rational thoughts about it—we expect to be surprised by it in the future. However, if we also say that we believe it has a rational order, then:

and Dr. Thorson gives two alternatives, accepting the second:

> . . .its contingency is a truly *open* one, because it finally depends on a source beyond itself to determine it (i.e., the free and creative choices of a sovereign God). . . .scientific theories, while potentially true, would always remain open to further, unanticipated extension; they could not, even in principle, be "necessary," absolute, or comprehensive in scope.

I refer to the "potentially true" portion later on as a problem which, perhaps, science *cannot* overcome.

The next statement is taken from his third address:

> Scripture clearly affirms that without a revelation of the Word of God we could have no significant knowledge of God to discuss.

And lastly, also from his third address:

> Scripture has a great deal to tell us about how "knowing" really works in relation to any level of reality.

I rely in my response on principles similar to the above in discussing questions of truth and epistemology in science.

Remarks About Polanyi

As Dr. Thorson has mentioned, Polanyi's book *Personal Knowledge* contains a wealth of information on the history of science as well as valuable insights about the psychology of learning and the skills of performance. In addition, of course, he has much to say about knowledge in science. The most interesting (and, for Polanyi, the most basic) series of statements forming the foundation for his epistemology of science are the following:

> Yet this group of persons—the scientists—administer jointly the advancement and dissemination of acience. They do so through the control of university premisses, academic appointments, research grants, scientific journals and the awarding of academic degrees which qualify their recipients as teachers, technical or medical practitioners, and opens to them the possibilities of academic appointment. Moreover, by controlling the advancement and dissemination of science, this same group of persons, the scientists, actually establish the current meaning of the term "science," determine what should be accepted as science, and establish also the current meaning of the term "scientist" and decide that they themselves and those designated by themselves as their successors should be recognized as such. The cultivation of science by society relies on the public acceptance of these decisions as to what science is and who are scientists. (pp. 216, 217)

Now, Polanyi tries to give assurance that scientists, by means of cross checking one another, won't go that far astray, but the record shows that serious errors have been made by the scientific community as a whole. He gives the following accounts:

> . . .Ordinary people were convinced of the fall of a meteorite, when an incandescent mass struck the earth with a crash of thunder a few yards away, and they tended to attach supernatural significance to it. The scientific committees of the French Academy disliked this interpretation so much that they managed, during the whole of the eighteenth century, to explain the facts away to their own satisfaction. It was again scientific scepticism which brushed aside all the instances of hypnotic phenomena occurring in the form of miraculous cures and spellbinding, and which—even in the face of the systematic demonstrations of hypnosis by Mesmer and his successors—denied for another century after Mesmer's first appearance the reality of hypnotic phenomena. When the medical profession ignored such palpable facts as the painless amputation of human limbs, performed before their own eyes in hundreds of successive cases, they acted in a spirit of scepticism, convinced that they were defending science against imposture. We regard these acts of scepticism as unreasonable and indeed preposterous today, for we no longer consider the falling of meteorites or the practice of mesmerism to be incompatable with the scientific world view. But other doubts, which we now sustain as reasonable on the grounds of our own scientific world view, have once more only our beliefs in this view to warrant them. Some of these doubts may turn out one day to have been as wanton, as bigoted and dogmatic as those of which we have now been cured. (pp. 274, 275)

It would seem, by inference from Polanyi's views, that what constitutes science, scientific methods, etc., is subject to change as scientists change their minds. In fact, it would appear that the only thing in science which one can guarantee (in principle) will not change is the fact that everything else will. It should be noted that such a conclusion is not all that different from Dr. Clark's and that therefore, inferences from Polanyi's view on the ultimate bases for epistemology in science might well lead one to sympathize with the views of Dr. Clark!

Remarks About Dr. Clark

Dr. Clark would agree with all the remarks that Dr. Thorson has made about his beliefs, with the exception of a part of the following paragraph in the second address:

> But I fear that his *extreme* reservation implies an equally *extreme disjunction* between two sorts of *human knowledge*: one sort having a kind of absolute certainty to it because its *source* is *revelation*; the other sort being basically wishy-washy and always radically in doubt because it involves our personal blundering around, trying to get the proper conceptual and articulate "handle" on things. I think that this overlooks the fact that *all our knowledge*, regardless of its source, has to be acquired and held by persons: it is still personal knowledge.

The disagreement, I believe, hinges more around why Dr. Clark considers knowledge in Scripture to be truth and scientific knowledge not to be the truth. It has to do not with the fact that scientific knowledge is personal, but rather with Dr. Clark's belief that the mind of God is unchanging, and truth which is unchanging must be associated with archetypes in the mind of God. Since the world created by a purposive God could well be changing according to his purposes, one cannot establish truth simply by observing the world; rather, one must turn to Scripture to ascertain truth. Dr. Clark is not opposed to science; he considers science to useful and helpful. He just does not consider science to be a tool to obtain truths, which for him are eternal. He also does not consider that he himself possesses 100% confidence of having absolute truth!

It is not necessarily the case that the faith of Christians would suffer if it were found that the truths and methodology of science were in fact false in some way.

Truth and Epistemology in Science

The statements made by Dr. Thorson on truth and epstemology in science may be summarized as follows:

1. The basis of science is that God's purposes are invariant and therefore the laws of nature are invariant.

2. The invariant laws of nature can be closely approximated by inference from observed phenomena.

3. Scientific laws can therefore truthfully describe parts of reality, the knowledge of which is cumulative, building up a consistent, orderly account of the world.

4. Any critique cutting down science also tends to cut down Christianity, because scientific knowledge in many respects is like other knowledge, including theology. Therefore, for example, a philosophic position using operationalism in science would seem to force one to use operationalism in theology.

5. Lastly, cutting down science by insisting it cannot contain truth is bad for morale, and will hurt scientific efforts.

In response to the thrust of what (I believe) Dr. Thorson is saying, I would like to consider the science of demography (population growth). In demography, mathematical formulae have been developed based on models of human behavior in an attempt to determine what the population of various countries and the world will be like in the future. The problem with this method is that there is no mathematical formula in the *world* which can exactly predict the population growth of a purposive people. Each individual person makes his own decisions about the size of his family, where he will live, and so on, none of which can be predicted by mathematical formulae of any sort. One would have to know the mind of the individual involved to be able to understand and predict what he or she will do. To be sure, there is a tendency for an aggregate mass of people to be more "mechanistic" in the short run because the effects of the purposes of large numbers of individuals tend to cancel out. But sometimes, powerful individuals make decisions that can significantly affect the

population of the whole world. Consider Hitler and World War II, Stalin and his 1930 purges, or Mao Tse Tung and the estimated 30 to 60 million deaths he is reputed to have caused. In the U.S., the Supreme Court decision on abortion in 1973 drastically affected population increases. None of the above incidents could have been predicted by any sort of mathematical formula, without knowing the minds of the people involved.

Here is the point of all this:

Scientific laws, represented by mathematical formulae, cannot with certainty or absolute accuracy correlate observable quantities unless it can be assumed that those quantities are governed in a mechanistic, non-purposive manner.

What about the world? Is it governed in a purposive manner? I think the Bible rather clearly states in various psalms, Genesis, Job (esp 37:13) and Hebrews that God both made the world and governs it as well for his purposes.

Perhaps God governs the world but never changes the way he governs it. I think the miracles are evidence that this is not necessarily so. Furthermore, the world had a definite beginning and will end, thus making it impossible for such governance to be unchanging, at least in terms of what is observable.

If we accept all the foregoing, is not God being unfair to us by not specifying how things will be changing and when? An examination of John 21:25 should indicate that many, many books would be required if God were to tell us *all* his plans for future changes, in view of the books that would be required to tell us all that happened to Jesus in his three short years on earth. In compensation for this, there are the promises throughout the Bible for the protection of the believers. God has indicated that he will take care of us *regardless* of what occurs.

Note that I am not saying God's purposes change; they do not. But his unchanging purposes may still necessitate changes in operational relationships on earth such that there would be no such thing as "eternal" scientific truths.

Have we undermined Christianity by restricting science in such a manner? I don't think so. As a matter of fact, the Bible has far more authority over truth and falsehood than observations of the world around us, as Dr. Thorson has mentioned. In fact, it would be good to compare some of the differences between the actual methods of knowing (in the biblical sense) and knowing (in the scientific sense):

Bible	*Science*
1. Written without error—the infallible word of God.	1. The world being investigated is fallen and has many flaws.
2. The actual words are given by God without error.	2. Man translates perceptions into words—possible sin and error enter. Also there are measurement errors.
3. Truth is either specifically mentioned or deducible from Scripture - no logical fallacies are inherent in the process.	3. "Truth" is arrived at by induction which is technically a logical fallacy. Another theory (besides the one considered true) might also explain the observed results.

These are but a few comparisons that indicate why the truths of the Bible are far more authoritative than any "truth" of science could hope to be. Note, too, that the methodologies are really considerably different. Therefore, it is not necessarily the case that the faith of Christians would suffer if it were found that the truths and methodology of science were in fact false, in some way. Furthermore, one would think that if it is correct to assume that the loss of science would weaken the faith, then how do we explain the fantastic joy, hope, and faith of the early church, before there was any science at all, as we know it today? In fact, I doubt that one could really compare the vitality of the church today and the church back then. I also doubt that one could prove that science has necessarily weakened the faith as some people have maintained, although a case could be made that the *misuse* of science might have weakened the faith of some. Nevertheless, I doubt very much that God's purposes and plans of salvation are contingent upon the preservation of science as we know it today.

What about the morale of the scientist? If what I have said is correct, than what can the poor scientist do, who has spent all his career life, hoping against hope that the theories he works with are indeed "true"? I'll have to admit that my own reaction when I came to believe this, was similar to the child who had been told that one S. Claus does not in fact exist. But, if what I believe now is correct, should I have been kept in the dark for the sake of my morale?

Finally, what then should scientists and other technical people do? In my opinion, they can (among other things) do the following:

1. Continue with mathematical correlations, but just do not expect from them what they cannot do, namely, generate confidence that one has discovered some sort of invariant eternal law. Remember, according to Dr. Thorson himself,

> . . .scientific theories, . . .always remain open to further, unanticipated extensions; they [can] not, even in principle, be "necessary," absolute, or comprehensive in scope.

2. Examine the Scriptures carefully to assure that any so-called scientific laws are not at variance with Scripture. I recognize that we need to be sure our interpretation of Scripture is correct, using Scripture to interpret Scripture. If we are unsure after all this, then we are unsure regardless of *what* scientific "laws" are brought to bear.

3. Apply whatever correlations one obtains to the task of subduing the Earth. Subduing the Earth also includes solving pollution problems; otherwise, the Earth will subdue us!

4. Continue work on the philosophy of science in concert with studies in Scripture with the objective of obtaining a completely coherent philosophy of science in tune with scriptural principles. As Dr. Thorson has said, "Scripture has a great deal to tell us about how 'knowing' really works in relation to any level of reality."

5. Study more the history of past thinking in science. I think if at the very least the idea of finding "truth" in science is relaxed to some extent, we may strengthen the respect we have for the thinking of other ages. We may want to look especially at some of the thinking that has "lost out" in times past. For example, Leibnitz is reputed to have used "pre-relativistic" ideas to criticize Newton. Newton "won out;" his notion was considered "true" and Leibnitz's was not. Leibnitz's ideas were forgotten for over 200 years. Had physicists been a little less certain that they possessed the truth with Newton's laws, it might have been that the ideas of relativity could have developed earlier (this is conjecture, to be sure!) C. S. Lewis has warned us of the problem of "chronological snobbery" (the idea that we, in this enlightened age, have so much more truth than people of other ages, that we do not need to even consider what such people said). To counter this tendency, he recommends reading "old books." Perhaps scientists may get inspiration and ideas by reading ancient scientific theories as well as the most up to date theories.

Finally, I'd like to comment once again that my disagreement hinges not on my possession of greater assurance of knowledge than Dr. Thorson has but on less. I admire his assurance, although I don't agree with it. I also sympathize with his concern about the fate of science.

Ultimately, though, what we have in common is much more important:

> For I am convinced that neither death nor life, neither angels nor demons, neither the present nor the future, nor any powers, neither height nor depth, nor anything else in all creation, will be able to separate us from the love of God that is in Christ Jesus our Lord. (Rom. 8:38,39)

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It is the very givenness of the parameters of the milieu of human life—the parameters of the fundamental constants, fundamental particles, and the laws of matter-energy-space-time—which make human freedom and human perception possible. Only in a universe with this kind of ordered givenness is there the stable matrix within which freedom can be genuinely exercised and which makes perception and conceptualization possible. In other words, the emergence of human consciousness, with its characteristics of freedom and perception, is only possible in a cosmos which exerts certain constraints.

A. R. Peacocke
Creation and the World of Science, Clarendon Press, Oxford (1979), p. 71.

Further Comments on Scientific Truth. . .

SCIENTIFIC TRUTH: IS IT TRANSIENT OR ENDURING?

As evangelical Christians we are faced with the problem of trying to help both the skeptical, non-Christian scientist, and the modern ultra-fundamental creationist. If we are going to be able to help either or both of these we must have genuine confidence in both the Holy Scriptures and in the results of careful scientific research. The skeptical non-Christian scientist has little or no confidence in the Scriptures, and is usually doubtful about the permanent value of the discoveries of science. The ultra-fundamental creationist usually has a similar skepticism concerning the value of science, but of course has a strong confidence in the Scriptures.

We unfortunately find in our own moderate evangelical "camp" a lack of confidence in the results of scientific research, and an uncertainty concerning man's ability to know the creation in a reliable and enduring way. And we sometimes seem to have the same problem that the ultra-fundamentalists do in doubting the stability of God's natural laws.[1] (I speak of *God's* natural laws, and in so doing recognize that this universe in which we live was *ordered* by God, and therefore that the activities and relationships we see in nature are consistently orderly, and not erratic.) Of course we must not take an extreme uniformitarian view of the earth's history, for we know that there has been great variation in the forces and processes which have formed the earth's crustal features. But this variation has never included changes in the fundamental physical and biological laws which God established when He created the universe.

Concerning the certainty and dependability of modern scientific discoveries we must recognize: (a) There are many theoretical aspects of science which *are* transient or temporary; (b) On the other hand, there are a good number of known scientific truths which are enduring, *because* they are actually discoveries of some of the principles of God's plans of the creation. In other words, God allows man to discover by scientific research some of the stable, natural laws which *He* established and understood from the beginning.[1]

If we recognize that there are divinely established, stable physical and biological laws, we should not take the pessimistic view that the scientific principles which have been discovered in the past are all subject to being outmoded and fundamentally changed within the coming decades.

The Misunderstanding Illustrated

A specific example of the confusion which now exists concerning the question of the permanency of scientific discoveries may be helpful here. It is often said by laymen, theologians, and some scientists, that all science textbooks go out of date practically as fast as they are published. This is taken as an indication that the scientific truths in those books rapidly disintegrate as scientific research progresses. From the standpoint of the popularity of certain themes in the various scientific disciplines, the books soon do become out of date. But it is *very* far from true that the validity of the actual content goes out of date. For example, in the 1940's and 1950's the textbooks of general biology put heavy emphases on the detailed stages in the reproductive life cycles of many kinds of plants and animals, and on taxonomy. Then in the late 1950's biologists throughout the entire western world became excited about the biochemical cycles within the cells of living organisms, and about the working principles of the genetic code which is built into cells (the functions of DNA, RNA, and other information-bearing compounds). Demand for even the best biology textbooks of the mid-1950's quickly dwindled to a mere trickle.

This circumstance was particularly amusing to extreme fundamentalists who had been saying all along that scientific truth is only transient. But these critics were ill-informed. Practically none of the principles taught even in the biology textbooks of the 1920's and 1930's had been declared invalid. New principles and the life cycles of many new plants and animals had been added in the textbooks of the 1940's and 1950's, so that the college freshman at that time had a 600 or 700-page book. Half or more of that material had to be dropped for the adding of new biochemical materials—and then *more* biochemical materials as the years progressed. So we have merely observed a trend in science education, and in the interests of scientists—not a disqualifying of the discovered principles concerning the life cycles of marine plants and invertebrate animals. Finally, the trends in biological education have continued to go on, as Professors have become infatuated with new aspects of biochemistry and the physiology of living cells, and have let other aspects of the science fall by the wayside. This same principle of legitimate change is seen in the textbooks of other disciplines of science. For example, in the medical and surgical sciences, the publications are constantly being brought into conformity with the latest discoveries in methods of treatment, the exact causes of diseases, and newly discovered functions of various tissues in the human body. But we do not find the newly published textbooks denying the basic functions of the tissues and organs which have been known for the past half-century. It is of course true that occasional corrections in the textbooks have to be made, due to inadequate data at the time the earlier editions

were published. An example of this was the change from 48 to 46 chromosomes in human somatic cells (about 1960), *but* this is not the denial of a fundamental principle such as the fact that human cells do have chromosomes which are duplicated in the process of cell reproduction.

Holding to a view that scientific truth is only transient will render us powerless in the task of helping those who claim that scientific observations on the history of the earth are not dependable.

Reasons for our Confidence in the Enduring Nature of Scientific Truth

1. We need first to recognize that there is a biblical, reasonable basis for believing that man can discover some of the permanent physical and biological laws which God originally ordained. This basis rests upon the fact that man was created "in the image of God."[2] What do we mean, "created in the image of God"? This term refers to several spiritual and mental characteristics that man has, but the trait that concerns us here is our possession of a rationality that is fundamentally like the rational nature of God, except in lesser degree. It is true that man lost some of his "image of God" characteristics at the time of the Fall described in Genesis Chapter 3, but the Bible makes it clear that man still retains fundamental God-like abilities.[3] These abilities enable man to know the same kinds of relationships, laws, and principles as God knows, and thus to comprehend God's creation to some degree. Possessing this ability, man is thus able to gain objective knowledge of the created world—which means that our knowledge of created objects, laws, and relationships can correspond to (be fundamentally similar to) God's knowledge of the same, except to an incomplete degree.[4] The scientist must of course seek to exercise honesty, persistence, and breadth in his research, so as not to violate the rationality that God has given him. We do not maintain that a scientist has to be a Christian in order to discover enduring scientific truth, but it *is* necessary for him to be an honest seeker of truth with a recognition of rational, cause-effect relationships that have been established by an Authority greater than himself.

2. We have, in the inspired Scriptures, several statements that Christ made while He was here on earth concerning man's ability to make reliable observations of the natural phenomena around him. These should be taken as highly significant, and relevant to the ability of man to collect reliable scientific data today. In Matthew 7:9-10 Jesus referred to the people's ability to accurately distinguish between bread and stones and between fishes and snakes. (Perhaps you say, "Of course those distinctions are obvious." Yes, but it is highly significant that they *are* obvious to man, and that Jesus had no question concerning man's ability to make such observations.) Some other human observations of the natural world that Christ recognized as valid are: (a) the distinction between old cloth and new cloth, and between old wine and new wine (Matthew 9:16-17); (b) time distinctions (John 11:9); compare John 4:53 for an inspired assertion of a particular man's ability to make time distinctions; and (c) the recognition of clouds as precursors of rain (Luke 12:54-56).

3. Science has already made many time-honored discoveries that give no prospect of ever being fundamentally altered. We referred in a general way to this principle, in the discussion of the content of science textbooks above, but should now consider some specific cases of discoveries which are undeniably permanent, and thus indicate to us that in these cases God has allowed man to discover principles that have been known to and upheld by Him from the earliest times.

The first of these to be considered here are discoveries concerning the make-up of the human body. There was a time when man did not know that the elemental components of his body are the same as those found in sea water and elsewhere on the earth (Ca, O, H, Mg, etc.). At least most of the elements in the human body have now been identified and shown to be the same as those which are found in the ocean, in limestone beds, in phosphate deposits, and elsewhere in the earth. Even though one or more rare elements now thought to be present in human tissue may eventually be eliminated from the list, there is no chance that we will one day discover that calcium is not present in human bones, or that the water in the human body contains no oxygen or hydrogen. The same validity of man's discoveries applies to such characteristics of the body as cellular organization, and the presence of muscle fibers, connective tissue fibers, and functioning organs.

Over 300 years ago, the famous physiologist William Harvey conducted detailed experiments and observations regarding blood flow and the function of the heart in mammals. These experiments and observations were carried out over a period of 20 years, and resulted in the discovery of the primary function of the heart and some laws of blood circulation—such as that blood flows out of the heart through vessels and back to the heart through a different set of vessels. God had known these laws ever since the creation of mammals, but now He allowed man to discover them for himself. Thus, these are part of the body of scientific truth known to man which is *not* transient. We accept this fact, whether we will admit it or not, since we realize that the function of the heart as discovered 300 years ago is being faithfully redemonstrated on operating tables in many hospitals every day.

Some other examples of scientific discoveries that are in no danger of being shown to be erroneous or a mere part of man's cultural bias at this point in history are the following: (a) mosquitoes carry malaria, (b) many green plants take in CO_2, give off O_2, and synthesize sugar and other organic compounds, (c) mammals are dependent upon oxygen as one of the elements needed in metabolism, and give off CO_2 as a by-product, (d) sea urchins reproduce by eggs that they release into the water, (e) some sharks bear their young alive, (f) the globicerina ooze of the ocean really is produced by living organisms, (g) the sun is farther from the earth

than the moon, (h) liquid water can be evaporated into a gaseous form, and that same water recovered by condensation, (i) quartz is distinctly different from calcium carbonate rock, with regard to both hardness and chemical content, (j) both acidic and basic lavas are produced by volcanoes, and (k) the element lead is more dense than iron.

Is it not self-evident that these are enduring truths which will not change, even though our entire culture may be completely altered, and the time may come when human beings will no longer be performing experiments that demonstrate these principles, or writing scientific reports? Also we will have to recognize that even though I or some other person might make one or more accidental errors in our statements concerning these principles, this will not alter any basic, known truth that has been carefully observed and recorded in hundreds of scientific reports. Again, we need only to recognize that God has allowed man to search out and begin to know some of the truths concerning his creation, which were known to God from the beginning but not known to man until comparatively recent times.

The Stability of Natural Laws From God's Standpoint

We now deal briefly with the frequently-heard suggestion that scientific truth can be considered transient because of a possibility that God may sometimes change the controlling principles or natural laws that He originally established. This is a charge made by some extreme fundamentalists, but it need not worry anyone who is familiar with the biblical teaching on the nature and character of God.

First of all, we should accept the principle that natural laws, e. g., the laws of biological growth, are objectively real. The success of early modern science seems to have been based on the fact that Copernicus and other scientists of his era insisted that man can discover what is *actually true* in nature.[5] Any theist who accepts the Bible as a revelation from God should have no trouble in accepting such an objectivity in the universe. In Hebrews 1:3 we read that God "upholds the universe by his word of power," and we observe all around us an order, regularity, and dependability of natural events that readily convinces us that God has "backed up" his creation with what we might call "regulations which work." Any denial of the cause-effect relationships involved in this is a denial of the validity of human observation, knowledge, and rationality.[6] Such a denial is contrary to the statements of Christ referred to above, as well as to the teaching of Scripture with regard to man's possession of "the image of God."

Concerning our confidence that God does not follow an erratic pattern of occasionally or periodically changing His natural laws, we should remember the many statements in divine revelation to the effect that God is immutable; for example, "I, the Lord, do not change" (Malachi 3:6); Hebrews 13:8; and Psalm 102:27.

We also find assurance that God has not changed the natural laws in the fact that life as described in the Garden of Eden and soon afterward was very similar to what it is today. Plants were carrying out photosynthesis; animals were using plant materials as an energy source; reproduction was occurring according to genetic limits; and, after the expulsion, man found that hard work produced "sweat on (his) face." The Genesis account gives us no hint that life processes or the environment in which man lived was essentially different from what it is now. Furthermore, if the laws of biological growth and maintenance were all functioning properly then, we have no grounds for thinking either that God would change them later, or that He found it necessary to go through a process of developing or perfecting them in earlier times.

Conslusion: What To Do Now?

In view of the foregoing evidences for the enduring nature of scientific truth, we should:

1. Encourage both laymen and professional scientists and theologians to recognize (a) that God has created a consistent and understandable world, and (b) that even though man's comprehension of God's works has been dimmed by the Fall, God wants us to *know* and rejoice in truth discovered by scientific research.

2. Remember that holding to a view that scientific truth is only transient will render us powerless in the task of helping those who claim that scientific observations on the history of the earth are not dependable. (Many of the latter are accustomed to thinking that science can discover nothing at all about the past history of the earth, and that the Bible is the only source of reliable information on this subject.)

3. Refuse to pattern our own thinking after that exhibited by educators who fail to recognize God as the author of both creation and man's ability to know it.

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[1]It is true that many scientists, including some evangelicals, speak of man as "formulating the natural laws," but for the evangelical this can mean only that man puts into words a recognition of the law or relationship which was originally established by God (Holmes, *Christian Philosophy of Science*, p. 6). Such original laws are sometimes called "prescriptive laws," in contrast to "descriptive laws," which are man's formulations, made by synthesizing his observations of phenomena (from Russell Maatman, personal communication, 1980).

[2]Genesis 1:26-27.

[3]Genesis 3; Psalm 8:5; Psalm 82:6; John 10:34-35; Acts 17:28; Romans 1:19-20.

[4]Van Til, *A Survey of Christian Epistemology*, p. 4; Schaeffer, *He is There and He is Not Silent*, p. 43, 48-50, 65-72, 76-80.

[5]Thorson, "The Spiritual Dimensions of Science," p. 239-245, *in Horizons of Science*, p. 217-257; and Schaeffer, *He is There and He Is Not Silent*, p. 67-69, 76.

[6]Maatman, *The Unity in Creation*, p. 50-66, 75-80.

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The Logic of Miracles

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Christians who require strong evidence for their beliefs would have little to lose should miracles be found inadequate to establish them. Other grounds for belief are, I believe, quite sufficient.[1] However, because we have good reason to believe that Jesus as well as the whole of the Hebrew and early Christian tradition accepted miracles as adequately verifying religious claims, Christians particularly should be hesitant to write off miracles completely.

With this as my own motivation for looking into this question, I would like to examine the logic of miracles as evidence for metaphysical and religious claims. I believe that only if such foundational matters are closely analyzed can we adequately understand miracles and answer many of the common objections to the claim that they possess evidential value.

Following this lead of going back to the ancients, I believe that contemporary apologists have basically gone wrong by building on modern concepts, such as that of natural law. It has become common to try to provide evidence for God's existence and activity by attempting to present phenomena which indicate a suspension of such natural laws. By making such a move in defense of miracles, apologists have left themselves open to the most devastating critiques.[2]

Another late concept, that of the nature/supernature duality, has not had the same disastrous results and, indeed, has greatly contributed to our understanding and defense of miracles. However, being a late concept, we will see that it is not strictly necessary for understanding the logic of miracles. We will examine the concept of supernaturalism later in this paper.

What is strictly necessary is to find a way to justify the claims of the agent of the miracle. But how can these claims be established as true? How can a miracle be identified which possesses evidential force?

Similar questions can be found in contemporary critiques of miracles. So it is of value to look at some common objections. Antony Flew maintains that one must have a strong sense of natural law in order to claim miracles: "It is only and precisely insofar as it is something really transcendent—something so to speak, which nature by herself could not contrive—that such an occurrence could force us to conclude that some supernatural power is being revealed."[3] He goes on to make his second point: "We certainly cannot say, on any natural (as opposed to revealed) grounds, that anything that actually happens is beyond the power of unaided nature any more than we can say that anything which any man has ever succeeded in doing transcends all merely human powers."[4]

The same objection can be found among orthodox Christians: the non-theist could quite justifiedly face a miracle

How can we identify a miracle such that particular religious claims are verified?

and respond, "Well, strange things do happen after all," according to presuppositionalist Cornelius Van Til.[5] Even evangelical apologist Norman Geisler claims that miracles have evidential value *only after* the theistic world view is in some other way established. Otherwise, proponents of any of the several world views—natural, supernatural and pantheistic—could justifiedly interpret the same phenomena to fit their respective world views.[6] At one point or another the contention is made that something other than a high theism can account for any phenomenon in this world. Thus the most important question remains: how can we identify a miracle such that particular religious claims are verified?

I define a miracle as "a non-normal occurrence in the world, perceived through normal sense experience and giving evidence for the existence of a being of greater than normal human intelligence and/or power, and giving evidence for the claims of the apparent agent of the phenomenon."[7]

As was stated earlier, with this definition the distinction between nature and supernature is not necessarily presupposed; indeed, any of the several major world views may be evidenced depending on the claim of the agent of the miracle. What follows is an analysis of the logic of miracles as, I believe, it has been assumed from antiquity. Concepts such as that of natural law and the distinction between nature and supernature have not always been with us; yet the intrinsic evidential value of miracles has been accepted for ages.

Characteristics of Miracles

The first necessary characteristic of a miracle is that it is an unusual and rare phenomenon; it does not fit "the order commonly observed in nature," as Aquinas puts it. Secondly, a miracle must involve a propositional claim which is either inherent in the phenomenon or precedes it as a prediction that the phenomenon will occur.

There are several possible interpretations of a miracle as distinguished by the above characteristics. One can accept a naturalistic world view and claim that nature is absolutely uniform and admits no exceptions. Potentially, this strange phenomenon will eventually be fully explained through scientific examination.

One can take a naturalistic world view and claim that nature is not absolutely uniform; exceptions may be admitted. Causal factors such as forces or even existent objects may come into being from no prior cause at all. The laws of nature may have exceptions. The strange phenomenon called a miracle is claimed to be a true ontological anomaly of nature that science will never be able to explain.

A second world view claims that the "miracle" is merely a manifestation of God—who is the universe—into a new form. According to the pantheist, God sometimes appears simply as the world, sometimes as Krishna, sometimes as Jesus, sometimes as a burning bush which is not consumed; all are God, *Ātman*, the One, or whatever the particular metaphysic may wish to claim.

The third world view is supernatural theism. Here it is claimed that the miracle is the direct result of the power of the divine or the supernatural acting in nature.

All of these world views are equally justified in their interpretations if we grant the first phenomenal characteristic alone, the miracle's unusualness or rarity. But if the second characteristic, the propositional element, is also present, then a particular claim and/or one of these particular world views may be evidenced. This now needs to be demonstrated. A miracle gives evidence for the existence of a being with greater than normal human power and/or knowledge and it provides evidence for the claims of the apparent agent of the miracle. The evidence for each is different and so each will be considered separately.

Evidence of Superhuman Power or Knowledge

There are one thousand white marbles and one black one in an urn. A man randomly selects marbles from the urn. Before he does so, I make a prediction that at some seemingly random point—say the 813th pick—the black marble will be selected. On the 813th pick, the black marble is selected. The chances are 1/1001 that I could make the right guess—not very good odds to say the least. But if I had some kind of knowledge of the arrangement of the marbles and the exact way the man would select each marble, or if I have some kind of control over the arrangement of the marbles and over the man's choices in selecting marbles, then there would not be any improbability whatsever of making the right guess as to when the black marble would be picked.

Likewise, if Jesus predicted his bodily resurrection from the dead, the chance would be extremely improbable that it would occur unless he had some control over the situation and/or some knowledge people do not normally have.

Though we cannot know for sure, it seems very unlikely that a physical resurrection from the dead could ever occur by chance, no matter how many eons of time we allow. But let us imagine that eventually such an event could take place. Imagine that the chemical arrangements of the cells of the body just happened to reform in a manner such that life would again be possible. (Many biblical miracles are such that we can imagine them happening by chance at some time or another if we are given enough time.)

So let us imagine that given enough time, a physical resurrection could occur. Say the chance is one out of some very large number like 10^{1000} ($1/10^{1000}$) that it would occur to some particular individual. If we have 10^{1000} persons, it

will likely occur eventually. This is the same principle we use when we say that we have 1/1001 chances of picking the black marble at any given time but that we have 1/1 chance of picking it eventually.

Now suppose Jesus never predicted his resurrection. Suppose he was crucified and died and after two nights and one day in the tomb, he came back to life totally healthy. He could not now claim this event as evidence for the existence of some being with superhuman power or knowledge who effected the event (or that he himself had this power or knowledge). He could not do this any more than I could claim special knowledge or powers for myself if I waite until after the black marble was picked to predict its selection.

My point here is that a prediction is needed for us to have evidence of greater than normal human knowledge or power. This is because the event is far too unlikely to occur by chance at the time predicted. The alternate explanation of special power or knowledge is the only alternative. We face no improbability whatsoever for the latter explanation. A wise man apportions his belief according to the evidence according to Hume. It is immensely improbable that this event could be caused by chance. It is not at all improbable that it had been caused by the intervention of a being with greater than normally assumed human power and/or knowledge. Therefore, this second explanation is the more reasonable and the wise man will assume it.

Now a fulfilled prediction is not the only means of giving evidence of special knowledge or power. The miracle of the burning bush (Exodus 3) is such a case. Here the phenomenon (the bush burned without being consumed) involved the propositional claim within itself (the Lord speaking from the bush). The situation was such that it seemed as though the speaker actually had control over the phenomenon, the burning.

The distinction between prophecies and most other biblical miracles (and miracle claims of other religions) consists in the fact that the miracles usually involve an event that cannot be accounted for by science—or at least by contemporary science. A prophecy may be of a normal natural occurrence. But as we have seen above, a miracle is essentially of the same nature as a prophecy. Special power or knowledge is evidenced by both.

The prohlem we now face is to move from our present conclusion—the existence of a being with special power and/or knowledge, whether it is the apparent agent of the miracle or a claimed other—to the more particular claims of the agent. That is, if Moses or Jesus made certain claims about the nature of the being they stated enacted these signs, it seems that they should be believed. So far, we know only that special power and/or knowledge has been evidenced. We do not know if this power/knowledge is possessed by the one who predicted the event would occur—or if it is carried out, as was usually claimed, by another, such as God. We do not even know if the special knowledge/power consists merely of a slight-of-hand trick or some other more sophisticated deception. It may consist of technological knowledge possessed by an advanced civilization such as the "Chariot of the Gods" hypothesis claims.

Human trickery can be somewhat eliminated by close examination of the phenomenon or the historical evidence. So the historical evidence does have a bearing on removing some interpetations of the phenomenon. But other alternatives cannot as easily be eliminated. How do we know that the resurrection of Jesus gives evidence for the existence of a good creator God, for instance? Might the one (either Jesus or another) who effected this event be evil? Is anything evidenced by this event other than special power or knowledge?

In fact, any of the three major world views could still be claimed to be compatible with the phenomenon. Naturalists could claim that extraterrestrial aliens caused the event. Pantheists could claim that this is a manifestation of a God who has the power to so manifest himself. The alternative that is definitely eliminated is the claim that the event is a result of pure chance, one of the more important naturalistic interpretations. We have evidence of the power and/or knowledge of a being who is either in and part of the physical universe or nature (naturalism), outside of nature (supernaturalism) or identical with nature (personalistic pantheism).

Can we move from these conclusions to justified belief in the claims made by the agent of the miracle?

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Evidence for the Claims of the Agent of a Miracle

Regardless of one's world or life view, it must be admitted that a greater than normal human power and/or knowledge is evidenced by a miracle. Normally the leap from this claim to belief in the claims of the miracle worker, the prophet, or the object of the vision involves something very like the scientific process of hypothesis verification, with the claims constituting the hypothesis.

The claim may confirm any one of the major world views with variations ranging from spiritism to panentheism. The miracle worker may even claim to be a very accomplished and capable conjurer and that the power and knowledge displayed is solely his own.

The claim, that is, the hypothesis under consideration, is relatively verified by the sign or miracle. For example, the claim that an omnipotent, omniscient, omnibenevolent creator exists is relatively verified by the occurrence of a phenomenon that requires an extremely great knowledge and/or power. If God exists, then this event could occur; the event occurs; therefore, this God exists. Thus we have the logic of hypothesis verification.

Obviously the syllogism is not valid since it involves the fallacy of affirming the consequent. Our problem—as is commonly the problem in scientific hypothesis verification—is that other hypotheses may equally well be able to account for the occurrence. A less than infinite mind or power, a pantheistic god, an intelligent creature from a distant galaxy, perhaps even a good human conjurer may be able equally well to account for the occurrence. Why pick the particular hypothesis claimed by the miracle worker? How can one hypothesis be found to be more adequate to the evidence than another?

Most people would admit that if they confronted a miracle, such as any of the several presented in the Hebrew and Christian Scripture, they would believe the claims of the apparent agent of the miracle. The most antitheistic professor I had as an undergraduate, an avid Humean believer in the epistemic worthlessness of miracles, admitted (perhaps inconsistently to his Humeanism) that he would "believe" if he saw the burning bush (Exodus 3), so long as he had a chance to check for mirrors, wires, etc. What exactly is this evidential force that most people would admit to?

I believe that the answer lies in several factors combined. First of all the claim, the hypothesis, fits and thus is relatively verified by the now clearly evidenced state of affairs that there exists a being of greater than normal human intelligence and/or power. The involved claim is more evidenced than it would be without the miracle. As we have just seen, however, this is not enough in itself to establish the evidential value of miracles. Secondly, it is clear that there is an agent of the miracle who either knows that the claim is true or does not know that it is true. Thus the agent of the miracle must either be definitely lying or definitely speaking the truth. Thirdly, because a claim should normally be believed unless there is good reason to doubt the credibility of the claimant and because of the first factor we have just considered, it follows that the claim of the ultimate agent of the miracle should be believed (and the proximate agent, if there is a distinction between agents). Allow me to clarify this argument further through a critique of this view.

Stephen Wykstra in a critique of John Montgomery's evidentialism suspects that Montgomery may accept the same criteria for miracles we have just presented:

> . . .the fact that a person *has* a certain extraordinary power neither entails that he know, nor, if he knows, that he is truthful about, the true explanation for this power. If it *were* factually established that Jeanne Dixon could prophecy, or that Uri Geller could bend spoons across a room, would we be rationally obliged to accept any explanation of their powers they proffer, simply because other humans cannot do what they can do? By the only criterion Montgomery provides, Uri would have to be accepted as an Agent of Revelation if he explains to us: "Only by the special power of God Himself, the Omnipresent One, can I bend spoons across an empty room.[8]

Wykstra suggests that this criterion is obviously specious. I would argue that once the more ludicrous features of such miracle examples are removed, the criterion should be admitted as valid. Bending spoons across an empty room is, in this case, much in the same category as miraculously growing hair on billiard balls (Montgomery's example). Both lack a "fitness" to the claims of the agent of the miracle, at least if the claim is notable (i.e., if, say, it is claimed that the phenomenon were carried out by an infinite God rather than by an apprentice magician). Clearly a greater than normal power and/or knowledge is evidenced; but *such* a display of knowledge or power is not quite what we would expect of the Omnipotent One.[9]

So would one *otherwise*, "be rationally obligated to accept any explanation of their powers they proffer, simply because other humans cannot do what they can do?" One would, because the claim is relatively verified by the phenomenon and because we should in any normal circumstances trust a person's non-exceptional claims.

Should such a phenomenon be given, it would be a display of power or intelligence as would be expected of the omniscience or omnipotence of God. We trust a person's normal claims in normal circumstances without full proof of their statements but only with minimal indication of their truthfulness. Likewise we should trust one's religious claims so long as a similar yet proportionately greater minimal indication of their truthfulness is given by the miracle. Because the religious claim requires more verification than a normal claim, we need a display of power/intelligence as would be expected were the religious claims true.

Miracles were called "signs" in biblical times because they were pointers evidencing the religious claims made. They did not contain within themselves a full display of the infinite power, knowledge, goodness or creatorhood of God; rather they gave sufficient evidence for an experient to justifiedly infer the truth of the claims of the apparent agent.

It should now be said that some miracle claims are evidentially very strong even without any inference to the full claims of the apparent agent. Certain prophecies, for instance, which involve very long periods of time and exact historical concurrences give evidence of so great a source of intelligence and power that even hypotheses of super-intelligent space travelers cannot explain the data.[10] Thus the hypothetical alternatives may diminish even more than we had suggested earlier.

With this analysis of the evidential value of miracles we can now look at some common objections.

Miracles were called "signs" in biblical times because they were pointers evidencing the religious claims made. . . .they gave sufficient evidence for an experient to justifiedly infer the truth of the claims of the apparent agent.

Objections

Let us first consider the arguments against miracles presented at the beginning of this paper.

Flew claims that we need a strong view of natural law in order to have evidence that nature is truly being transcended by a miracle. But on our present argument, we do not need to show that nature is transcended and we need nothing more than "the order commonly perceived in nature" to evidence a miracle.

Such an order need not imply exceptionless "nomologicals." We are not verifying religious claims by a phenomenon which is an exception to natural law. Rather we are verifying them by establishing the existence of one of greater than normal human intelligence and/or power and by establishing the truthfulness of their claims. The non-normalcy of the phenomena need consist of nothing more than a fulfilled prediction or some other manifestation of power or knowledge.

Though we need not accept inviolable nomologicals, we could just as easily accept them with no harm to our argument. On the one hand, we could reject nomologicals: A miracle may be a "breaking" or "overriding" or "suspension" of natural law. Lewis argues that general but not absolute or inviolable laws or uniformity of nature are philosophically acceptable.[11] Modern advocates of exceptionless laws, such as Flew, are oblivious to the metaphysical leap they are taking. One cannot establish exceptionless nomologicals following the normal criteria for establishing natural law (á la Flew, *Hume's Philosophy of Belief*, p. 206) since these criteria can in no way show whether or not there can ever be exceptions to such laws. An intraversable "broad ugly ditch" separates experience from inviolable laws.

On the other hand, inviolable nomologicals may be accepted by the proponent of miracles. Jesus' walking on the water or his ascension to heaven need not be seen as breaking a natural law any more than our sending a rocket to the moon should be seen as breaking the laws of gravity. Both merely indicate special activity in the normal course of nature by human or non-human agency and both can fit the laws of nature. Augustine represents this view by claiming that, "a portent is not contrary to nature, but contrary to our *knowledge* of nature."[12]

In Flew's second argument, he asks how we can know that anything which does occur is beyond the power of an unaided nature. We can know by the claim of the agent of the miracle which is established as trustworthy. Our reply to Geisler is that the several world views cannot equally interpret an occurrence if that occurrence displays a greater than normal power and/or intelligence and if the apparent agent of the phenomenon makes specific claims concerning the truth of one world view. If no such claim is made, then only what is stated is verified.

Flew: The Arbitrariness of Miracle Choices

We may be able to glean from Flew another important objection.[13] If we admit a biological miracle such as the resurrection on the basis of historical evidence, why not admit another type of miracle which could equally well explain the evidence? Instead of a biological miracle, why not posit a psychological miracle such as mass hallucinations of Jesus and the empty tomb. Or suppose that two or three hundred years after the death of Jesus (or any other arbitrary number of years up to the present) individuals and groups all over the civilized world began quite spontaneously to believe in the resurrection and deity of this Jesus (who otherwise would not even be remembered). Non-Christians likewise assume the existence and history of this Christian community. Aged documents relating stories of Jesus' teachings, life, death and resurrection as well as the teachings and exploits of his immediate followers spontaneously appear in the possession of some of these Christians.

This state of affairs would explain the physical evidence as we now have it. And such possible alternate miracle scenarios could be thought of *ad infinitum*. Why choose one miracle over the other? Why believe the biological miracle of a resurrection over the psychological miracle of the body being stolen by the Jewish leaders or the tomb guards?

It may be that this is not such a decisive problem after all. Don't we merely end up with several possible miracles, any one of which justifies the religious claim made? Does it matter which miracle we choose as long as the same religious conclusion is reached? Suppose, for instance, that we posit our late-spontaneous-belief hypothesis. We have a definitely non-normal phenomenon and we also have a claim that a non-normal phenomenon will evidence the

Messiahship of Jesus. The claim is now in written documents which were created *ex nihilo* several hundred years after the time of Jesus. The claim is apparently made by the agent of the miracle.

The only problem with this answer (and the problem is substantial) involves the truthfulness of the speaker, the agent of the miracle. In this case, the stated claim is that the miracle is that of a resurrection and that this is stated by a pre-mortem Jesus. If this were actually a miracle of created documents and implanted beliefs, then the speaker would be lying. In such a case, the speaker could not be trusted in any of his claims and the miracle would evidence little more than that a being of greater than normal human intelligence and/or power has acted.

However, as we saw when we examined the evidential value of miracles, a person's religious claims should be trusted if under normal circumstances we would trust their non-religious claims and if some further minimal indication of their truthfulness is given by the phenomenon fitting the claims (as a resurrection could be expected of an omnipotent God). As we should trust one's normal claims, so we should trust one's non-normal but proportionately more attested religious claim.

Hume's Argument From Probability

David Hume is believed by many to have conclusively put an end to any possible argument from miracles to religious belief.[14] C. S. Lewis has refuted Hume's central argument from probability more thoroughly and in more detail than I would hope to attempt.[15] But the general form of Hume's argument, or at least a necessary element in it, which has been much repeated by other critics can be briefly considered here.

Hume claims that human experience can establish probability. Thus uniform human experience can supposedly establish the infinite improbability of the occurrence of a miracle. If all of our past experience does not include a particular type of experience, then no perceptual or testimonial evidence, according to Hume, should rightfully persuade us.

But this is surely inadequate. Indeed, Hume is inconsistent with his own principles which establish this claim. He says that, "it is a miracle that a dead man should come to life, because that has never been observed in any age or country. . . . And as a uniform experience amounts to a proof, there is here direct and full *proof*, . . . against the existence of any miracle."[16] Yet elsewhere Hume admits that such unprecedented events could be known to occur. A total darkness covering the earth for eight days, to use Hume's example,[17] is surely an event fitting his above definition of a miracle.

Wykstra's Argument from Probability

Wykstra draws out of Hume's critique a much more credible presentation of the problem of probability.[18] He points out that since we establish through experience those probabilities we assume for nature's order, the comparative probabilities of Jesus' resurrection to his "swooning" (a mistaken diagnosis of death by the Roman execution team) would establish the former as infinitely less likely to have occurred. ". . .our experience concerning what happens to physical bodies following death is *much* more extensive—one might even venture 'infinitely more extensive'—than is our experience of what happens when Roman soldiers attempt to do their job."[19] Wykstra is definitely correct if this is all that is involved.[20] Indeed, we had earlier suggested some arbitrary degree of probability, say $1/10^{1000}$, that a predicted physical resurrection could occur to some particular person. But as we further noted in that discussion, that improbability would decrease enormously if some superhuman intelligence and/or power were involved in the events considered. Since a theistic world view is not antecedently less likely than any other, a resurrection would in this case be quite possible and far more probable than any alternate explanation such as that of the "swoon" theory.[21]

It is in our modern application of natural law to miracles—such as in the definition of a miracle as a breach of natural law—that modern apologists have gone wrong.

A Third Argument from Probability

There is another problem the proponent of miracles must face concerning probability.[22] The proponent will admit that a miracle is an unusual event. Thus it would be improbable that a miracle would occur at any particular time. This is not to say that it is improbable that a miracle will ever occur. Though it is improbable that one will pick the first time the one black marble in an urn filled with one thousand white marbles, it is not improbable that it will be picked eventually.

But if it is improbable that at any particular time a miracle will occur, then would this not count against any particular claim that a miracle has occurred? This question does give us reason to require stronger than normal testimonial evidence. An uncommon event should obviously be more attested than a normal event. (At this point we should recall that we have seen that we cannot assume, as Hume did, that miracles are infinitely or even extremely improbable.)

The event is admittedly uncommon, but not in principle more uncommon than, say, the prospect of being called up by a casual high school acquaintance after a separation of forty years. If the phone call does occur, we do not normally (nor should we) wonder whether the event did actually occur simply because it was extremely improbable that it

should occur on that particular day. And if we should tell someone else that this ancient acquaintance has called, we would likely be doubted only if our veracity is for other reasons questionable.

Incompatible Miracle Claims of Conflicting Religions

This objection, classically stated by Hume,[23] involves the claim that conflicting religions are supported by miracles which, as such, mutually destroy whatever evidential value they would otherwise have. The answer to this will be only summarily stated because of space.[24] Generally, the following criteria question whether the conflicting miracles both equally evidence their proffered claims or are equally evidenced to have occurred. This objection fails unless there is equal evidence for conflicting miracles.

If a true conflict of miracle claims occurs, we should first compare the testimonial evidence to determine whether both miracles can justifiedly be claimed to have occurred. Secondly, we need to compare phenomenal characteristics. Is one miracle more unlikely to occur without superhuman power than the other? Third, is the propositional element in proper relationship to the phenomenon? A normal phenomenon must be adequately predicted, for example. Fourth, we have a test of more limited value. In some cases, one miracle may display a source of power greater than that of the other, as when the serpent of Aaron devoured the serpents of Pharoah's magicians (Exodus 7).

A fifth criterion for comparative analysis is a moral test. Any miracle that involves a moral evil or the advocation of evil in the proposition should be rejected in its claim. This must be our conclusion unless there is other very conclusive evidence—such as that of religious experience, I would claim—that the agent of the miracle and the claim has the right to cause or command this evil. If the ultimate agent of the miracle is evidenced to be evil, then he cannot be trusted to give us the truth. A greater than normal intelligence or power is evidenced, but nothing more.

Should all of these tests fail or be inapplicable for comparative analysis then Hume's critique would have force. This would not, however, exclude the possibility of adjudication by some other means such as philosophical or other arguments, or religious experience. With the exception of the fourth criterion, all of the other criteria should be considered for evaluating a miracle's evidential value even when not used for comparative purposes.

Supernatural Miracles

It is helpful to see how the relatively modern nature/supernature duality fits the concept of miracles as we have just considered it. The nature/supernature duality is a valuable hypothesis or model for explaining how science would be unable to examine the ultimate origin of a miracle. This would be important for theists who maintain that God cannot be found out or "examined" by human effort alone or that God should not be confined to the created universe. If by whatever means such theistic claims are verified, then a miracle would have to involve "an interference with Nature by supernatural power" as Lewis defines a miracle,[25] or a similar model would have to be constructed. The following model presents a miracle not as a suspension or overriding of natural law but as an event which fits natural law.

Imagine nature as a complicated nexus of causes and effects (Figure 1). Like billiard balls, one factor "hits" another which hits another, which hits another, etc. A miracle involves the introduction of a causal factor from outside of nature into nature (Figure 2). By "outside of nature" I mean something analogous to the state of "spaceland" being outside of "flatland" in Edwin Abbott's Classic *Flatland*.[26] Indeed, at present I see no need to deny that the analogy could be quite correspondent: supernature could be merely a fourth spatial dimension that we would have no possible way of entering or perceiving without substantial changes in our very nature, which in turn we could not effect on our own. As the flatlander cannot even conceive of spaceland, so we cannot conceive supernature without specially given vision or except by analogy. On the other hand, our three-dimensional world would be readily open to entrance by beings in the four-

Figure 1. Normal Course of Nature

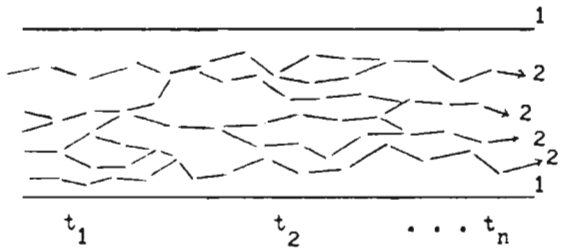
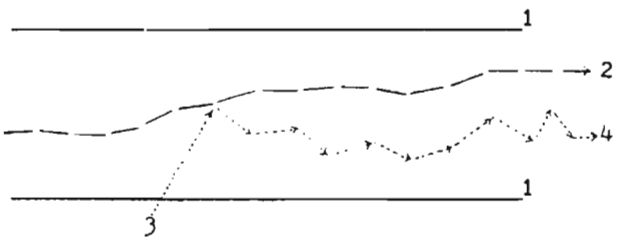


Figure 2. Miracle



[1]Boundaries of nature.

[2]The normal path of events nature would take without newly introduced determining elements.

[3]Introduction of new causal element from outside of nature.

[4]A new course of events occurring in nature. Laws (patterns) or nature are not broken.

dimensional world. "In calling them miracles," says Lewis, "we do not mean that they are contradictions or outrages; we mean that, left to her own resources, she (nature) could never produce them."[27]

The most ideal science conceivable would be able to trace causal factors to their original sources within the system thus explicating all of the causal origins of all events. If science were thus to become omnicompetent, it could not in principle trace back the ultimate origin of a miracle. The omnicompetent scientist would trace back causal factors to a point beyond which he could not go. At that point at the border of nature, it would seem as though the last examined event were caused by apparently nothing. We would have effects with no apparent causes.

A miracle may have a long series of natural causes which accumulate in the non-normal phenomenon itself. Indeed, all claimed miracles may have been set into motion at the origin of the universe. If this is so, then an ideal science would trace such a miracle back through normal causal factors in nature until it has reached the origin of the universe. The biblical miracle of the parting of the Red Sea (Exodus 13) is one that apparently has a long series of intermediate natural causes. Scripture itself speaks of a strong wind causing the parting. The fact that natural causes such as these can be pointed out does not diminish the evidential value of a miracle, as we have seen. On the other hand, it may be that a particular miracle involves very few, if any, intermediate natural causes between it and the causal entrance into nature.

Flew: Miracles as a Roadblock to Scientific Inquiry

We have been considering supernatural miracles primarily because of their limitation on the power of science. So, of course, objections arise to this claim. Flew complains that it would be a roadblock to inquiry to claim that some things are or may be inexplicable scientifically.[28] According to a supernatural model of miracles, the introduction of causal factors into the causal nexus of nature from outside of nature forms a path that even an ideal science could not trace backwards beyond the point of introduction. Flew should not be so close-minded as to assume that there cannot be admitted to be any area inscrutable to science. As Grace Jantzen points out, he should rather be willing to allow the scientist to investigate to determine whether this is the case and be open to evidence as it presents itself.[29]

We should follow science as far as it can go. If it comes to a dead end in any particular investigation, we should not presuppose either that science will eventually be able to investigate this matter further or that science cannot in principle investigate any further. We must simply wait and see what science with time can discover. In the meantime, we should keep an open mind to either possibility. Of course, a long term failure to get beyond such a dead end may dispose us to believe that there may be no way science can do so. However, it would be a mistake to claim that this alone would give us grounds for believing that we have a miracle evidencing God's activity (as Jantzen claims). This approach is incorrect, as Geisler would point out, because other world views can just as adequately adapt the phenomenon.[30]

Conclusion

It is in our modern application of natural law to miracles—such as in the definition of a miracle as a breach of natural law—that modern apologists have gone wrong. Accordingly, the dominant consensus in philosophy that miracles cannot evidence religious claims has been held with good justification. We can only begin to establish a defensible criterion for identification of miracles and to reverse this consensus once we come to understand the rationale with which mankind has for ages accepted "signs" as having evidential value. I believe that such a criterion has been presented and that miracles have been shown to definitely verify religious belief.

REFERENCES

[1]I believe that religious experience can be defended as the Christian's grounds for belief. Indeed, this essay was originally written as an appendix to a Master's Thesis on "The Evidential Value of Religious Experience," (Trinity Evangelical Divinity School, 1979), pp. 108-123. Other than religious experience, I believe some theistic proofs as well as historical evidences have value.

[2]A very recent and exceptionally forceful critique has been given at this point of issue by Stephen J. Wykstra in "The Problem of Miracle in the Apologetic from History," *Journal of the American Scientific Affiliation* 30 (December, 1978): 154-163.

[3]Antony Flew, "Miracles," *Encyclopedia of Philosophy*, 5:348.

[4]*Ibid.*, p. 349.

[5]Cornelius Van Til, *The Defense of the Faith*, 3rd ed., rev. (Philadelphia: Presbyterian and Reformed Publishing Co., 1967), p. 240.

[6]Norman L. Geisler, *Christian Apologetics* (Grand Rapids, Mich.: Baker Book House, 1976), pp. 95-97.

[7]This conforms roughly to Aquinas' definition; "those things. . .which are done by divine agency beyond the order commonly observed in nature." (*Summa Contra Gentiles* 3. 100.) In my definition, however, I am not assuming that divinc agency is necessarily involved.

[8]Wykstra, "Problem of Miracle," p. 157.

[9]The criterion of fitness is one we have referred to when discussing the problem of incompatible miracle claims of conflicting religions in "Evidential Value," p. 121.

[10]In "Daniel's prophecy of the seventy weeks" (Daniel 9), it is predicted that the Messiah would come and be manifested at a particular time. The time stated by the writer of Daniel very exactly corresponds to the time of Christ. Some scholars claim to have determined to the day that the predicted date of the prophecy is the same day that Jesus entered Jerusalem earlier in the week before his crucifixion, viz., the date of the "triumphal entry." See e.g., Harold W. Hoehner, *Chronological Aspects of the Life of Christ*, (Grand Rapids, Mich.: Zondervan Publishing House, 1977), pp. 115-139.

[11]C. S. Lewis, *Miracles* (New York: Macmillan Co., Macmillan paperback, 1947), p. 109.

[12]*City of God* 21.8.

[13]This objection was pointed out by John Montgomery in his critique of Flew in *Faith Founded on Fact* (Nashville: Thomas Nelson, Inc., 1978) pp. 57-58.

[14]David Hume, *An Inquiry Concerning Human Understanding*, in *On Human Nature and the Understanding*, Anthony Flew, ed., (New York: Collier Books, 1962), ch. 10 pp. 115-136.

[15]Lewis, *Miracles*, ch. 13, pp. 103-111. Flew admits the force of Lewis' argument at the point to be questioned (*Hume's Philosophy of Belief*, p. 205).

[16]*Inquiry*, pp. 119, 120.

[17]*Ibid.*, p. 133.

[18]Wykstra, "Problem of Miracle," p. 160.

[19]*Ibid.*

[20]Wykstra misreads Lewis as contesting this statement (Wykstra, p. 160). Wykstra seems to give the impression that Lewis' basic contention in chapter thirteen involves a mistaken distinction between "antecedent" and "historical" probabilities. Whether or not there is such a distinction is virtually insignificant to the argument of this chapter. Indeed, Wykstra admits to Lewis' conclusion that for some events, both past and future (Lewis, p. 108), normal probability determination procedures would not be applicable (Wykstra, p. 161). Wykstra rather maintains that the more important question yet remains unanswered: "How can we know when we face such an event?" It is this question we have been concerned to answer in this paper.

[21]Our comparison of the "swoon" and resurrection hypotheses may suggest the problem of the arbitrariness of miracle choices. If the improbability of a resurrection is decreased by the possibility of intelligent intervention, might not the "swoon" theory be established as even more probable than a resurrection on the possibility that intelligent superhuman intervention is involved with it? Here I must refer directly to the section of this paper dealing with the arbitrariness of miracle choices. Clearly the answer must be no.

[22]This argument is implicit in Hume's critique. See, for example, Norman Geisler's discussion in *Apologetics*, pp. 266, 267.

[23]*Inquiry*, p. 125.

[24]See Jensen, "Evidential Value," pp. 120-123 for a more detailed explication of this answer.

[25]Lewis, *Miracles*, p. 10.

[26]*Flatland* (New York: Dover Publications, Inc., 1952). See the writings of Karl Heim for a more sophisticated development of the flatland theme. For an interesting discussion on this theme, see "UFOs: Is Science Fiction Coming True?" by Mark Albrecht and Brooks Alexander, SCP Journal 1 (August 1977): 21 particularly. Published by the *Spiritual Counterfeits Project*, P.O. Box 4308, Berkeley, Calif. 94704.

[27]*Miracles*, p. 63.

[28]*Hume's Philosophy of Belief*, pp. 169, 193.

[29]Grace Jantzen, "Hume on Miracles, History and Politics," *Christian Scholars Review* 8 (1979): 324.

[30]Not only can pantheistic systems adapt it but also naturalistic systems. It may be claimed that this is a true anomaly of nature which in principle cannot be reduced to natural law. Or, it may be claimed, the phenomenon fits a law of nature which science will never be able to discover because of human limitation. Why should any of these alternate world view explanations be considered less likely than the theistic view?

The Genetic Basis of Homosexuality

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In the past, a common explanation for the origin of homosexuality was the assumption that it was a result of a biological malfunction, either due to improper hormonal levels, or to an inheritance of factors influential toward sexual development. The research on various hypotheses relative to various biological and genetic causes of homosexuality are examined. It is concluded that there is no clear evidence for a biological or genetic basis for homosexuality. In essence, it is a learned behavior; the most supported theories are those which are basically sociological in nature.

One of the stronger arguments for permitting homosexuals to "practice their lifestyle" is the argument that homosexuality is genetically inherited and therefore "cannot be helped any more than color blindness, skin color or any other inherited trait."[1] As was stated in Newsweek:[2]

> If homosexuals have little choice in their sexual preference—if homosexuality is no more a matter of choice than being black or female—then they seem entitled to be free of discrimination.

Writings by homosexuals commonly utilize the above

argument to justify their sexual orientation. A good example of this is the following quote from Troy Perry's autobiography:[3]

> Now I know that I'm opening Pandora's box when I tell you that I'm sure that homosexuality is preordained. . .I am firmly convinced that much of what we are comes to us through our genes. I know that many people will throw up their hands in horror and say: "Why, where could you get such an idea?" Well, I'll just draw a blank. I just believe it, that's all. . .I read about a professor. . .who is conducting experiments along that very line. The rest of the people can wait for him. But not me. I'm sure. I'm going to go right on and believe it. . .
> If you follow the law of averages, those who catch the brass ring turn out to be homosexuals. Well, I caught the brass ring. And, I'm sure that homosexuality was in my genes, and in my soul, from the very beginning.

Simms,[4] from his review of the literature, concluded that, "some clinicians and therapists claim that some homosexual persons may be constitutional [born homosexuals], and perhaps the majority of practicing homosexuals insist that this is so."

Beliefs Common During the Early 1900's

The belief that homosexuality was inherited was held by many scientists until recently.[5] It was commonly believed that a homosexual was a man born with a woman's disposition and a man's body and was actually "a third sex," which was an abberration of nature. Even today, homosexuals are called "the third sex."[6]

In 1896, the well-known German psychologist, Krafft-Ebing,[7] suggested that homosexuality was an inborn characteristic caused by large amounts of male and/or female substances in the hereditary composition of the brain. Havelock Ellis,[8] who uncritically accepted Krafft-Ebing's conclusions, caused the notion that homosexuality was of a biological origin to become commonly accepted. Mantegazza[9] explained homosexuality as a genital malformation caused by the displacement of sensory nerves which normally originate in the penis, but which in homosexuals have, in essence, shifted to the rectum. The errogenous zone, he felt, had shifted correspondingly. Later, Hirschfeld[10] concluded that "homosexuality is always an inborn state, conditioned by specific homosexual constitution of the brain." Glass et.al.[11] and other researchers felt that hormonal or endocrine factors were influential.

The Public's Attitudes

Before we review the genetic evidence, we briefly look at the public's attitudes regarding the innate/learned controversy. A 1977 Gallup Poll[12] relates: "The great majority of Americans are convinced that homosexuality is more prevalent today than 25 years ago. . .At the same time a majority of the public, 56%, believes homosexuality to be a product of upbringing and social environment rather than innate predisposition—a view only 12% hold. Another 14% say both factors are involved." Interestingly, the *less* education a person has, *the more likely* he is to believe that homosexuality is innate. Of the college graduates, 12% feel homosexuality is innate compared to 14% for high school graduates and 15% for grade school graduates. In contrast, 61% of the college graduates feel homosexuality is a result of upbringing, compared to 57% of those with only a high school education and 44% for those with only a grade school education.

These results suggest that with increased education individuals are more aware of the research data on this subject. After reviewing the research on the various biological hypotheses proposed to account for homosexuality, Buss concluded: "None of the biological hypotheses has received support, and they have been discarded by most investigators."[13]

The Genetic Evidence

Nineteenth century investigators leaned towards a biological explanation of homosexuality.[14] Some scientists during this period felt that it was the result of a degenerative disease of the nervous system. In view of the fact that the human embryo appears to be hermaphroditic, some researchers, including Freud, have proposed the idea that the normal psyche is bi-sexual.

Interestingly, the biological approach in understanding the cause of sexual "deviance" has focussed primarily on homosexuality. There have been few studies researching the possibility that other sexual deviations such as pedophilia, necrophilia, bestiality, etc., stem from biological causes.

There is abundant evidence from research on animals that sexual behavior depends largely on sex hormones.[15] There is thus some basis to assume that the cause of homosexuality in humans might be some inherited defect in either the sexual organ or sex hormones. Some early studies suggested that this was the case. For example, Kallman[16] concluded from his research on a comparison between identical twins and fraternal twins that there was an inherited component in homosexuality. If homosexuality *is* inherited, we would expect that the incidence of homosexuality in fraternal twins (twins who develop from two separate eggs and thus do not share the same genetic pattern) would be no greater than the level found among brothers. On the other hand, we would expect to find a higher rate in identical twins, because they come from the same egg, and thus share identical genes. Kallman found far more cases where both identical twins were homosexual than for fraternal twins, supporting the hypothesis that homosexuality is at least partly inherited.

There are, though, several major shortcomings in Kallman's work, and unfortunately, some have uncritically accepted Kallman's conclusions. For example, in one article, Earnest Havemann[17] stated:

> France Kallman. . .once managed to find 40 men, all homosexuals, who had identical twin brothers. In every case, the twin brother also turned out to be homosexual, even though the brothers had never confided in each other and had sometimes grown up apart from each other—so possibly there is some kind of inborn pattern of glandular activity of brain function, not yet recognizable by any test thus far developed which predestines some men for homosexuality.

Kallman's research can be questioned because of such problems as the representativeness of his sample and the in-

fluence of non-hereditary variables on his results. One of the chief criticisms of his conclusions is that some individuals move from heterosexuality to homosexuality during adulthood when hormonal changes are unlikely. There have also been a number of verified changes in the opposite direction.[18] If homosexuality is inherited, such shifts in sexual preference should not occur. Another problem with Kallman's research is that the relationship found was greater than could be reasonably expected. The study actually indicates that genetic control of sexuality is as dominant as genetic control over eye color or blood type.

Because a higher incidence of homosexuality may occur in twins does not conclusively demonstrate that homosexuality is inherited. It is quite possible that the powerful identification between identical twins may result in a greater tendency for both twins to engage in pre-adolescent and adolescent homosexual activities. The close association between identical twins may reduce guilt from homosexual activities that generally exists between other siblings. In summary, there may be a greater incidence of homosexuality concordance in monozygotic (identical) compared with dizygotic (fraternal) twins, but it cannot be assumed that genetic factors influence the development of homosexuality.[19,20] The social relations between monozygotic twins may be such that a higher precentage of both will be homosexuals than even dizygotic twins.

Even Kallman concluded: "The question of the possible significance of a genetic mechanism in the development of overt homosexuality may still be regarded as entirely unsettled."[21]

Metabolic Research

Other studies have suggested that there are metabolic differences between persons who are exclusively heterosexual and those who are exclusively homosexual. One study found that the level of etiocholanolone and androsterone was lower among homosexuals.[22] There are many possible reasons for this difference, if it exists. Prolonged homosexual or heterosexual behavior could affect the breakdown of testosterone. In addition, behavioral differences such as differences in aggressivity or passivity between those in a heterosexual life style and those in a homosexual life style could affect the breakdown of testosterone. Other variables such as health, diet, drug use, smoking, amount and type of sexual activity, physical and emotional stress also have to be considered. Possibly homosexuals differ from heterosexuals in general emotional responses and it is these factors which cause some hormonal differences.

Whether a person is a male or female, normal or abnormal biologically, in most cases he or she will accept the sex that he or she was raised, and not the sex that he or she is biologically.

The theory that the cause of homosexuality lies in high or low amounts of the sex hormones was recently examined by several researchers and found to be without foundation. Normal males have a preponderance of androgen and normal females have a preponderance of estrogen. Male homosexuals, in general, do not have a higher level of the female hormone estrogen, or less androgen, than found in heterosexual males. On the average, hormonal imbalance of any type is not more common in homosexuals than in heterosexuals. Hormonal therapy designed to correct a possible imbalance has failed to alter homosexual behavior or interest. In addition, there is an abundance of evidence that the learned psychological role, and not biological factors, determines the individual's sexual identification.

Ellis studied 48 cases of hermaphroditism and found that the great majority of cases assumed the sexual libido and sex role that accords primarily with his or her upbringing.[23] This was true of both pseudohermaphrodites (individuals with congenitally malformed external genitalia resembling one sex while the gonads are those of the opposite sex) and hermaphrodites (where a person has *both* male and female sexual organs, or some lesser mingling of both male and female traits). Hampson studied men and women with biological sexual abnormalities, including those that were both anatomically bi-sexual or had ambiguous sexual anomalies. He concluded that when the biological sexual tendency clashed with the psychologically assigned sex role, the assigned sex role predominated.[24] In other words, if a biological male was raised a female, his behavior and sexual orientation was that of a female and most always remained female in spite of effects to change his psychological sex to his biological sex. This and other studies have supported the view that homosexuality is not the result of inherited factors, but is the result of factors in the child's

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upbringing.[25]

Relative to the evidence on a possible hormonal etiology of homosexuality, Socarides[26] concluded from his review of the literature that "contemporary scientific findings clearly establish that homosexuals can have endocrine dysfunctions just as can any other individuals but the androgen-estrogen ratio among male homosexuals usually falls within normal limits. Large doses of endrogenes or estrogenes influence the overall sexual drive in homosexuals but cannot change the pattern."

Kolodny et.al.[27] reported that their research found that "there is no suggestion that endocrine abnormalities will be found in a great majority of homosexuals or that endocrine dysfunction is a major factor in the pathogenesis of male homosexuality."

Brik et.al.,[28] after examining the serum testosterone levels in [36] male homosexual patients, found that there was "no correlation between [sexual preference] and serum testosterone level." In addition, the homosexual subjects in Brik's study had normal testosterone levels.

Tourney et. al.[29] investigated hormonal metabolism in heterosexual and homosexual men, and found no indication of disturbed endocrine functioning in homosexual males. Numerous other studies found the same or similar results.[30-36]

Chromosome Studies

Another area of research has looked at variations in the chromosomes as the cause of homosexuality. A normal male has an XY pattern and a normal female an XX set of chromosomes. Researchers have found many abnormal variations such as a single X (labeled XO, producing Turners Syndrome, causing mental retardation in 20% of the cases, or Bonnevie Ullrich's Syndrome), "XXX," "XYY," "XXY," or even "XXXY" and "XXYY." These abnormal variations tend to cause deviant anatomical sex characteristics and often other problems. In addition, some individuals, such as hemaphrodites, are born with both male and female sexual organs. Fortunately, in recent years, it has become possible to examine chromosomes directly. Pritchard[37] examined the chromosomes of male homosexuals, most of whom evidently had never had any heterosexual interests, and found the normal XY complement in every case. Pritchard and others have noted that there is a large body of genetic evidence against the hypothesis that homosexuality is caused by chromosomal abberations. By means of sex chromatin and karyotype studies, several researchers examined the possibility that female chromosome constitution might be implicated. No abnormalities were found, although based on late maternal age at birth, Pritchard speculated that some chromosome abberations may be found in certain homosexual males. Klinefelter's syndrome (a condition characterized by the presence of small testes, fibrosis, hyalinization of the seminiferous tubules without involvement of leydig cells, and increase in urinary gonadotropins) is associated with an abnormality of sex chromosomes (XXY) and includes some cases with homosexual behavior, but the incidence was not higher than the population as a whole.

Kallman[38,39] postulated that a polygenetically controlled disturbance in psycho-sexual maturation patterns caused homosexuality. It was felt the genetic component may affect both the ability to perceive and respond to sexual stimuli, and the ability to achieve sexual satisfaction and success. In turn, these experiences are used as integrating forces in sexual role development. As of yet, there is little supportive evidence for this hypothesis.

Conclusions

The above research is one of the main reasons why, according to the Gallup Poll,[40] "54% (of those surveyed) say homosexuals should not be hired as elementary school teachers and 65% feel gays should not be allowed to become members of the clergy." The public believe that homosexuals in these positions will influence students and youngsters in the churches and schools in a homosexual direction. It is not understood exactly what learning produces a homosexual orientation, but because it seems that this behavior is learned, it is likely that much homosexual behavior is learned from other homosexuals. In some studies, it has been found that 90% of homosexuals were introduced to homosexuality by active homosexuals.[41] Rather than take any chances, most people prefer that their children not be taught by homosexual teachers or ministers.

If homosexuality is not inherited, it must either be caused by the environment or willfully adopted. A number of studies have found that homosexuality is related to poor parental relationships, certain types of parents, a history of general frustration in interpersonal relationships with persons of the opposite sex, negative early heterosexual experiences, and poor identification with the same sexed parent (often based on covert expression of the parent's superego defects).[42] Simms[43] feels: "The insistence upon a 'constitutional' homosexuality is. . .at the bottom of a contemporary expression of blaming God as the last resort, the shift of responsibility for one's being, and the parallel abdication of freedom."

Probably the most convincing evidence for the social learning theory are the studies which found that persons who are raised in a sex role which was different from their chromosomal sex, in most every case, became the gender role in which he or she had been reared, regardless of the true sex.[44] Thus, as noted above, whether a person is a male or female, normal or abnormal biologically, in most cases he or she will accept the sex that he or she was raised, and *not* the sex that he or she is biologically.

Probably the most famous research which demolished the long-stranding belief that homosexuality was biological was published by Dr. Irving Bieber in 1962.[45] Dr. Bieber and his researchers cited the case histories of 106 homosexuals who were treated by the Society of Medical Psychoanalysts. They found that a remarkable proportion of them had been reared by mothers who were over protective throughout their childhoods. The mothers of these

homosexuals regarded their children as their "pride and joy"—to be protected from the hazards of growing up. According to this research, the mother jealously protected her boy from any girl who might show an interest in him. She often catered to his every whim and smothered him with affection, openly preferring him to her husband. Some of this attention had obvious sexual overtones, even to the extent of having him sleep in her bedroom until after he reached adolescence.

In these cases, the son evidently unconsciously replaced the husband as a love object. Importantly, though, this type of mother and a father who is cold and aloof are both necessary. If a son of an overprotective mother has a warm, affectionate father who sets a good role example and the son can look up to him, homosexuality will not develop, according to Bieber. It should be noted that some of Bieber's conclusions are now being questioned by some researchers, although this is mostly because of social trends rather than recent advances in research.

In summary, we must ask the same question that Freud[46] did, viz: "If a person of the opposite sex is available, why should a male choose another male or a female another female. . .or even, sometimes, a lock or hair or a piece of underclothing?" The well-known researcher on homosexuality, Socarides,[47] concluded that "the answer is to be found in the developmental history of the individual." Most other researchers agree,[48] and until we have some evidence for biological factors, we must accept the theory of eitiology that has the most empirical support.

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Notes on "Science and the Whole Person"—
A Personal Integration of Scientific and Biblical Perspectives

Part 16

Abortion

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The abortion question is heavily emotion laden. Opinion is readily polarized with anti-abortion "Right to Life" forces upholding the rights of the fetus as an absolute on one hand, and pro-abortion "Women's Rights" forces upholding the rights of the woman as an absolute on the other. Often the former position becomes categorized as "the Christian position" because of the Christian concern for human life as a creation of God, in opposition to the latter as "the anti-Christian position" because of its willingness to take the life of the fetus. Like many other issues of this type, the abortion issue calls for a neither/nor approach to ethics that excludes extreme positions and enables us to deal with the real and imperfect world in a meaningful and compassionate way. We are aided if we come to the point where we realize that relative values are often the key to specific decisions, not always absolute values that form an inflexible code capable of dealing with all general problems in the same way. Unfortunately our preference for simple solutions is not realistic; complex problems demand something more.

The abortion issue is another major ethical issue we are considering in this continuing series on "Science and the Whole Person." In the spirit of this integration of science and biblical perspectives, we are concerned to see what inputs we can derive from scientific and theological approaches in order to arrive at specific decisions.

Scientific Inputs

The major scientific inputs describe the development of the fetus from conception to birth. If we understand the nature of this biological development, we may be ennabled, in keeping with our previous emphasis on the human being as a pneunopsychosomatic unity, to guide our ethical decisions. These basic scientific inputs are summarized in the following Table.

This summary emphasizes the rapidly changing biological development of the conceptus from the moment of conception through full development and viability. A continuous process can be seen in which biological and personal attributes develop in parallel, as we would expect from our view of living creatures as whole creatures with attributes commensurate with their concurrent stage of development.

A common approach is to argue that at least human identity is present from the moment of conception and that any interference with development of the conceptus after conception has occurred corresponds to the termination of a human identity. If this approach were taken seriously, objections to the use of the IUD device and the morning-after pill would of necessity follow; as a matter of fact, use of these techniques seldom encounters ethical objections.

Another approach is to argue that once a human life has been started, with its full potential for development into a mature human being, any attempt to terminate this development is tantamount to destruction of a human life which, so to speak, already has reality and dimensions in the purpose of God. This perspective can easily lead to the conclusion that all conception is good since it brings into

Stage of Development	*Time Period Involved*	*Processes Used for Birth Control and/or Prevention*
1. Separate ovum and sperm.	Before conception.	Chemical and mechanical means to keep ovum and sperm separate.
2. Fertilized ovum.	From conception to implantation in the uterus.	IUD devices: morning-after pill.
3. Embryo	From implantation to about 8 weeks old.	Abortion with consent of woman and her doctor.
4. Fetus	From 8 weeks to birth.	Abortion requiring progressively more levels of approval as time passes; only in dire emergency during last trimester.
a. Development of central nervous system	From about 3 months.	
b. Viable outside the uterus.	From about 5-6 months.	
5. Infant	From birth.	Infanticide.

the world creatures made in the image of God, and that efforts at birth control by any means might well be suspect.

Both of these arguments are somewhat tempered by three other inputs from a scientific understanding of the processes involved in development of the fetus, as discussed by Gardner.[1] (1) Identical twins separate from a common cell-mass as late as the fourth week after initial conception; the identities of those two twins does not exist therefore during those first four weeks. (2) Up to half of all conceptions end in spontaneous abortion (miscarriage), usually very early and without the realization of the woman; do half of the identities God brings into the world never exist in this world beyond the biological state of a mass of cells? (3) Human eggs have been fertilized outside the human body in the laboratory and have developed up to the 16-cell stage at least; does each of these fertilized eggs have an identity as a human being before God? Certainly if this were true, such research should never be carried on.

Indications for Abortion

In a very helpful treatment of the problem Nelson[2] lists seven commonly accepted possibilities for requesting and/or granting abortion. In discussing these we also attempt to indicate the basic reasoning involved. In all these cases we are considering possible grounds for granting an abortion to someone who desires it, not grounds for forcing abortion upon someone who chooses not to request it.

1. *Non-psychiatric medical risk of a pregnancy to the woman.* This is perhaps the easiest of all ethical problems related to abortion. The situation is one in which competition for life exists between two human beings. The humanness of the fetus is still at the biological level in the early stages of pregnancy; the humanness of the woman, on the other hand, is the fruit of a mature life, a life with biological, social and spiritual dimensions, a life with personal relationships and dependencies. To end the life of the fetus to preserve the life of the mother is still a tragedy, but it is less of a tragedy than to end the life of the mother.

This continuing series of articles is based on courses given at Stanford University, Fuller Theological Seminary, Regent College, Menlo Park Presbyterian Church, Foothill Covenant Church and Los Altos Union Presbyterian Church. Previous articles were published as follows. 1. "Science Isn't Everything," March (1976), *pp.* 33-37. 2. *"Science Isn't Nothing," June* (1976), *pp.* 82-87. *3. "The Philosophy and Practice of Science," September* (1976), *pp.* 127-132. *4. "Pseudo-Science and Pseudo-Theology. (A) Cult and Occult," March* (1977), *pp.* 22-28. *5. "Pseudo-Science and Pseudo-Theology. (B) Scientific Theology," September* (1977), *pp.* 124-129. *6. "Pseudo-Science and Pseudo-Theology. (C) Cosmic Consciousness," December* (1977), *pp.* 165-174. *7. "Man Come of Age?" June* (1978), *pp.* 81-87. *8. "Ethical Guidelines," September* (1978), *pp.* 134-141. *9. "The Significance of Being Human," March* (1979), *pp.* 37-43. 10. "Human Sexuality. *(A) Are Times A'Changing?" June* (1979), *pp.* 106-112. *11. "Human Sexuality. (B) Love and Law," September* (1979), *pp.* 153-157. *12. "Creation. (A) How Should Genesis Be Interpreted?" March* (1980), *pp.* 34-39. *13. "Creation. (B) Understanding Creation and Evolution," September* (1980), *pp.* 174-178. *14. "Determinism and Free Will. (A) Scientific Description and Human Choice," March* (1981) *pp.* 42-45. *15. "Determinism and Free Will. (B) Crime, Punishment and Responsibility," June* (1981), *pp.* 105-112.

2. *Threats to the mental health or psychiatric condition of the woman.* Once again the welfare of the mother is the focus of attention, with perhaps the welfare of the family also in view. But this time the dilemma does not pit human life against human life, but the life of the fetus against the personal (mental, social, spiritual) wholeness of the mother. An adequate resolution of this kind of dilemma can hardly be done once and for all in general; specific needs and situations must be evaluated.

The common but extreme argument that all abortions are permissible because they lie within the right of a woman to have control over her own body cannot be sustained. Although it is true that a woman does have the right to control her *own* body, the decision for abortion is not one of these simple kinds of decision. When the woman has the absolute right to control her own body is in the period before conception. But after conception has taken place, it is not simply a matter of a woman and her own body. Now a third human life is involved, whose existence, possibilities and prerogatives must be considered in addition to those of the woman herself.

3. *Abnormality of the fetus.* This indication for abortion can be separated into several different subcases: (a) Should an abortion be allowed in cases where there is a statistical probability of abnormality but no direct evidence? (b) Should an abortion be allowed in cases where there is direct evidence (as from amniocentesis) of abnormality? (c) Should a Christian consider abortion in the case of (a) or (b)?

The standard refutation of the proposal that abortions should be granted in cases where a statistical probability of abnormality exists is to cite the following case history.

> The father has syphilis, the mother tuberculosis. They have already had four children—the first is blind, the second died, the third is deaf and dumb, and the fourth has tuberculosis. The mother is pregnant with her fifth child and the parents are willing to have an abortion should you so decide.[3]

If ever a case history seemed to support the wisdom of abortion, it is this one. The punchline, however, is that the fifth child was born and turned out to be Ludwig van Beethoven! A decision for abortion would have deprived the world of the genius of Beethoven. Such an argument by hindsight cannot, in my opinion, be sustained. How many untold Einsteins, Mozarts, Michelangelos etc. have failed to appear on the earth because conscientious parents practiced birth control? Taken seriously this objection would call for massive efforts to increase procreation—hardly a responsible action in today's world.

There are many heartwarming histories of abnormal children who have brightened the lives of parents who took care of them and lavished upon them the love and care they needed. If the parents desire to continue through with the pregnancy and are prepared to bestow upon the abnormal child the needed love and care, then this should certainly be their prerogative. Does this mean, however, that all parents should be required to give birth to such abnormal children regardless of the consequences to the matured child, the parents or the family? If it is known that a fetus is physically or mentally malformed in such a way that its full human development cannot take place, but that it would exist in a short and possibly painful life with only the most severe physical and mental limitations, is there some divine requirement that would prevent the termination of the development of this fetus by abortion at an early stage of the pregnancy if the parents so desired?

Such a situation does raise the difficult question of the grounds on which the abortion is desired. An abortion performed for the sake of the fetus raises the anomalous case of "saving" the fetus by ending its existence. It is essential in deciding about such an abortion that it be clear why the abortion is being sought, and that the reasons proferred are consistent, meaningful and accepted by those involved.

4. *Rape.* Pregnancy following rape is a case where the woman has been forced to give up control of her body under the most traumatizing physical and mental conditions. This case is rather similar to the second case, with an even additional basis for considering the psychiatric welfare of the woman. Shall a woman who has been assaulted and humiliated, then in addition be required to endure the experience of pregnancy and labor in order to give birth to an unfortunate child who comes into the world without the love of father or mother? Prompt termination of the pregnancy at the earliest possible moment with the request of the woman involved seems a responsible option.

5. *Incest.* This case is related to the previous one in many ways. Most cases of incest involve young girls in their early teens who desperately need to be delivered from the consequences of their environment.

6. *Population control.* Abortion is widely used in many parts of the world as the major method of birth and population control. In societies and among individuals for whom hindsight is both easier and more culturally acceptable than planning in the area of sexual experience, abortion takes the place of prevention of conception. For a variety of reasons, probably all would agree that conception prevention is desirable to abortion, but many financial, political and cultural barriers need to be overcome.

7. *Eugenic control.* Of all the indications advanced for abortion this one has the most ominous sound, calling up visions of Hitler's plans to develop a super race through genocide and control of reproduction. It need not have quite this negative an image, and indeed our discussion above of the possibility of abortion in the case of fetal abnormality is a specific type of eugenic control. As in all these cases, the prospect for abortion darkens immeasurably if we shift attention from the grounds on which abortion should be granted to those who desire it to the grounds on which abortion should be required of those who do not desire it. The latter is such a dangerous area that it should be consistently rejected and circumscribed with as much safeguarding as can be managed.

Criteria for Abortion

Many of the dilemmas raised in this discussion would be

appreciably lessened if there were just some simple way of drawing a line during the development of the fetus so that abortion before this time would be totally devoid of all moral implications and abortion after this time would be morally forbidden. If we could argue that a fetus didn't become human until such and such a time, or if we could argue that the soul doesn't enter the fetus until a specific date during pregnancy, our problems would be greatly eased.

It is exactly this kind of attempt that has characterized so many historical ways of dealing with the abortion question. True humanity and the infusing of the human soul have been dated all the way from the moment of conception, through the moment when movement is first felt or viability outside the mother becomes possible, to birth itself with the drawing of the first breath as the occurrence which is like God's breathing into man the breath of life in Genesis 2. Our own line of reasoning consistent with biblical and scientific inputs, as spelled out in Part 9 of this series, does not allow us this kind of an escape. The conceptus is *wholly* human from the moment of conception, in that no 1-hour old fertilized ovum is ever more human than the 1-hour old fertilized ovum of a human woman; on the other hand the conceptus is by no means *fully* human and will not become *fully* human until it has passed through all the stages of this life, come to faith in Jesus Christ, and been raised to new life in the resurrection. For the human conceptus there is no human/not-human disjunction; being human is a process of becoming.

Similarly our view provides us with no mechanism of escape by considering the time of the infusion of soul and/or spirit. Soulfulness and spirituality are characteristics of the total human organism as it develops as a single unity. Again, for the human conceptus there is no ensouled/not-ensouled disjunction as if a fully-developed soul were added to a biologically developing body at some particular interval during pregnancy.

These considerations do not mean, however, that the timing of a proposed abortion or the passage of time are of no consequence in coming to a decision concerning abortion. Although the humanity of the conceptus is assured from conception on, what we may call the "person" is not. To speak of a "person" is to speak of a human creature beyond that stage of development at which the biological correlatives or personhood are formed. Before the central nervous system has formed, we cannot meaningfully speak of the thoughts or experiences of the fetus; i.e., we cannot speak of the fetus as having personal attributes. Although no actual discontinuities exist, as a practical matter a case can be made for dividing the pregnancy into three trimesters as has been done in the Supreme Court decision on abortion. Such a vague and indefinite division seems more in keeping with the development of the fetus and its significance than an attempt to draw a fixed line at the time of viability outside the mother's body, or at the time of birth.

The first trimester is a time in which abortion based on grounds such as those discussed above may be undertaken for responsible reasons. Even here there is no place for flippancy, or abortion-by-whim; abortion at any stage of development remains a serious choice, not to be entered into lightly. The shorter the time between conception and the ending of the pregnancy, the less critical the considerations. The common use of the IUD for pregnancy prevention is probably a very short term type of abortion in which implantation of the fertilized ovum is prevented. Once pregnancy is actually realized, however, about one-third of the first trimester has already passed, and the time has come for separating out motives of a purely selfish and convenience nature from motives with more justifiable bases.

The abortion issue calls for a neither/nor approach to ethics that excludes extreme positions and enables us to deal with the real and imperfect world in a meaningful and compassionate way.

Once the first trimester is past, the situation is different and only the most serious bases for abortion during the second trimester seem sufficient. The central nervous system, the biological counterpart of personhood, is developing rapidly during this second trimester. Finally, when the third trimester has begun, we are dealing with a fetus that is viable outside the mother's body; abortion for any grounds whatsoever except the actual physical endangering of the mother's life is out of the question. Even in such an extreme case, the operation should more properly be considered as premature Caesarean delivery than abortion, with every effort being made to sustain the delivered child.

Those who believe it is appropriate for purely convenience and social reasons to end a pregnancy by abortion in the final months can have little reason to oppose ending the life of an infant after birth. In other days and cultures such consistency was exhibited and may be again if present trends continue unabated. We ought, perhaps, to turn this argument around. Appealing to a residual abhorrence for infanticide on purely social if not theological grounds, we should argue for an equal abhorrence for the taking of the life of a fully-developed fetus, which is essentially indistinguishable from a newborn child.

Biblical Inputs on the Status of the Fetus

In his chapter in *Birth Control and the Christian* Waltke gives two arguments from the Old Testament which seem to allow abortion, and three arguments that protect the fetus.[4] Taking the latter three arguments first, they are: (1) Unlike the Assyrian Code, the Mosaic Law never demands that the life of an innocent fetus be sacrificed to repay for the life of a fetus killed by accident or on purpose. (2) The Old Testament consistently upholds the view that children are not only the consequence of sexual relations but are in a direct way a gift of God and a sign of His blessing, e.g., see Psalm 127:3-5, Genesis 4:1; 16:2; 17:19; 29:31; 30:22, and Ruth

4:13. (3) The Old Testament describes God as directly involved in the formation of the fetus in the womb, e.g., see Psalm 139:13-18.

Waltke's first argument in favor of abortion comes from the silence of the Old Testament on forbidding abortion. Although in general the Mosaic Law is stricter on sexual matters than the Assyrian Code, the Assyrian code requires that a woman found quilty of abortion be impaled and not buried. By contrast the Mosaic Law contains no such injunction.

The one specific passage in the Old Testament dealing with the fetus is Exodus 21:22-25,

> If men strive, and hurt a woman with child, so that her fruit depart from her, and yet no mischief follow: he shall be surely punished according as the woman's husband will lay upon him; and he shall pay as the judges determine. And if any mischief follow, then thou shalt give life for life, eye for eye, tooth for tooth, hand for hand, foot for foot, burning for burning, wound for wound, stripe for stripe. (KJV)

I have used the KJV translation rather than the RSV since the latter already involves an interpretation of "so that her fruit depart from her" as "so that there is a miscarriage."

At least three different interpretations of this passage have been set forth leading to different conclusions about the significance of the fetus in this Old Testament passage. These are summarized in the following table.

"fruit departs from her"	*"no mischief follow"*	*"mischief follow"*
1. miscarriage—fetus dies	woman is unharmed	woman is harmed
2. premature birth of a healthy child	neither child nor woman are harmed	either child or woman is harmed
3. labor is induced	woman is harmed but child is healthy	child is harmed

The first interpretation is what might be called the "standard interpretation," embedded in the official translation of the RSV. If only the fetus is lost, then only a fine is exacted; if the woman is seriously harmed, then the full requirements of *lex talionis* are invoked. The conclusion is that although the fetus is valuable, it does not have equivalent value to a mature personal human life. Waltke[4] who defends this interpretation presses further by pointing out that the Mosaic Law expressly commands that "If a man kills any human life he will be put to death." Since in the present instance the death penalty is not required if only the fetus is killed, it follows that the fetus is not considered to have full human status.

The second interpretation is defended by anti-abortion groups. Montgomery advocates this position.[5] What is being described is not a miscarriage at all, but rather a situation where induced labor produces a healthy child. If neither child nor mother is harmed, then only a fine is imposed because of the interference with the normal progress of the pregnancy. But if either child or mother is harmed, then the full payment of the law is required, even to life for life. Thus the passage maintains the essential indistinguishability of the status of the fetus from that of the woman.

The third interpretation is also an anti-abortion position defended by Kline.[6] Through a detailed linguistic study, he concludes that the penalties described for "no mischief" and for "mischief" are identical, that "no mischief" refers to harm to the woman, and that "mischief" refers to harm to the child. His conclusion is that the fetus, *at any stage of development*, has the full human rights of the mother; any harm to the fetus, even life for life, must be repaid according to the *lex talionis*.

General Guiding Principles

The discussion of Exodus 21:22-25 in the previous section leaves us with the general conviction that a clearcut response to the status of the fetus is not to be obtained unambiguously from exegesis. Guiding principles must therefore be derived from a broader view of the whole scope of the biblical revelation. Sometimes these lead us into very practical matters in an imperfect world, as well as into abstract moral and ethical models.

1. The conceptus at whatever stage of development is wholly human and deserves to be valued in a manner commensurate with that stage of human development. This means that abortion is always a serious matter (even as are other methods of birth prevention) and that the future of the conceptus is not to be decided by the whim of any human being, even the mother.

2. Although the conceptus is always wholly human,[7] it is involved in a process of becoming more and more fully human as its capability for personhood develops with its biological framework. It is therefore appropriate to view early abortion as the ending of human life, but not as the ending of personal life. The biblical concerns are primarily with personal life, not with biological human life in the abstract. It is therefore not appropriate to argue that the fetus has all the rights and prerogatives of a mature human

being in that first stage of development in which personhood has not yet developed.

3. Just as it is fallacious to argue for the absolute human rights of the fetus, so it is equally fallacious to argue for the absolute human rights of the mother. A woman does have the right to control her body; this right is properly exercised before sexual relationships. Once pregnancy results from sexual relationships freely entered into by the woman, the newly conceived human life may still be *in* her body and dependent *upon* her body, but it is *not her body*. Justifiable reasons for an early abortion may exist within the framework of the woman and her social and emotional environment, but such an abortion is not properly subject to the arbitrary choice of the woman.

4. A society that treats human life callously will degenerate morally. Therefore it is essential to defend fetal personhood against arbitrary abortion. This is particularly true in the later periods of pregnancy when abortion essentially means the killing of a live and viable child.

5. When all abortions are made difficult to obtain, it is the poor and underprivileged women who suffer. Wealthy women can always find some way to obtain a safe abortion regardless of their motivation. Poor woman may also have justifiable motives for early abortions; opportunities for such abortions should not be taken away from them.

6. In many cases (psychological problems of the parents, abnormality of the fetus, unwanted children etc.) abortion can be viewed either as (a) a way to escape from the burdens of caring for a human life that God has given to a couple in order to test, strengthen and then bless them, i.e., a way to escape selfless sacrifice, care for the defenseless, and redemptive suffering, instead of accepting these burdens in faith; or (b) a way to exercise human stewardship before God in such a way that the normal commitments to the reduction of human disease and suffering are extended to the area of terminating the life of pre-personal human matter before it develops to the state where personal suffering, limitation and deprivation have meaning. Each individual must decide before God where he stands in such a choice.

7. In many cases a false approach to abortion decisions may occur if all of the options are not explored. To provide a full range of freedom to the pregnant woman, counseling is necessary to enable her to be aware of all the options possible. Financial aid may be an essential ingredient of such counseling if the woman is to be ennabled to make a meaningful choice. In husband-and-wife situations, or even in the case of an unmarried couple, the perspective of the father should be included in the total decision making process.

8. The fetus does not derive its value from being wanted. Therefore, not being wanted cannot be taken as an automatic sanction for abortion. On the other hand, all too many cases exist in which an unwanted child has been brought into the world only to face a life scarred by early lack of love and personal rejection. A child unwanted by its natural parents may however be very much wanted by another couple unable to have children of their own and anxious to adopt.

The common but extreme argument that all abortions are permissible because they lie within the right of a woman to have control over her own body cannot be sustained.

The Importance of Case Histories

If there is anything that we can learn from a consideration of abortion, it is that no simple formula can be put together which makes all abortion decisions a simple and straightforward matter. In addition to the many gray areas we have described above (e.g., no human/not-human or soul/no-soul dichotomies), the complexity of the actual situations is brought out most clearly by the consideration of pseudo case histories. In his book Gardner[1] has put together twelve such case histories and then has obtained the opinion of groups of conservative evangelical Christians in the following categories (24 in each): consultant obstetricians and gynecologists, general practitioners, ministers of religion, well educated lay people and clinical medical students; he also included a control group of Christian ministers with a wide range of theological and denominational viewpoints. For our purposes here, we reproduce just three such case histories, give the results of Gardner's questionnaire, and propose a rationale based on the guidelines of this paper.

> *Case 1.* Mrs. A is a woman of 28 years, with two children, a boy aged 10 and a girl aged 8 years. She is happily married. Her husband is a clerk who is having to spend an increasing amount of time helping his wife with the housework. Three years ago she was diagnosed as suffering from cardiac disease, which is causing increasing limitations in activities so that now she gets breathless on carrying out normal household duties. Cardiac surgery is being contemplated but she is told that any improvement may not be lasting. Despite the fact that she has been using a vaginal cap and contraceptive jelly she has missed two periods. On examination she is found to be an intelligent woman, rather underweight, with evidence of valvular heart disease, ten weeks pregnant.[1]

The obvious disadvantage of such case histories is that they do not tell us all that we might wish to know; our comments must therefore be provisional. In each case the woman comes asking for an abortion; there is never any question of forcing an abortion on an unwilling woman. Mrs. A. has responsibly tried to prevent conception in view of her weakened physical condition. Although we cannot be sure that continuing the pregnancy will prove to be a threat to her health, it seems highly likely. She has two other children that require her love and care, insofar as she is strong enough to give it to them. She might be brought through the pregnancy and then give the child up for adoption, but this would appear to be a severe strain on both her physical and mental health. Being ten weeks pregnant, she is about at the end of the first trimester. Almost all of the facts and

Abortion decisions are highly complex, highly personal, and highly specific. Two questions dominate: (1) Why do you want to have an abortion? (2) Have you waited too long?

their reasonable extrapolations favor giving her an abortion as requested. Of those questioned, permissions for abortion ran from 57% for the medical students to 100 % for both the consultant obstetricians and the general practicioners; the average for all groups was 88%.

> *Case 2.* Mrs. C is 40 years of age. She has had 6 children, the youngest of whom is now 9 years. Her husband is a skilled craftsman. She herself recently started work in a shop. This she claims is largely for the sake of companionship and for the pleasure of at least being able to get out of the home. She is at present complaining of not having had a period for 4 months, and wondering whether or not she is at the "change." On examination she proves to be 16 weeks pregnant. On being told this she appears indignant stating that she cannot be bothered to start again at her age.[1]

This case is almost the exact opposite of Case 1. The woman's health is apparently unthreatened, and although it is true that she has had 6 children there appear to be no severe financial constraints on the family. The major effect of a pregnancy would be an inconvenience and an adjustment of lifestyle during the period of the new infancy. Since she is 16 weeks pregnant, she is well into the middle of the second trimester. Although a basic appeal to women's rights might defend abortion on the grounds of Mrs. C's right to choose for herself, all other indications are against granting an abortion. Of those questioned almost none would grant an abortion except for 6% of the laymen and laywomen; the average over all those questioned was 3% in favor of an abortion.

> *Case 3.* Mrs. F is aged 35 years. She has four children, ages 12, 10, 8 and 6 years. Her husband is a schoolmaster. She herself is a housewife. They have a nice home which is normally happy. She admits to a single act of folly, resulting in adultery with the husband of a friend. He is of another race. He has two children. It is now 6 weeks since her last period. She does not know whether her neighbor, or her husband, is the father of the baby, but if the former, the fact will be unmistakable after delivery. On examination she is a likeable woman, in great distress with full insight into the problem and her own responsibility for it.[1]

The first two cases were relatively clear cut, but most cases, of course, are not. Our third case is simply one example of the kind of tangled human relationships that may enter into a decision to grant an abortion. Other cases might well include such considerations as a history of abnormalities with previous children, a critical threat to lifelong career hopes of the woman, severe financial problems in the family, pregnancy without prospect of marriage, mental incompetence with possible rape or incest, pregnancy outside marriage with fear of social consequences, teenage indiscretion leading to pregancy etc.

In Case 3 there is no apparent threat to the woman's health but there is a threat to the woman's family life. She seeks abortion to cover up an indiscretion that she now sorely regrets and presumably repents of. We do not know how her husband would respond if she confessed her actions to him and asked for forgiveness. Given normal statistics, the probability that the child has been conceived in adultery is rather low, and her worst fears of public stigma on both herself and the child may be groundless. In this case counseling would seem best directed first toward being honest with her husband in the hope that he would accept the situation and support his wife without the need for abortion. If it should be obvious that the child was born from the adulterous act, it would be possible to know this immediately upon birth and offer it for adoption with all parties consenting. Although it would certainly be a mistake to insist that the woman carry to term as *punishment* for her adultery, it would be equally a mistake to needlessly end the life of a healthy fetus. Still, pregnancy has probably proceeded for only about 4 weeks and it is still early in the first trimester. The case is evidently not simple. Of those questioned the fraction approving abortion ranged from 14% for the ministers and the medical students to 38% for the general practitioners; the average over all categories was 27% in favor of granting the requested abortion.

Summary

The title of this series is "Science and the Whole Person: A Personal Integration of Scientific and Biblical Perspectives." The choice of this title in the context of ethical issues implies the acceptance of the basic principle that ethical decisions in the real world cannot be made without full inputs from both scientific and biblical sources.

In the case of abortion, for example, it is shown that biblical exegesis provides general guidelines but no specific do/don't references. Application of these guidelines is informed by an understanding of the chronology of biological development and by that model of the human being, derived from scientific and biblical inputs, as a pneumopsychosomatic unity.

Many traditional approaches to the abortion issue are defective. Emphasis on the absolute right of the fetus or on the absolute right of the woman is inappropriate. Criteria that seek to set the time at which abortions become morally questionable based on whether or not the fetus is human or whether or not the fetus is ensouled are inapplicable. To call abortion in the early stages of pregnancy "murder" is as misleading as to refer to the third-trimester fetus as "the woman's body."

Human life begins at conception. Half of such human conceptions terminate spontaneously without even the knowledge of the mother in many cases. Although it is never an insignificant act to end a human life, it is conceivable, as outlined in this paper, that situations may exist which justify the ending of a human life *before* the biological development giving rise to human personhood. If spontaneous abortion (miscarriage) can be consistently viewed as the will of God, it would seem that induced abor-

tion in the early stages of pregnancy can also be viewed as the will of God expressed through human agents. If infanticide is viewed as a crime against society and a violation of the commandment against murder, it would seem that the killing of a viable fetus in the third trimester of pregnancy for any reason other than saving the life of the mother should also be viewed as murder.

It must be recognized that abortion decisions are highly complex, highly personal, and highly specific. Case histories form the kind of matrix in which the actual nature of these decisions can be seen, when one tries to make them in this present imperfect and sinful world. Two questions dominate: (1) Why do you want to have an abortion? (2) Have you waited too long?

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TOPICS FOR DISCUSSION

1. If an IUD device works by preventing implantation of a fertilized ovum into the uterine wall, does this type of termination of human life raise ethical problems for you?
2. There are laws that prohibit parents from harming their children by acting or refusing to act in accordance with their own religious convictions. Do you think there should be laws to prevent a woman from asking that her own life be sacrificed for the sake of the fetus if she has a number of other children who rely upon her continued care as their mother?
3. Is a 1-week embryo different from a woman's appendix? Is early abortion different from an appendectomy? If there are differences, what are their consequences?
4. If you have had several children, did you ever think about the situation involving the last child if you had decided to stop having children after the next-to-last child? What about the next child you would have had but didn't? Did you deny life to a potential human being? How does this kind of thinking fit in with ethics on birth control and abortion?
5. Is it possible for a Christian consistently and in good conscience to abort in the early stages of pregnancy in order to prevent the birth of a severely physically and/or mentally deformed child?
6. Consider the situation where a man is "made" in the laboratory by synthesizing all the material that makes up a man in *exactly* the same way that it occurs in a normal living man, but that this synthesis is done at a sufficiently low temperature that consciousness has not yet come into existence. If this being is thawed out, he will become a normal human being, according to the arguments of Part 9 of this series.[7] But suppose that before he is thawed out, i.e., before he has any self-concious experience, he is ground up in a meatgrinder and put down the garbage disposal. Would murder of a human being have been committed? Is this story relevant to considering abortion of a fetus before development of the central nervous system?
7. Suppose that the scriptural record had unambiguously said that a person's life was forfeit in the Mosaic law if he caused the death of a fetus by physically injuring the mother. Would this unambiguously establish that the fetus had the same human status as the mother?
8. It seems as if many attempts to legislate morality broadly end up by depriving the poor and underprivileged of badly needed aid in emergency situations while leaving the wealthy free to purchase violations of the legislation in some legally acceptable way. How can this kind of social inequity be overcome?
9. Could the Supreme Court have done better than to decide that abortion within the first trimester was a matter to be decided by the woman and her doctor?

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Galileo, Churchman

Galileo in the news! A feature editorial, "Galileo's Ordeal and the Modern Age," appeared in the Washington Star, October 30, 1980. It was based upon a report at the recent Synod of Roman Catholic Bishops on its reopening of the celebrated Galileo case. Pope John Paul II, in his November 9, 1979, address to the Pontifical Academy of Sciences, had remarked, "I wish that theologians, scholars and historians might examine more deeply the Galileo case." The Second Vatican Council, in turn, had deplored in 1964 the current attitude that "faith and science are mutually opposed;" it regarded the Galileo affair as "something that is not altogether without fault on our part"..."miserable and unjust." Later (1965) Pope Paul VI had made a gracious remark about Galileo upon a visit to his tomb in Santa Croce, the Westminster Abbey of Italy. It had been Pope Clement XII, the first Florentine Pope since Galileo's burial (1642) in the adjoining Capella, who had his remains transferred to its present tomb—funds having been left for this purpose by Galileo's "last disciple," Vincenzio Viviani, the 18-year old youth who had come to study under the 75-year old master. The church had been reluctant to have any honor bestowed upon a member who had been severely sentenced by Pope Urban VIII. Galileo had been made to abjure publicly in the Dominican convent of Santa Maria Sopra Minerva in Rome his theological errors. His "Dialogue Concerning Two Chief World Systems" (1632) had been prohibited. It was not till 1835 that a new edition of the *Index of Forbidden Books* omitted this book, although all specific prohibitions had been removed in 1822 and the general ban on Copernican works abrogated in 1758.

Over the years there have been many interpretations of this dramatic historical event—including current (1955) distortions such as Bertholt Brecht's *The Life of Galileo* and Georgio de Santillana's *The Crime of Galileo* (Stillman Drake's studies are highly recommended). Even today the issues are still unresolved, viz., the relation of developing science to dogmatic philosophy, including theology, and the attitude of established institutions to freedom of thought.

It is my personal opinion that Galileo was a loyal churchman. In response to the preliminary reading of his sentence Galileo requested that two specific charges be dropped, namely, that he was not a good Catholic and that, by inference, he had obtained the authorizing Imprimatur by devious or cunning methods. These, accordingly, were omitted. Galileo never attacked the Church per se; he did, however, object to certain Church authorities arrogating to themselves jurisdiction over non-doctrinal science.

Over Galileo's tomb are two figures representing astronomy and geometry—neither symbolic of his greatest contribution to science. At the age of 12 he attended the nearby monastery school of Santa Maria de Vallombrosa, where he actually became a novice. His father anxiously transferred him to the University of Pisa, which he entered as a premedical student at 17 (400 years ago in 1581). Two years later he became fascinated by the geometry being taught by Ostilio Ricci, the tutor to the children of the Grand Duke of Tuscany. At 21, however, Galileo became an academic drop-out owing to lack of funds from his father or from the University, where the argumentative youth was not popular with the professors. Seven years later, without any degree, he returned there as Professor of Mathematics, appointed by the Grand Duke Ferdinando I de' Medici. After a sojourn at the University of Padua he returned twenty years later as Chief Mathematician and Philosopher to the new Grand Duke Cosimo II.

He himself had insisted upon the title philosopher in view of his interest in natural philosophy (designated Physics by Aristotle). He was neither an Aristotelian nor a Platonist; he did, however, respect Aristotle's reasoning and his belief in a real world. He was not at all a pure mathematician, but rather an applied one. In the spirit of Archimedes he used geometry, particularly its proportionalities, for describing physical phenomena. He regarded mathematics as a tool to gain insight into experiential nature.

Although Galileo occasionally referred to himself as a "Catholic astronomer", he could truly claim this title only in the light of discoveries that he had made by scanning the heavens with a telescope (modern opera glass), which he himself had devised and made: mountains on the moon, spots on the sun, crescent phase of Venus, moons about Jupiter.

The best portrait, I believe, is one he himself used in a parable in *The Assayer* about "a man endowed with extraordinary curiosity and a very penetrating mind." In the same writing he discussed his own philosophy of science. He had a burning desire to understand physical phenomena (i.e., appearances). "Philosophy," he claimed, "is written in the grand book, the universe. . .in the language of mathematics." (*N.B.* This does not mean the universe is identical with mathematics.) Galileo worked and wrote as a genuine scientist; he recanted as an obedient churchman.

Galileo was truly a mathematical physicist—in modern terms. He rejected the method of his contemporary philosophers, who sought first principles (metaphysical) from which one could hopefully predict phenomena. Galileo, however, started with experimental data and sought physical principles that would describe them. This gap between philosophy and science persists to this day.

In this connection one requires careful observations that can be related to precise definitions, preferably in quantitative terms, e.g., the old concept "speed" and a new one "acceleration." Thus mathematics became useful. Galileo was by no means an armchair philosopher; he was interested in practical matters, e.g., a pump that failed to raise water above 27 ft. Galileo worked with his hands; he made his own lenses (better than those of the Dutch discoverer of the telescope, who could not make one adequate for viewing Jupiter's moons until ten years later). Another feature of his investigations was the use of ideal models, e.g., a frictionless plane (again in the spirit of Archimedes).

He was quite sceptical in his approach to nature—well exemplified in his chief work, *Two New Sciences* (the strength of materials

and falling bodies)—a major contribution to the understanding of terrestrial mechanics, a prerequisite to celestial mechanics. Unfortunately, Galileo's work was incomplete so that his false theory of tides was inadequate support for the Copernican theory. He might better have presented the latter as a hypothesis, as advocated by the theologian Robert Cardinal Bellarmine. (i.e., the use of the orbits, including eccentrics and epicycles, as a calculating device "to save the appearances"—in the manner of Ptolemy—qualitatively "better", but not a great improvement quantitatively). Instead, he stubbornly insisted upon it as "the truth." No wonder his publicized pronouncements irritated academic philosophers who then sought refuge in the authority of the Church.

Galileo's first conflict with churchmen, a minor one, grew out of a casual remark made by a professor, Cosimo Boscaglia, to the dowager Grand Duchess Christina of Lorraine at dinner in 1613. He claimed that any motion of the earth would be contrary to the Scriptures. Galileo being absent, his position was defended by his former student and successor at Pisa, the Benedictine monk Benedetto Castelli. Galileo subsequently presented his views succinctly in an informal letter to Castelli. Somehow copies of this letter were circulated so that Galileo felt impelled in 1615 to formalize his views in a letter to the Grand Duchess herself (published 1636). Pope John Paul II found it worth referencing: "Galileo formulated important norms of an epistemological character which proved to be indispensable for putting holy scripture and science in agreement." The Pope complimented Galileo for reaffirming the truth of Scripture in his statement that "holy scripture can never lie, on the condition that it be penetrated in its true meaning." It is unfortunate that the Church at that time did not interpret the Scriptures more broadly in the spiritual sense.

In his letter Galileo, quoting St. Augustine and St. Thomas Aquinas, emphasized that "two truths can never contradict each other. . .holy scripture and nature alike proceeding from the divine word." (Nowadays we are torn between literalism and liberalism—each representing a view that depends upon one's viewpoint. A *reductio ad absurdum* is evident in the recent decision of the National Council of Churches to emasculate the Bible, e.g., to replace the wise men with "sages", the boy Jesus with the "child" Jesus, et. al. John Greenleaf Whittier's hymn now reads, "Dear Mother-Father of personkind.") He warned about too literal interpretations as when the Scriptures speak of God's arm or his hand or his eyes—or when we speak of sunrise. Galileo affirmed, "Our opinion is that the scriptures accord perfectly with demonstrated physical truth"—nature being the arbiter for the latter. He quoted Cesare Cardinal Baronius, "The intention of the Holy Ghost is to teach us how one goes to heaven, not how the heaven goes." The Church, however was particularly sensitive to the Protestant promulgation of independent judgment with respect to the Scriptures—a major concern of the Dominican Order of Preachers. (Even now one is confused by the plethora of English translations, each purporting to give the "true" meaning.) Years later (1893) Pope Leo XII in his encyclical *Providentissimus Deus* presented a relationship between science and religion little different from that of Galileo.

Meanwhile, a Dominican friar, Tommaso Caccini, had preached (1614) a sermon at Santa Maria Novella on Joshua 10:72—"Sun, stand thou still. . .and thou, moon," and a Dominican Niccolo Lorini had sent (1615) a copy of the Castelli letter to one of the Inquisitors-General in Rome. Galileo decided to press the matter by arguing it personally there. He was anxious to prevent the Church from prohibiting the Copernican point of view; he did not insist upon the Church adopting it; rather, in the spirit of St. Thomas Aquinas, who distinguished two realms of truth (faith and reason), each independent and limited, he sought freedom for investigating natural phenomena. Whereas Copernicus had been publicly mocked, Galileo incurred open hostility, partly because of his own aggressiveness and partly because his writings were in popular Italian rather than in learned Latin, but, above all, because the tell-tale telescope could be understood by even the illiterate.

Pope Paul V was eager for a decision on the Copernican theory by the Sacred Congregation of the Holy Office (established 1542). Its consultors censured two propositions, viz., that the sun is immovable at the center of the world, and that the earth is movable and not at the center of the world. They judged the new astronomy to contradict the Scriptures—a hasty conclusion in which all participants, including Galileo, were partly to blame. Both opinions were completely out of order inasmuch as neither proposition was a matter of "faith or morality" as stipulated by the Council of Trent (1545-1563) to be considered of theological concern.

Although Galileo had not been directly involved, he was subsequently admonished by Cardinal Bellarmine not to "hold or defend" the Copernican system. He requested and received a certificate from the cardinal to indicate that he himself had not been called by the Holy Office. Unfortunately, the only report of this event (in the Holy Office) was not signed; it has the additional injunction "not to teach." This document became of paramount importance later in Galileo's trial. It is still a matter of controversy, but it is certainly not a forgery—even though probably "illegal." At any rate the procedure was somewhat questionable. It is noteworthy that the objection to Copernicus' theory was not confined to Catholics or even Italians; it was generally condemned by philosophers and theologians. (Martin Luther regarded the theory as the work of a fool; his friend Philip Melanchthan considered it not honest or decent for teaching. Even as late as the early 18th century John Wesley believed it tended to infidelity.)

Galileo maintained silence until the election of his long-time friend Maffeo Cardinal Barberini as Pope Urban VIII, to whom he dedicated his scientific manifesto, *The Assayer*, in 1623. The following year he visited Rome to secure a papal blessing for his projected work presenting a tidal theory as evidence of the truth of Copernican theory. He was cordially received and encouraged to write his book, provided it stressed the hypothetical nature of the idea (the tides were not to be mentioned in the title). The Pope, however, apparently did not make it quite clear just what Galileo could and could not say, relying upon his own judgment as to what would consitute an impartial mathematical presentation. The final product *The Dialogue*, could at best, be termed a "roguish compliance;" there is never any doubt as to the author's intent. The *coup de grace* was his manner of including the requested reservation of the Pope, viz., that an omnipotent God could make the universe a mystery even to rational men. Galileo had the remark inserted incidentally by Simplicio (probably named after a distinguised 6th-century Aristotelian, but actually a simpleton in this role, as contrasted with the other two interlocutors, the urbane Venetian Sagredo and the clever Florentine Salviati (representing Galileo)—an unintentional slight. Urban, a keenly observant person who brooked no contradiction, was persuaded by Galileo's enemies that he had been betrayed in this seeming caricature.

Thus arose Galileo's second conflict, the major one, with Church authorities. He was summarily summoned to report to the Holy Office for questioning. After the first hearing the Dominican friar Firenzuola, Commissary General, apparently persuaded Galileo to confess the error of his ways in the hope of a lenient sentence—a "deal" that did not materialize. The pope's final judgment was given in quite a different vein. On the basis of "a vehement suspicion of heresy," Galileo was required to make public abjuration of his scientific opinions in the Dominican Con-

vent of Maria Sopra Minerva on 22 June 1633 and committed to life imprisonment; his book was prohibited, and he himself forbidden to treat in any manner questions as to the stability of the sun and the mobility of the earth. (There could be no decision as to heresy inasmuch as the Copernican theory had never been judged by an "infallible authority.") His trial had been the natural climax of machinations by a motley coalition of jealous Jesuits and domineering Dominicans (individuals—not the Society nor the Order), of dogmatic theologians and authoritarian philosophers. Galileo himself, to be sure, was not guiltless; he had given evasive answers and had failed to report Bellarmine's admonition. The sentence, however, was not at all commensurate with his misdemeanor; the punishment did not fit the "crime." What is more, Galileo himself must have experienced a keen inner conflict, torn between his loyalty to the Church and his commitment to free inquiry in scientific matters. At the end he had as alternatives, church excommunication or personal perjury. He bowed in obedience to the Church.

Little is know of Galileo's personal religion other than is revealed in his famous letters. He was certainly sincere in his belief in a Supreme Being. He spoke of the Divine Artificer, "the great Architect." In the case of his own telescopic discoveries he acknowledged that he was "illuminated by divine grace." He was not, however, spiritually minded as is seen by the permission granted to have his daughter (Virginia), the nun Maria Celeste, relieve him of his penance, i.e., to say the seven penitential psalms weekly for three years.

It is not for us to judge Galileo *ex post facto*: what would we have done under the circumstances? We can, however, try to understand him from his viewpoint and regard him sympathetically from our own.

As a person Galileo exhibited sincere humility before the altar of scientific truth. On occasions, he admitted, "I do not know." With respect to the nature of comets he insisted, "I wish to discover the truth". His attitude, of course, was quite different from that of modern physicists, who have generally abandoned the quest for abstract truth and are content if a theory—possibly more than one—is true to the observed phenomena. He enjoyed doing things himself.

Galileo was a polemicist, good at debate, quick witted. He was wont to amplify his opponents' arguments, even strengthen them, and then demolish them completely, much to the advocates' chagrin. He would not give up without a struggle; he did not suffer defeat gracefully. He was stubborn; he would not compromise. He made his 1616 trip to Rome despite the advice of friends; he persisted in defending the Copernican system as uniquely true despite equally good evidence for the Tychonic proposal not even mentioned in his *Dialogue*. There is a myth (due to Guiseppe Baretti 1757) that he muttered, "*Eppur si muove*" (Yet it does move), when he rose humiliated from his abjuration—hardly likely. Upon his leaving his friendly host at Siena, where he had been first "imprisoned," he might have so remarked slyly as he bade his well-wishers, "*arrivederla*." Galileo was certainly an optimist; until the judgment, he seemed to expect matters to turn out all right. After all, he had many friends in high places (including the Church).

Galileo was quite imaginative so that he was popular as an expositor and as a lecturer. He wrote in Italian so that the common people could understand his message. He had a flare for the dramatic. It is not unlikely that the old Galileo reminisced with the young Viviani, who later told the tale, that for a group of students he had dropped two different weights simultaneously from the Leaning Tower of Pisa to demonstrate that the difference in times of fall was considerably different from what might have been expected from Aristotle's assumption.

Galileo was unquestionably self-centered. He enjoyed the comfortable hospitality of his friends, their good houses, good food, and good wines. His own house in Arcetri, where he was under house arrest, was a small estate in the country. When he abandoned his Paduan mistress he took their three children with him to Florence, where the two girls (under ten) were at once confined to a nunnery for life. At the very end he indulged himself with his scientific interests. But he was by no means a martyr of science! Priorities continually bothered him—in the case of the telescope, of sunspots, and of comets. At the end of his second hearing he pleaded pitifully that consideration be given to his bodily ailments, his honor, and his reputation.

At best, Galileo was honest only to a degree. Only partially true was his claim in *The Assayer*, "Poor as I am, I am at least upright." I do believe, however, that he was correct about Bellarmine not instructing him in 1616 with the incriminating phrase "not to teach" Copernican views. When Galileo was questioned about his intention with respect to his sentence, he committed downright perjury, viz., "I affirm, therefore, on my conscience, that I do not now hold the condemned opinion [Copernicus] and have not held it since the decision of the authorities." (1616) Galileo's behavior was in some respects blameworthy and in others praiseworthy. His admittance at the second hearing rings true: "My error has been, and I confess it, one of vainglorious ambition and inadvertence"—typically human.

Undoubtedly he helped free scientific thought—but only at the costly price of its divorce from culture (cf. our modern "two cultures")—what Brecht calls the real "crime of Galileo." In his play where the people are the hero, not Galileo, he captions the last scene with this reference to the "Two New Sciences":

> "The great book o'er the border went
> And, good folks, that was the end.
> But we hope you'll keep in mine
> He and I were left behind."

The Galileo case is usually cited as a dramatic focus on the supposed warfare between science and theology. Actually it is merely an instance of the perpetual clash between an individual's freedom of thought and society's establishment of authority. It just happened then that the person was a scientist and the institution the Church. The issue itself is still alive today, but such conflict is not inevitable. It would not have taken place in the 17th century if Galileo's scientific attitude had been as broad as Bellarmine's, and if the latter's theological point of view had been as broad as Galileo's. Conflicts between the individual and society are always taking place; this particular one occurred in an area where truth was verifiable to a degree. But both Galileo and Bellarmine were wrong in allowing the Bible to be used at all as a science textbook even where there was no apparent objection.

I personally believe that there will always be some kinds of conflict between science and theology inasmuch as each gives an incomplete and continually changing view of the same world from differing viewpoints.

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This is the first in a special series on religious scientists.

A Pictorial Representation of MacKay's Argument for Human Freedom in a Mechanistic Universe

Some twenty five years ago, Donald M. MacKay proposed a novel argument which allowed, on the one hand, the freedom of men to determine their own actions even though, on the other hand, everything in the universe was assumed to be mechanistically determined.[1] Perhaps as remarkable as the argument itself, is the confusion that it has produced. A considerable literature has been developed concerning the argument[2-4] and in his book, *The Clock Work Image*,[3] MacKay has devoted an Appendix to listing and answering seventeen objections to his argument. Furthermore, in this *Journal*, there was recently an exchange between MacKay and John Cramer concerning the argument.[5] As a contribution toward understanding the essence of MacKay's argument I wish to present here a statement of his argument in graphical form. With the argument thus laid out in a pictorial format, the mind can visualize as well as analyze the argument as it is unfolded.

Visualizing the State of the Brain

The brain is composed of some 10 billion neurons each of which can be considered to be either active or inactive. From a materialistic viewpoint, the conscious state of mind at any instant of an agent A is completely determined by the physical state of these neurons. If, as a first approximation, we let the number 1 represent a neuron when it is active and the number 0 represent it when inactive then we can describe the physical (and conscious) states of the brain in terms of 0's and 1's.

With the brain state at any instant of time now described as numbers we can obtain a visual description of the brain by plotting the numbers against coordinate axes. In Fig. 1, for example, we have a plot for a brain containing only three neurons. Each of the three coordinate axes represents one of the three neurons, and the $2^3 = 8$ dots indicate the eight possible states of the 3-neuron brain. The numbers in the brackets give the coordinates of the dots and correspond to neurons 1, 2, and 3 respectively. Thus the brain coordinates indicated by (0,1,1) correspond to a brain state where neurons 2 and 3 are active and neuron 1 is inactive. Furthermore, as time goes by, the state of the brain changes so that a dot representing the brain state in Fig. 1 moves to a new location. The activity of the brain can be described, then, by the path of a dot in Fig. 1 as it moves with time.

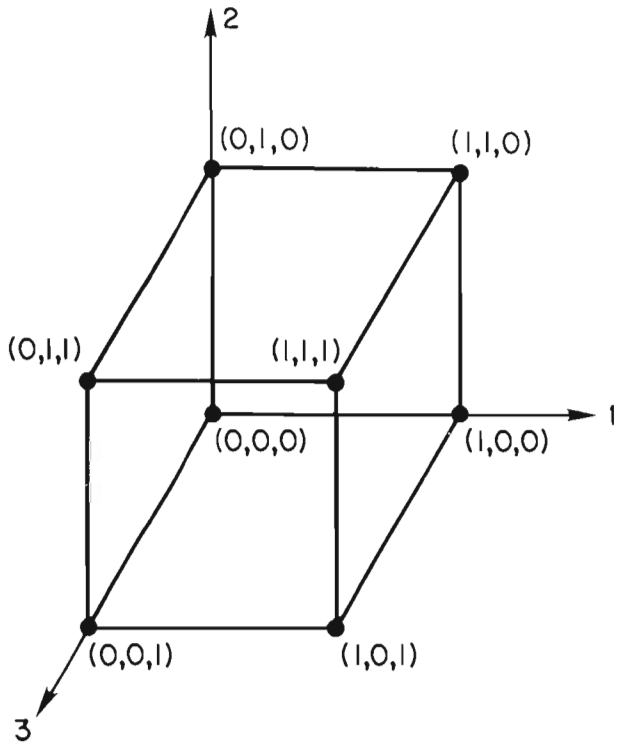

Figure 1. Brain-state coordinates for three neurons.

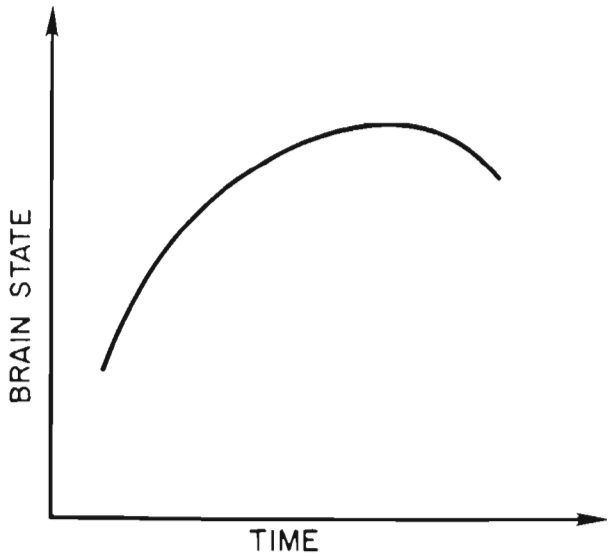

Figure 2. Brain-state diagram. The brain-state coordinates are collected together on the brain-state axis.

Since we are discussing the state of the brain as it changes with time, it is convenient to plot the brain state against a time axis. However, the brain state in our example has three dimensions (coordinates), and three dimensions cannot be plotted against a fourth dimension time. Thus, we must be content with a schematic plot (Fig. 2) where *all* of the brain coordinates are represented by the vertical axis.

In principle, it is easy to generalize from 3 neurons to n neurons in the brain. There will then be n coordinates (instead of 3 coordinates) in Fig. 1 and 2^n points in the plot. (Such a plot, of course cannot be represented in our 3 dimensional world). However we can still conceive the state of the brain at any instant as being one point in this dimensional plot. And finally, as before, we can represent schematically the n coordinates as a single vertical coordinate in the time plot (Fig. 2). Thus, we can represent schematically the physical (and conscious) state of a brain by a curve having the coordinate axes of Fig. 2. For reference, we denote a representation of a brain using the brain-state coordinates plotted against time as a brain-state diagram.

Visual Representation of MacKay's Argument

We now illustrate how brain-state diagrams can be used to illuminate MacKay's argument. We take the case where the brain of an agent A is under observation by an observer B. Since physical determinism is granted in MacKay's argument, B can, in principle, predict exactly the state of A's brain so long as he does not inform A of his prediction. (We might think of observer B as being

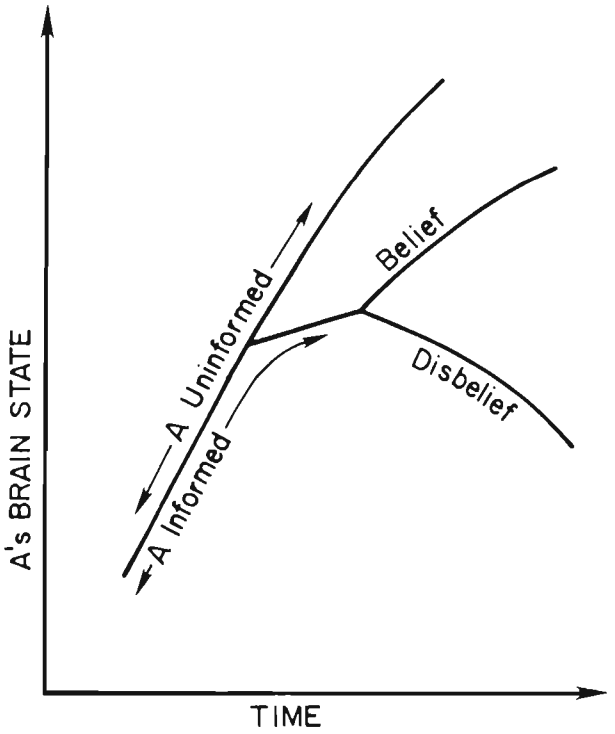

Figure 3. Brain states for an agent, A.

Laplace's super-Intelligence who uses the deterministic laws of the natural world to completely predict the future.) The state of A's brain according to this predition (of which A is uninformed) is represented by the curve "uninformed" in a brain-state diagram (Fig. 3). Thus A's brain state follows deterministic laws and A's future conscious behavior can be completely predicted by B.

We now introduce the possibility that B informs A of his prediction of the future of A's brain-state. Then, the original prediction will no longer be valid and A's brain state will be represented by a curve denoted "informed" which branches away from the "uninformed" curve. (Of course, B, in his omniscience, will modify his prediction of A's future brain state to allow for the fact that A now knows the prediction).

Now among the different effects of A's knowledge of the prediction on his brain will be the requirement for A either to believe or disbelieve the prediction. Since B has complete predictive power of A's deterministically-controlled brain, B can predict A's future brain state either if (1) A believes B's prediction of A's brain state or if (2) A disbelieves the prediction. Thus, if A were to believe B's prediction of A's brain state, B will predict that A's brain state will follow the "belief" curve (Fig. 3); if A were to disbelieve B's prediction of A's future brain-state, B will predict that A's brain-state will follow the "disbelief" curve (Fig. 3).

Furthermore, the observer B can predict whether A will indeed believe or disbelieve. To justify this statement in an objective manner, let us suppose that A has previously decided to make all of his "believe" decisions by flipping a coin with the consequence of "heads, I believe; tails, I disbelieve". Because the result of the coin flip depends on physical factors of which B is aware, B also knows whether A will believe his prediction about A's future brain state. (If A decides to believe on grounds other than a coin flip, B will also, of course, know whether A will believe because A's brain is functioning in a deterministic fashion).

We now consider the case when A believes B's prediction. Since B knows that A will believe, he predicts the "believe" curve (solid line in Fig. 4). We next consider whether A himself has a logically free choice to believe or disbelieve this prediction (even though we, and observer B, know that A will believe). If A believes the prediction, he is right since his brain will follow the "belief" curve as predicted (upper dashed curve in Fig. 4). If A chooses to disbelieve B's prediction, he would also be right becuase, then, his brain state would follow the "disbelief" curve (lower dashed curve in Fig. 4) and the prediction would be in error. In this case then, A has the logical freedom either to believe or to disbelieve (and to act accordingly) because he would not be wrong if he did either one.

We must consider the case where B predicts (correctly) that A will disbelieve B's prediction of A's future brain state (solid line in Fig. 5). In this case, if A believes the prediction, his brain state will follow the upper dashed "believe" curve in Fig. 5. Consequently, A would be wrong to believe the prediction since the "believe" curve does not coincide with the predicted solid curve. On the other hand, if A disbelieves the prediction, his brain state will follow the lower dashed "disbelieve" curve in Fig. 5. This time, A would still be wrong to disbelieve the prediction since now the prediction is correct (the lower dashed curve agrees with the predicted solid curve). Thus if B's knowledge leads him to predict (correctly) that A will disbelieve his prediction, A would be in error either to believe or to disbelieve B.

Summarizing these results, we have, in the second case, the conclusion that A will be in error (wrong) whether he believes or disbelieves the correct prediction. In the previous case we had the conclusion that A would be correct (right) whether he believes or disbelieves the correct prediction. Thus, in neither case, does B's prediction have, in MacKay's words,[6] "an unconditional claim to A's assent."

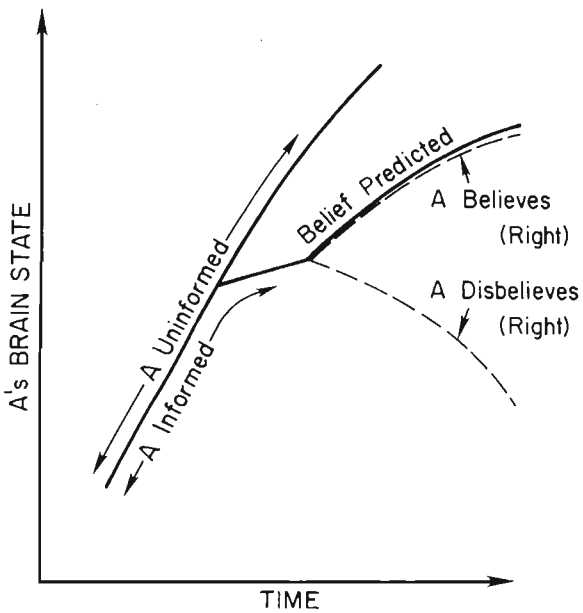

Figure 4. Brain states for an agent A, when an observer B predicts that A will believe B's prediction.

The Implications for Free Will In a Deterministic Universe

Except for predictions about the brain state of the person A (agent) under discussion, the (granted) determinism of the physical world does restrict personal freedom of choice. To take an example of MacKay's, if B informs A of a (correctly) predicted eclipse, the agent A, as well as the observer B, would be *right to believe* the prediction and *wrong to disbelieve* the prediction. In this case, B's prediction does have an "unconditional claim to A's assent" and A would not have the freedom either to believe or disbelieve the prediction, i.e. A does not have a freedom of choice about believing the occurrence of an eclipse.

However, as we have seen in the discussion above, if B tells A what A is going to do (A's action, of course, being determined by A's brain-state) then B's prediction no longer has "an unconditional claim to A's assent." Thus, while B's prediction will always be correct (since we granted B the power of prediction in a mechanistic universe), nevertheless, A will not be forced *logically* to accept B's prediction. For, in Case 1 above (Fig. 4) A will be right whether or not he believes B's prediction while, in Case 2 (Fig. 5) he will be wrong whether or not he believes B's prediction.

However, the reader may well object that most of the time no one is telling A what he is going to do. Rather A is making his choices independent of an observer B. In this situation, in both Figures 4 and 5, A's brain state follows the "uninformed" curve. This curve is predictable by an observer B and is unaffected by any effect of B's predictions since A is not informed about the predictions. In fact, B can write down what A will do and, after A has performed according to prediction, B can show A that B has been able to predict all that A did.

On this basis B might tell A that A had no freedom of choice. However, A can be stubborn and still insist that, during the course of his actions, he was making free choices. To adjudicate their disagreement, A and B can decide to take their case to what MacKay[7] calls, a "logical court." The court is asked to decide whether A had freedom of choice even though B was able to predict all of A's actions beforehand. To make its decision, the court uses the test: did B's prediction of A's actions have "an unconditional claim to A's assent?" In performing this test, the court must consider the logical status of A's brain state *if* A had been informed of B's prediction (although A need not be informed to make this logical test). Thus, when the court *tests* B's predictions A's brain states in Fig. 4 and 5 will leave the "uninformed" curve and proceed along the informed curves even though, while he was making choices, A's brain state had followed the "uninformed" curve. Consequently, in following the "informed" curves, the court will uncover the logical peculiarities associated with these curves (as discussed above) and the court will rule that B's predictions did *not* have "an unconditional claim to A's assent" even though, while A was acting, A was unaware of B's predictions. Thus, A has a *logical* freedom of choice at all times whether or not he is informed of (correct) predictions concerning his future actions.

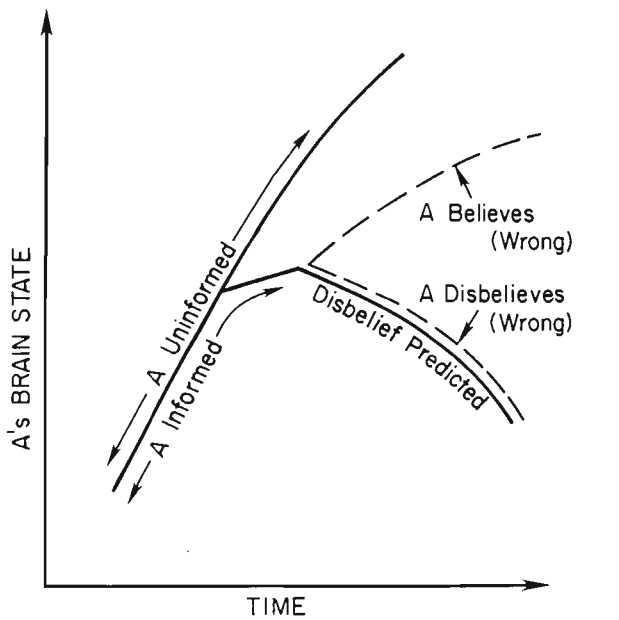

Figure 5. Brain states for an agent A, when an observer B predicts that A will not believe B's predictions.

In summary then, A, the agent, has the *logical* freedom to choose even though B, the observer, can predict everything that A will do. This freedom of A's is independent of whether or not B informs A of his predictions.

The author has benefitted from correspondence with Dr. MacKay.

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[1]MacKay D.M., "On Comparing the Brain with Machines." *The Advancement of Science* 40: 402-406, 1954; *American Scientist* 42: 261-268, 1954; *Annual Report of Smithsonian Institute:* 231-240, 1954.

[2]MacKay D.M.: "Choice in a Mechanistic Universe: A Reply to Some Critics." *The British Journal of the Philosophy of Science* 22: 275-285, 1971, and references therein.

[3]MacKay D.M.: *The Clock Work Image*, Inter-Varsity Press, Downers Grove, IL, 1974. *Human Science and Human Dignity*, Inter-Varsity Press, Downers Grove, IL, 1977.

[4]*Christian Scholars Review*, 1978: Hasker W., "MacKay on Being a Responsible Mechanism: Freedom in a Clockwork Universe:" 130-140; MacKay D.M., "Responsible Mechanism or Responsible Agent? A response to William Hasker:" 141-148; Hasker W., "Reply to Donald M. MacKay:" 149-152.

[5]Cramer J.A.: MacKay D.M.: "The Clockwork Image Controversy," *Journal American Scientific Affiliation*: 123-127, 1976.

[6]Reference 2, p. 276.

[7]Reference 4, page 143.

Modern Version of the Creation Account

Professor Wilhelm Knevels of Germany suggested in an interesting book (*The Reality of God*) that somebody should recast the story of Creation in Genesis 1 in terms of our present knowledge of the world around us, and that this should be done in such a manner that its theological content was retained. The suggestion intrigued me, and I decided to give it a try.

What follows is a first attempt toward such a story. It is experimental in nature and is given only as an example of what might possibly be done in this respect. I do not suggest that my attempt

should in any way replace Genesis 1, for I respect the Genesis text far too much for that. Moreover, I believe that Genesis 1 should remain the *essential proto type* of *our* confession of God the Creator.

Nevertheless, it might be helpful for some non-Christians to hear the message of creation in modern form; it might overcome some of their prejudices against the Genesis account. Also some conservative Christians, who are afraid that modern science might threaten the content of the Bible, might learn that they have little to fear. But the main intent is to give a confession of faith in God the Creator in terms of what modern science has to say.

The Creation Account

In the beginning space was empty. About 15 billion years ago God said: "Let there be a Universe". And in an instant of time God created out of nothing all the energy of the Universe in a very small part of space. This huge amount of energy caused a large explosion, and so the expanding Universe was formed. While expanding, the energy condensed into matter, the matter into galaxies and the galaxies into stars; and the stars began to shine, first dimly, then brightly. And God saw that it was good.

About 4.5 billion years ago God said: "Let there be a solar system with a planet that can sustain life." And our solar system was formed; a sun surrounded by planets that orbited around it, and each planet, in turn, rotated around its axis. Its third planet, counted from the sun, was destined to become habitable. The sun began to shine, and the rotation of the earth around its axis alternately produced day and night, day on the illuminated side, night on the non-illuminated side of the earth. And God saw that it was good.

Soon after its formation the earth was in a molten form; the earth and the lower atmosphere were very hot, and there were large amounts of water vapor in the atmosphere. But gradually the earth cooled and its surface became solid. When the atmosphere reached a temperature below 365° C, the water vapor in the atmosphere partly condensed and torrential rains fell upon the earth for a long time. When the earth and its atmosphere reached about the present temperature, a more stable situation arose, in which most of the water vapor had condensed and had assembled in the low-lying parts of the earth. So the seas and the dry land were formed. And God saw that it was good.

In this more stable situation weather processes as we know them occurred; sunshine, thunderstorms, lightning and rain. As a consequence complex molecules, amino acids, were formed in the primeval atmosphere, and these molecules were transported to the seas, where they accumulated; they would become the building blocks of future life forms. Each molecular species occurred in two possible forms that were each other's mirror image.

More than 3.5 billion years ago God said: "Let there be living cells that have metabolism and that can reproduce themselves." And a first primitive cell appeared, and from it all further living cells descended by cell division. Since only *one* living cell was formed at first, its molecules had a particular symmetry; and since all future life forms descended from it, they all had the same molecular symmetry up to the present.

The first living cells were without nucleus and so had limited genetic material. Therefore God said: "Let there be cells with a nucleus containing a genetic code as a blueprint for the appearance and the functioning of the living cell." And so living cells containing nuclei were formed. In the reproduction process the nucleus and its genetic code were reproduced, so that the offspring resembled the original in almost every respect.

And God endowed the genetic code with a certain amount of flexibility, so that over long periods of time the molecules in the genes of the nuclei of the cells could change by molecular rearrangement and by accumulation of new genetic material. Looking over short periods, the cells seemed to be reproduced perfectly, but looking over very long periods the cells changed into new species. And God saw that it was good.

During the development of these forms of life, cells appeared that could transform carbon-dioxide into starches and sugar with the help of light under release of oxygen (photosynthesis). The atmosphere had at first little oxygen but due to the new process it gradually became richer in oxygen. As a consequence the possibility was laid for new life forms that operated by breathing oxygen.

And God said: "Let there be complex, multicellular forms of plant and animal life." And plants and animals appeared, and God said: "Be fruitful, multiply and develop." And so it happened. The plants and animals developed and new species of both were formed. And where common evolutionary principles operating in this development were not sufficient, other principles became operative and speeded further development.

In this manner the plant kingdom was established. Mighty trees developed next to tiny plants. Seed-bearing grains and fruit-bearing trees developed next to beautiful flowers. Cell division was no longer the only form of reproduction but reproduction by spores and seeds became common. And God saw that it was good.

In the same way animal life developed. Worms, mollusks, spiders and insects appeared. So did after some time the fishes, amphibia, reptiles, birds and mammals. Carnivores and cattle, and all sorts of other animals, including primates (monkeys) developed upon God's command. In the development of higher forms of animal life sexual reproduction and mutual attraction between the sexes were introduced as principles for maintaining and developing life forms. And God saw that it was good.

And God said: "Let there be man, to rule over the earth, the plants and the animals, and to communicate with me and to serve and worship me." And upon God's command one of the primate species (not a modern ape!) developed first into a pre-human, and finally into a fully human life form. So man became capable of ruling over the earth, the plants and the animals, to communicate with God and to worship and serve Him. And God saw that it was good.

Comments

To conform with the Genesis narrative I stressed certain highlights in the development of the Universe and of life on earth. This should not be interpreted as meaning that God's creative activity was limited to certain crucial points in the development. Actually, God's creative activity encompasses all that happened.

The religious and the scientific views of the Universe do not conflict with each other but rather complement each other. Science will always ask the questions: "What happened?", and: "What were the mechanisms involved?". This would even be the case if science came up with evidence pointing to genuine "manufacturing." Faith will always relate the world around us to God, even where natural processes seem to be fully adequate to describe the developments. As in any complementary approach, both points of view extend all the way.

Some people maintain that the religious approach to the world was once an acceptable interpretation, but that it has now been superseded by the approach offered by science. Others maintain

that the religious approach to the world should be further developed into an alternate scientific theory that competes with the theory of evolution. Both approaches ignore the complementary character of the scientific and the religious points of view, and should therefore be discarded.

The highlights of the Creation account of this paper can be summed up as follows:

1. *The beginning.* The explosive situation at time zero could not have been assembled slowly; it is a *singularity* and should be treated as such. Some scientists who do not consider themselves Christians postulate here a creative act. This should gracefully be acknowledged, but it should also be understood that God would equally be Creator if the explosion were the result of a previous implosion or if the Universe were oscillating.

2. *The emergence of a life-bearing planet.* Whether or not this should be considered a unique event depends on how rare life in the Universe is. God would still be Creator if life-sustaining planets were found in other solar systems.

3. *The first primitive form of life.* It is clear from the observed molecular symmetry of all present forms of life that all life started from a single primitive cell. The emergence of such a cell must be scientifically described as an elementary event in the wave-mechanical sense, with a very small probability.

4. *The emergence of the nuclear cell with a genetic code.* This represents a radically new principle that most likely came about rather suddenly. If that were the case, it could be considered a unique event. But God would equally be Creator if the nuclear cell had emerged slowly.

5. *The development of multicellular life forms.* A multi-cellular life form is not a clump of loosely connected cells but an organic unity of cells; it could thus be considered a radically new beginning.

6. *The emergence of man.* The emergence of full man represents a radical change not so much in man's body as in man's spirit, in his self-awareness, his ability to think and reason, to invent and to communicate. But God is not Creator because these changes occurred suddenly; He would equally be Creator if the pre-human forms of life had crossed the human threshold slowly.

I made a cautious use of evolutionary processes, thereby indicating that they are under God's control; I left the possibility of other processes, as yet undiscovered, open. In the scientific approach to the Universe one must leave the possibility open that the description in terms of natural processes as we know them has limits.

The Creation account of this paper should not be interpreted as a harmonization effort. I did not aim to make the religious approach to the Universe more palatable, as such harmonization efforts usually try to do. But it should be understood that when one wants to confess God as Creator in modern terms, one unavoidably has to connect one's faith in God with our present understanding of the world around us. This is what I tried to do.

Conclusions

We saw how we could incorporate elements of the modern world view into our theological thinking. But we did so *critically*. Mixed with the facts of science are concepts that are religious in nature and that conflict with the biblical view; they should not be taken over but discarded. We made for example a careful use of the theory of evolution, but we did not take over "evolution" as a creed.

When following this rule we are in full accord with Genesis 1. It took over many of the ideas of the ancient world view, but not the religious concepts associated with it. For example, the moon and the sun were not seen as deities, but as God's creations, serving His purpose. This is basically not difficult to put into practice in our situation.

The aim of the discussion was not to vindicate Genesis 1. But we see that the picture that modern science gives of the world around us can very well be incorporated into the framework of Genesis 1.

There may well be difficulty with Genesis 2 and 3 and the biblical passages dependent upon it. The present scientific approach to man does not lead to a "first pair" and hence leaves little room for a "fall." We should therefore be satisfied with the theological content of these passages.

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Recombinant DNA: Round No. 2 - The Supreme Court Decision

During the 1970's science finally lost any pretense of innocence. The fact that science and technology take place in a socially-loaded context is now undisputed by scientist and layman alike. As much as any other contemporary issue, the genetic engineering debate has opened wide its gates to admit historians, philosophers, theologians, lawyers, sociologists, politicians and the "general public".

The recombinant DNA (RDNA) discussions have been unique among the issues of recent years in that the implications of the research were widely discussed prior to any significant application of the techniques to specific systems. Some members of the scientific community have pointed with pride to an apparent growing sense of responsibility among scientists to police their activities—in this case to publically air their concerns over the potential risks of RDNA research.[1]

Whether this sense of responsibility was all pervasive among those involved or whether a decision to halt the research would have been circumscribed is a moot questions. In any case, a decision to go ahead was made after extended discussion. Most (but not all) western nations have committees which advise appropriate government agencies and provide review and control over suggested research projects. In the US the RDNA Advisory Committee advises the NIH while in the UK the Genetic Manipulation Advisory Group establishes regulations.

Recombinant DNA technology involves chemical synthesis or isolation of one or more genes from an organism followed by insertion of this DNA into a piece of DNA of a host organism (recombined DNA) in such a form that the host organism will copy the inserted DNA. Once reproduced (cloned) in the host organism, the inserted DNA or its gene product (e.g., protein) may be isolated and purified from the host cell. The absence of any unique hazards stemming from over five years of research (that is, hazard over and above that of the organisms which are under investigation) has resulted in a relaxation (but not abandonment) of the original guidelines.

At this writing newspapers and scientific journals daily recount the advances being made. The popular press has become more positive than in the past in reporting the benefits of a particular discovery rather than creating sensational scenarios for potential hazards. *Science* recently devoted an entire issue to discuss current research.[2] The explosive development of the field has resulted in an equally expanding vocabulary for which the editor of this issue provided a three page listing of "ad hoc" definitions. Late in 1980, Geneteck became the first RDNA based company to offer its stock publically.

MIT Historian of Science, Charles Weiner early recognized that the RDNA issue offered a signal opportunity to view the ways in which science relates to modern society. With his MIT colleagues, he has amassed a unique collection of written and oral material on the subject. The oral-history approach has been found to be particularly effective in capturing those perceptions and details which are so often lost, destroyed, laundered or mythologized as time takes its toll on memories.

The *Journal ASA* pulished a cross-section of evangelical thought on the subject during the 1970's. A representative selection of the papers is found in 1980 reprint collection, *Making Whole Persons—Ethical Issues in Biology and Medicine*, edited by Robert L. Herrmann.[3]

The Supreme Court Decision

Although the intensity of the debate had diminished markedly by the end of the '80's a nagging problem lay unresolved. This situation was clarified (for the present) by the US Supreme Court which by the narrow vote of 5 to 4 ruled that "a live human-made organism is patentable."[4] This June 17, 1980 finding opened the way for commercial development of the processes and techniques of the embroyonic genetic engineering industry. At that point well over 100 patent applications were backed up awaiting a definitive decision from the courts.

The signal case before the Supreme Court involved a 1972 patent application by A. M. Chakrabarty of General Electric for a process by which four different plasmids capable of degrading four major components in oil spills could be transferred and maintained stably in a single Pseudomonas bacterium which itself has no capacity for degrading oil.

His original application was rejected by a patent examiner and the Patent Office Board of Appeals on the ground that living things are not patentable. The court of Customs and Patent Appeals reversed this decision concluding that "the fact that microorganisms are alive is without legal significance for purposes of the patent law." The patent office then appealed the case to the Supreme Court.[5]

Both the majority and minority opinions agreed that neither the morality of genetic engineering or changes in the patent laws were involved. Rather, the issue hung on the interpretation of already existing patent law. The majority opinion followed a broad view of the patent laws which considers anything made by man to fall under their provence except for laws of nature, physical phenomena and abstract ideas. Keys to the discussion were the 1930 Plant Patent Act and the 1970 Plant Variety Protection Act that authorized patents for certain asexually and sexually reproduced plants but excluded bacteria from its protection. The majority held that the exclusion of bacteria in the specific plant case did not extend universally to cover all areas of "manufacture" or "composition" of matter related to living things.

The minority opinion felt that the patent protection act has limits and should not be routinely applied to "unanticipated inventions" —especially where the "composition sought to be patented uniquely implicates matters of public concern." They also expressed the reservation that the majority's attempts to explain away the specific exclusion of bacteria in the 1970 Act "ring hollow."

From a distance it appears that the Court was able to have things both ways. They could affirm the right under current law for patents of life forms yet in the same breath remind Congress that it alone has the power to "broaden or narrow" the patent law; e.g., the ultimate decisions concerning the scope of RDNA research rest with the Congress.

Reaction to the decisions was mixed both within and without the scientific community. Leaders representing the US Catholic Conference, the Synagogue Council of America and the National Council of Churches, jointly, sent a statement to President Carter and to the Presidents Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavorial Research. Morris Abram, commission chairman, has promised to "survey the field to find out whether genetic engineering should be the subject of a review." The *Science* report noted that the church groups seem content to press their concern in a deliberate way. None has budgeted funds to do additional research on the issue and the Catholic Conference has dropped the two staffers who were working on it.[6]

Ethical Concerns

The issues which initially brought RDNA before the public eye appear to have been resolved in the scientific community and general public to the point that the number of workers in the field and areas of research are rapidly expanding and their work is reported in the press in terms of public benefit rather than public risk. For British biochemist Robert Williamson: "one of the joys of this field is that there will be goodies for all." "For the first time in many years, the techniques are more powerful than the intellectual abilities of those using them" "The man or woman with a good, elegant and insightful idea in molecular biology should, during the next decade, find little problem in putting the idea into practice."[7]

There are, however, individuals who continue to express various concerns about RDNA research. These concerns touch on three areas: (1) fundamental hazards associated with the work, (2) potential "dehumanization" of man from specific application of the techniques and, (3) related economic factors. In commenting on any of these questions one is faced with certain obsolescence due to the rapid expansion of knowledge in a field where research results have been discussed before congressional committees prior to publication in the scientific literature.

In seeking to minimize (or eliminate) the hazards associated with the research, biological and physical containment methods are employed. The former involve use of "fastidious" bacterial hosts which could not survive in natural environments and the use of extrachromosomal elements (called vectors) used to clone DNA which are able to grow only in highly specific hosts and unable to move from one host type to another. Physical containment involves use of portable hoods or negative pressure labs.

While containment procedures may adequately minimize hazards related to "in house" RDNA research, commercialization and application of RDNA products poses a more complex problem—the creation of a new type of biological pollution. What happens to GE's Pseudomonas once it has finished "eating oil?" The results of gene pollution may be of a different level of significance from those stemming from traditional pollutants in

their effect on living material and man.

The extension of these genetic methods offers the potential for elimination of human genetic deficiencies (e.g., the approximately 1600 genetically oriented diseases, and for modifying man in terms of intelligence, strength, etc. Speculation about these possibilities and their extension to various Frankenstein-type creatures has provided fodder for the press. However, most workers in the field feel that applications in these directions lie far in the future and that basic scientific questions must be resolved before extending the work to man. Clearly, research guidelines in this area will be needed. However, the exact definition of the guidelines should come relatively close to the point the research begins in order to take advantage of the experience of the past.

The major economic issue raised in the patent case dealt with the concern that a few big companies would dominate the genetic business through the ability to finance crash research programs and buy up patents from individuals who were unable to develop their work commercially.[8] The effect, in some eyes, would be a control on prices and a supply dependence that would not be in the public interest.

Another criticism follows the line that in producing various chemicals, hormones and drugs by cost effective genetically engineered microorganisms, we may become dependent on a very limited number of fragile biological entities for vital medicine and chemical necessities rather than the variety of current natural sources of these species. Society is thus seen as being forced into the hands of big business and high technology.

Concluding Comments

The scientific community can point with pride to the body of scientists involved in RDNA research for their willingness to discuss the hazards associated with their work in the initial stages and on a continuing basis. Going public before the fact seems preferable to heavy handed governmental control after the horse is let out of the barn.

Several lessons have been learned which have broad implications. Many scientists have been introduced to "realpolitik" and the media for the first time. Going public means that the general public which directly or indirectly funds our work may have other structural frameworks within which to evaluate progress than those employed by scientists. Within a democracy the community has the right to make the ultimate decisions even if wrong. The press is often concerned only with headline news and seldom has reporters who can understand and communicate scientific matters. The scientist must speak with extreme care recognizing that the potential to misread what is said is no less than that found for any other public figure.

Another lesson involves the point that prejudice or gut feelings are no substitute for hard facts. Some of the early concern in the RDNA case would have been minimized if the people involved had known more about infectious disease, epidemology and pathogenesis and hazard analysis, or talked to those who were experts in the field.

A further lesson concerns the need for a rapid, non-bureaucratic method for interfacing scientists, the public and government where contentious issues involving both safety and science policy are found.

The future will decide whether RDNA research lives up to its potential for biological understanding and industrial application as the latter has been encouraged by the recent Supreme Court decision.

[1] J. Dorman, *New Scientist, 85*, 86 (1980)
[2] *Science, 209*, 19 September 1980
[3] R. L. Herrmann, Ed., *Making Whole Persons: Ethical Issues in Biology and Medicine*, American Scientific Affiliation, Elgin, 1980
[4] *Chemical and Engineering News, 58* (34), 10 (1980)
[5] *The United States Law Week, 48*, 4717 (1980)
[6] N. Wade, *Science, 208*, 31 (1980)
[7] R. Williamson, *New Scientist, 84*, 12 (1979)
[8] J. Rifkin, et.al. *The Case Against Patenting Life*, Amicus Curiae, #79-136, Supreme Court of the United States, October Term, 1979

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Economic Causes of Soil Erosion in the United States

We youngsters pointed out that the tops of our rises were turning clay-brown, that bushels of black dirt washed into creeks and ditches every time it rained, and that in the non-Calvinist counties the tops of the rises were black. We were told we were arguing by results, not by principles. Why, God could replenish the black dirt overnight. The tops of the rises were God's business.

Our business was to farm on Biblical principles. Like, Let everything be done decently and in good order; that is keep weeds down, plant every square inch, do not waste crops, and be tidy. Contour farmers were unkingly because they were untidy. They could not be prophetic, could not explain from the Bible how to farm. . . .

from *Calvinist Farming* by Sietze Buning

Since the middle 1970's, the Christian church has paid increasing attention to the problems of world poverty and hunger. This renewed concern has arisen from both a heightened appreciation of the biblical emphasis on the necessity of caring for the poor, and also from increased study devoted to a world food system that does not seem to be working as well as we would like it to. Part of the concern for world hunger has focussed on the problem of soil erosion and declining soil fertility in the United States. Agricultural practice in the U.S. seems to promote soil erosion, and it is obvious that we cannot expect indefinitely to maintain or increase food production in this country under those circumstances. It is estimated that "more than one-third of the cropland in the U.S. suffers soil losses in excess of the amount believed consistent with maintenance of soil productivity over the long run." (Crosson and Frederick, p. 181) One Christian observer has stated:

> (I)t is becoming increasingly evident that agribusiness is bringing about a situation in which soil fertility has reached its limits and is in fact declining. The high production yields of the past twenty to thirty years have been achieved to some extent at the expense of the natural soil fertility which was present. . . . A form of sterility is developing in this important area of food production which our society has come to take for granted. (Zylstra, p. 10)

Similar concerns have been expressed by Geiger, Freudenberger, and Bossi among others.

There is a tendency in this literature to attibute these abusive agricultural practices to the stupidity or venality of contemporary farmers. Zylstra (p. 10) claims that the cause is the profit motive, pure and simple. Geiger cites inertia, custom, and shortsightedness (p. 97). Bossi blames large-scale farms, a business mentality, and speculation (p. 96). Freudenberger also discusses large size and deficiencies in farmers' perspectives (p. 137-141).

On their face, these explanations are not convincing. A firm (farm or otherwise) that is motivated by long-run profit maximization (or maximizing the firm's market value, which is the same thing) will not do so by wasting its productive physical assets. Nobody wants to own stock in a company that turns out goods year after year without ever investing in physical maintenance or replacing worn-out equipment. Such firms go bankrupt, no matter their size, and the executives lose their jobs and the investors lose their money. Similarly, we would think a person was crazy if he or she expected to minimize transportation costs by running a car for 100,000 miles, but refused ever to change the oil. That would be what is commonly called "false economy."

The assertion that farming large units leads to soil erosion also lacks economic plausibility. It is claimed that larger farms have lower production costs, and so win out in the competitive battle with smaller farms, but that the techniques used on large farms necessarily cause soil erosion. There are several problems with this argument. First, if soil erosion is counted as a cost, as it presumably would be by a long-run profit-maximizing farmer, it would seem that the advantage of the large farmer would disappear. This suggests that the cost advantage of large farms, if there is one, comes about in spite of increased soil erosion, not because of it. Furthermore, it is not clear that smaller farms are automatically more conserving of soil. Indeed, it would seem that for a farmer to practice extensive crop rotation, fallowing, maintenance of woodlands and swamps, and the raising of livestock along with crops, he/she would have to be maintaining a very large operation. No matter what techniques are used, farming involves high fixed costs, which make very small farms inefficient (Suits, pp. 16-17). Good stewardship requires that we not waste resources by maintaining farms that are too small.

I suppose that it could be true that extensive soil erosion occurs simply because farmers are unaware of the problems it causes, or of methods of dealing with it, or simply out of long-bred habit. Economists, however usually assume that people have reasons for their actions. To assume otherwise, that a whole class of people are ignorant or stupid, is patronizing at best, and not really consistent with the Christian view of mankind as bearing the image of God. Rather than impugning farmers' motives or intelligence, I believe we must try to understand the economic context in which farmers decide how much soil erosion to tolerate. It seems to me that there are a number of valid, systemic reasons for the decisions farmers make in this area.

Deciding How Much Soil Erosion to Tolerate

(1) On many farms, the quality of the soil is so good that quite a lot of erosion can take place before there is any significant adverse effect on productivity. Under this condition, it would make sense for the farmer not to undertake any erosion-preventing investments until the productivity loss from additional erosion exceeds the cost in lost productivity of preventing it. (On the increased cost of organic approach to the problem, see Oelhaf pp. 228-231.) The rate at which erosion is permitted will depend on the rate of time discount, with higher interest rates meaning faster erosion (Crosson and Frederick, p. 189). It should be noted that in this case, soil erosion is a disequilibrium situation, which would not be expected to continue indefinitely, even if economic conditions remain unchanged. The spread of conservation tillage in the 1970's (Crosson and Frederick, p. 187) and the increasing interest in all kinds of soil conservation techniques (Tucker) indicate that many American farms are for the first time reaching the point where conservation of soil pays off. As late as the middle 1960's, land prices tended not to reflect the condition of the soil (Held and Clawson, p. 265), which also supports this hypothesis.

On this view, erosion could be held to be occurring too fast for two reasons: Market interest rates that are higher than the proper social rate of time discount, and the contribution of soil erosion to air and water pollution.

It is well known that there are both biblical and general ethical reasons for thinking that market interest rates are too high to properly reflect the value of goods in the future (Tiemstra 1977, p. 101). A correct assessment of the value of maintaining God's creation and of the well-being of future generations argues for lower discount rates and hence a slower rate of soil erosion now. In this respect Freudenberger's warnings about sustainability of food production (pp. 136-138) seem apt.

The costs of air and water pollution from soil erosion are external costs, not borne by the farmer, but by society at large. They are therefore not taken into account by most farmers in their decisions about how much erosion to permit. (Crosson and Frederick p. 182). Farmers should be more sensitive to these considerations. The existence of this pollution problem also argues for some form of intervention by government to encourage soil conservation (This was one of the arguments for the founding of the USDA's Soil Conservation Service during the Dust Bowl era, Held and Clawson, Ch. 3).

(2) As any farmer will tell you, crop prices tend to fluctuate a great deal. This tends to exacerbate the erosion problem. When crop prices are high relative to their trend (as they were, for example, in 1973-74), the tendency is for farmers to maximize production in the short term, often at the cost of mining the soil. (Crosson and Frederick, p. 190). This is done in the belief that output in the future will bring lower relative prices than in the present, so there is not much sense in sacrificing output now for output tomorrow. This hypothesis also predicts that erosion is a disequilibrium phenomenon, with the amount of erosion rising and falling with food prices. Interest rates also matter here, since the more future revenues are discounted by the farmer, the less attractive conservation as a strategy appears to be.

There are two factors that may turn this cyclical tendency into a permanent problem. First, the uncertainty about future food prices may cause farmers to discount future revenues even more heavily than market interest rates would indicate, causing an even greater emphasis on present production at the expense of the future. Second, decisions about farming technology, made when cash is available for investment, may not be reversible quickly when crop prices fall. Farm machinery and improvements tend to be long-lived, so that once the technology is decided upon, the farmer may be stuck with it for a matter of decades (agricultural economists call this phenomenon "asset fixity" (Held and Clawson, p. 263)).

If crop price fluctuations are a major cause of soil loss, it would make sense to argue for an increased effort by government, perhaps in the context of international agreements, to try to stabilize prices of farm commodities. This sort of suggestion is a part of the calls from evangelicals and others for a New International Economic Order (Tiemstra 1979, p. 5), but its relationship to soil conservation is usually not recognized.

(3) Input choices and decisions about technology are made mostly on the basis of present and predicted input prices, in farming as

in most other industries. Prior to the middle 1970's, prices on non-land inputs into farming (chemical and machinery) were falling relative to the price of land. (Remember, land prices reflected only the area available, not fertility.) Desiring to minimize costs, as any responsible businessman would, farmers used more non-land inputs, and farmed the land more intensively (Crosson and Frederick, pp. 136-155). The use of these "land-conserving" technologies economized on the use of land area per unit of current output, but at the expense of future soil fertility. Asset fixity embedded these decisions in the system for many years to come, long after it was clear that these input choices were inappropriate.

But to say that farmers were reacting to market prices is not enough—we must ask why the market seemed to give the wrong signals. It is easy enough to understand why land increases in price; as Will Rogers is supposed to have said, "They ain't making it no more." However, prices for chemical inputs most likely were too low and rising too slowly for farmers to appreciate the long-term scarcity of the natural resources, especially petroleum from which the chemicals are made. Conventional agriculture is not sustainable in part because its chemical resource base rests on exhaustible minerals, but the prices of these inputs have led farmers, and most of the rest of us, to take a short-sighted view of this problem. What farmers have done in their use of petroleum-based chemicals is exactly analogous to what businessmen, homeowners, churches, and colleges have been doing for years when they built inexpensive, but very energy-wasting, facilities and buildings. The increased interest among farmers in soil-conserving technologies is no doubt due in part to the increased prices of oil and natural gas since 1973. The government's energy policies, if they are wisely designed and administered, may have a significant beneficial impact on the soil erosion problem. Unfortunately, the tendency is to exempt agriculture from energy-conserving programs.

Output prices also have a bearing on this thesis. Throughout the fifties and sixties, farmers became accustomed to low prices and surpluses of commodities. The long-term trend toward increased world-wide demand for food and higher prices, and the need for growing future production, may only have impressed itself on them in the last few years. Christians who write about world hunger have in mind a world in which the hungry are fed, which would increase demand and prices even more, if it were brought about. (Tiemstra, 1979, p. 5). Most farmers probably figure that poor people will not have a better situation in the foreseeable future.

(4) Land tenure obviously has an impact on decisions about soil conservation (Held and Clawson, p. 276-282). If a farmer rents land, rather than owning it, he has less interest in preserving its future fertility, and hence is more likely to mine the soil (that is, if the landlord lets him). Some Christian commentators assume that this same incentive structure is true of corporate farms, as well (Bossi, p. 96). That is probably not true. A corporate manager is judged on how well he preserves, enhances, and utilizes the corporation's assets. A manager who wastes them will be out of a job before very long. It is good, as many Christians assert, for farmers to own their own land, but a good deal of the criticism of corporate farming is misplaced.

(5) Government agricultural policy is burdened with multiple objectives, and it sometimes happens that the government's professed interest in soil conservation is undermined by policies directed at other goals. (Held and Clawson, p. 284). Acreage allotments for particular crops and land set-aside programs are designed to reduce total production and increase prices. Sometimes it is also claimed that, by increasing fallow, they also promote soil conservation. However, the response of farmers to being forced or bribed to reduce the land they have under cultivation is often to try to maximize output on their remaining land. The best land is cultivated year after year, and the worst always set aside. Intensity of cultivation increases, with the resulting increase in erosion. The government would be much better advised to concentrate on other types of policy for maintaining a high level of farm prices. Unfortunately, more direct methods for supporting prices often attract a lot of opposition from consumer-oriented political groups and politicians.

(6) Technological progress in agriculture, as in all fields, comes about because business and government undertake research and development. It makes a difference who does the R&D, however. Almost all farms are too small to undertake their own research program, so the R&D for the industry is carried out by the suppliers of chemicals and machinery, and by the USDA (Oelhaf p. 7). (Universities do quite a bit of the actual work, but they are usually funded by suppliers or USDA.) Now if you make your money by selling chemicals or machines, the temptation is for you to push farm technology in the direction of more chemicals and more machines. It is hard (though not impossible—see Tucker) to make a living telling farmers how to farm in a self-sufficient manner. To be a bit more charitable, it may not always be just profits that motivate researchers to move in this way. If you have been trained as a chemical engineer, your temptation is to try to solve every problem you come up against by inventing a chemical to deal with it, even if you have no financial stake in the outcome. The only way to counteract this tendency is for the USDA, which presumably has an interest in the long-term viability of American agriculture, to be more creative about how it spends its R&D budget, rather than just following the lead of the chemical and machinery suppliers, as it apparently has done in the past (Oelhaf, p. 231).

(7) Urbanization certainly plays a role in soil erosion. If a farmer anticipates that some time in the not too distant future his land will be converted to another use, such as housing or transportation, there is not much point in spending money or foregoing yield in order to maintain soil fertility. Fertility is not a factor in the price of land for non-farm use. In the fifties and sixties, the national trend was in the direction of urban sprawl, and unfortunately much of the best agricultural land lay in the way. Cities were established where the people were, and in the nineteenth century, the people were where the best land was. Economic trends in the seventies have slowed urban sprawl considerably. Increasing transportation and energy costs and slower population growth have lead to a declining demand for additional urban land. Nevertheless, many state governments are moving toward more comprehensive land-use planning, partly for the sake of preserving farms. This trend has been endorsed by some Christian commentators (see e.g. De Witt, Schaddelee), and deserves our continued interest and support.

In summary, we have found that many Christians who are concerned about world hunger have identified soil erosion as a major obstacle to solving the world food problem over the long run. For the most part, their recommendations have focussed on changing the behavior of farmers. While it is certainly appropriate to draw attention to the problems connected with conventional American farming practice, farmers can hardly be faulted for trying to produce food at the minimum possible economic cost, and for trying to provide a decent living for their families. Indeed, it may be counterproductive to accuse farmers of willfully destroying the economic base of their own industry. We have identified a number of areas in which public policy could make a more positive contribution to the long-run health of American agriculture. It is important that much more research be done to identify empirically which of these areas offer the greatest opportunities to reduce soil erosion. It is also very important for Christians to be involved in working constructively to bring about these policy changes.

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The Modern Technocratic Society: The Church's Response

The role of technology in modern society has been a topic of increasing importance during the last two decades. In the 1960's the American commitment to putting a man on the moon dominated our nation's imagination. The protests of the counterculture in the late sixties and early seventies are viewed by many as a rebellion against the mechanization of man and society. More recently the dangers of nuclear technology have become matters of everyday discussion. As America began a new decade, doubts surfaced that questioned whether the price of technological development has been too high. People are beginning to wonder who is really in control—man or his machines.

Criticism of technology and its application is rife. It is pictured as threatening to take over society *a la* the computer Hal in *Space Odessey: 2001* or as contributing to the belief that man is only a highly complex machine that science has yet to fully understand. Theodore Roszak in *The Making of a Counter Culture* describes the subtle and often negative influence technical-managerial experts (technocrats) have in our society and the dangers that exist as society defers decision-making to their totalitarian mindset. Jacques Ellus in *The Technological Society* and other works also attempts to describe the mole-like growth of what he calls *technique*, and its increasing influence on man and society. Many see a bleak picture. Society appears drifting towards some sort of irresistible technical revolution that will remake man; even more depressing is the belief modern man is already caught up in Orwellian events he cannot escape.

The impact of technology on our life is dramatically evident in the controversy over atomic energy. Nuclear power is used as an example of technology out of control. It is an inherently evil technology in the eyes of many. Recently several Western scientists involved in atomic energy development in the 1930's and 1940's have questioned whether they should have participated in atomic research after seeing its later destructive military applications. However, they have failed to seriously consider what today's world would be like if Hitler's scientists had possessed a total monopoly on nuclear knowledge. His concern was entirely military. Western stewardship of atomic energy is not above criticism (in fact it leaves much to be desired and may be the best example of technocratic management), but it must be recognized that in democratic states influenced by Judaeo-Christian ethics, technological research can be studied and applied in societies that have better political and moral safeguards against misuse.

Any technology or scientific research will ultimately have a possible military application or a tendency for abuse, if not in the generation it was invented, perhaps in a later one. To prevent the abuse of technology all scientific research would cease. The social and moral consequences of such a step would be disastrous for society and unacceptable to the sick, to the lazy and the comfortable. If there is a societal need, and even often when there is no apparent one, a technology, including nuclear power, is developed. Unless there is a world government to control research and application a scientist or engineer somewhere will be curious enough to study some aspect of the unknown. Moreover, to stop all technical research hinders positive contributions in the form of future technical spin-offs. Knowledge builds on knowledge. A technology that can bring a Hiroshima can also bring hope to a cancer patient. This dilemma presents society with a decision, one that has moral consequences.

Decisions are made on the basis of values. Values, therefore, are fundamental to the development and use of technical information. If there is a problem with technology, it results from the value system in which it is applied. To spend time and money on the development of the electric hairdrier instead of nutritutional research indicates a social choice based on certain values about life. To focus on atomic energy development instead of solar energy reflects a scientific judgment based on certain values and conditions created by those values.

In the television series, *The Ascent of Man*, Josef Bronowski made an interesting comparison of the modern industrial era with the state of agricultural technology in 5000 B.C. He points out that machines seem to be threats to modern society. Yet seven thousand years ago as man moved from a nomadic to an agricultural existence, a similar danger was menacing society. It was the danger inherent in domesticating an animal that could lessen the drudgery of farm life, the horse. Initially the domestication of the horse threatened the supply of grain in society. While it enabled the farmer to cultivate more land, the horse consumed so much more food than other domesticated creatures that it threatened to bring starvation by eating the farmers' own grain. Later the horse was used for military purposes by nomads who wanted to raid the grain supplies of their settled neighbors. Ancient man could use the horse for good or evil purposes. He also had to face danger inherent in mastering equine technology. Today we might see this challenge as a minor problem in the history of society, especially when faced with the dangers of the atom, but for ancient man it

was a serious problem with life and death choices.

As Christians we are not insulated from the impact and challenges of technology on our life even in our strictly religious pursuits. It creeps into our vocabulary as the "electronic" church. We are dependent on the automobile for church worship and fellowship. And of course in our society Christians are not isolated from the effects of a Three Mile Island incident or a credit computer memory system. Also important to Christians are the questions related to their stewardship of technological innovation and the proper response of Christians to the new society in which they are to be "salt."

Many Christians have become alarmed at some of the technological trends they see. In a recent book, *Christ and The Media*, Malcolm Muggeridge argues that television is an innately evil technological device because by its very nature it alters reality without appearing to do so. He chooses to see some inventions as having an inherently evil character, while others, he implies can contribute to the public good. It appears that for Muggeridge, machines themselves have qualities tending toward good or evil. Among other Christian authors a spate of books on the coming of the Anti-Christ and the end times present vivid pictures predicting how technology will be abused by malevolent forces.

Christian reactions to technology have ranged from those who willingly accept any new technology from atomic energy to television to those who would move "back to the farm" to avoid the evils of modern technical society. Some in the evangelical community share a wish to lash out at technology as the great evil of our age. Other Christians have adopted a fatalistic resignation, choosing to believe that we are doomed to be controlled by technocrats unless Christ returns. These attitudes ignore the reality that we live in a technical age and have to live out our faith in an environment that may require difficult and unusual adjustments. Since the time of Christ, the church and Christians have had to adapt to the forces and challenges of diverse cultures and technical changes. It should not be too much to expect that as the church faces the 1980's it can also be a vital force in a technocratic society.

In the late seventeenth and early eighteenth centuries in England during the First Industrial Revolution, the church successfully faced the challenge of technology. Amidst the problems and social disruption caused by new technologies, there existed a ministering church—meeting workers' spiritual and social needs; a reforming church—taking biblical stands on moral issues affecting the application of technology to society (e.g. child labor laws); and finally a renewing church—willing to let the Holy Spirit work revival and give direction in responding to society's needs.

Obviously with the computer age the ramifications of social manipulation and dehumanization by technology are greater. But is this the fault of technology? After all machines have a maker and designer. If man cannot harness his invention, he will find himself in the predicament of the sorcerer's apprentice who had a power, which unleashed effects he could not control when he used it. To blame machines for man's technological dilemma is analgous to blaming God for man's spiritual dilemma.

If there is a problem with technology it is how man uses and controls it. How man uses and controls it rests largely on his worldview. If his worldview stresses force, his technology will be applied to help mankind. If there is a problem with technology, it is because there is a problem with man. And the problem with man goes back to the Fall.

Too often it is easy to blame engineers and scientists and their inventions for our manipulative technical society when we should be looking to those who apply technical innovation in society—in other words the politicians, teachers, journalists, businessmen, filmmakers, and those engineers and scientists who are directly involved in implementing their creations in society. Many of these are the so-called humanists or humanistically trained in our society, people who supposedly know something of higher ethical and social values.

For the most part engineers and scientists have been content to discover and theorize, invent and build. It has been the modern humanist who has been envaluing technology to reconstruct society according to his hope for mankind. Society has accepted the humanists' affirmation that he has man's best interests at heart and has believed his proclaimed aim of fighting man's depersonalization. Humanists have pictured themselves as the last hope society has to prevent a technological Armaggedon. They have gladly accepted the engineer's lack of concern for societal applications of technology and have taken charge of making society better through machines, believing they can see the long-range implications of technology better than engineers and scientists. They have tried to tame or humanize the "machine." However, the problem modern humanists have, and one Francis Schaeffer documents, is that they have built their worldview on false presuppositions of the role of God and nature of man, and are compounding the problems technology is presenting. It is the one who uses and applies technology to society who gives the machine a personality or character.

Thus, for example, the problem Muggeridge sees with television is not so much the problem with technology as the problem of who controls the technology or who creates the value system within which the technology is used. It is at this point the modern church is at its weakest. Unfortunately the church has not presented a viable Christian humanist alternative for technocratic society. Christian humanism must assert the importance and value of man within God's creation without sacrificing the realities of man's fallen condition; it must show modern man how to control and find meaning and liberation in a technocratic society; it must forcefully proclaim man's uniqueness over the mere mechanical. Secular society has only a dim witness of a viable Christian humanistic alternative. The result is the rise of a general hopelessness about the meaning of life in a seemingly controlled society and for Christians a feeling of resignation to events that they believe they cannot influence. Technological manipulation represents the failure of Christian humane values to influence society.

The church, instead of trying to apply humanistic Christian principles for using technology, has attempted to Christianize secular technological applications. For example, in Muggeridge's critique of television he criticizes the message and content of that technical medium. This is not the fault of those men involved in the invention of television; it represents a failure in our Judaeo-Christian standards to hold and guide society and perhaps a failure of those Christian journalists or artists to know how to present, uphold, or articulate their alternatives in a pluralistic society. They have allowed God's intended image of man to be distorted by the mechanical interpretations of television technicians who see no value in man because they have no image of God.

While television, including Christian television, has failed to fully understand both the manipulative and humane implications of the mechanical, Christians in other professions have not been able to present a Christian humanistic perspective of life or technology in their respective fields either. As a result, the mechanization of man and the obscuring of his divine purpose has continued, resulting in depersonalization, manipulation, and moral turpitude. Unfortunately, far too many Christians have glorified the practical results of technology without examining its moral and spiritual effects.

The church needs to present Christian humane values in our technocratic society; it must show modern man an alternative to a mechanical determinism and do it without sacrificing biblical truth. It has to consider its response to the following questions.

—*How should the church respond theologically to a technological society?* Christianity can offer a realistic hope for man in a technocratic society, because it can reconcile the fallenness of man with the victory over sin man can have in a risen Christ. In Christianity we have a transcendent Being capable of giving objective guidance from outside the technocratic system.

—*What role should technology play in evangelism?* The church is responsible for a witness to modern man that cannot be manipulated by the mechanical into a distorted Gospel. It must intelligently evaluate the technology it is using to be sure the truth is accurately portrayed and that man's personhood is not being exploited.

—*What can Christians do to influence technological application?* The church must be willing to grapple with the intellectual changes of our society as it faces the ethical, social, and even technical implications of futurist technology. Too often Christians find themselves reacting to technical change instead of influencing or directing it. Christian scholars, engineers, and scientists must take the lead in evaluating change to make sure a biblical alternative is heard. If technocratic thinking is to be challenged, it should start at the policy formulation level, and this requires hard and capable thinking on the part of Christians in those areas.

—*How can the church best protect the human worth?* The church today must formulate a Christian humanism that speaks to man's need for a sense of who he is without deifying the human. There is an alternative to the mechanization of man—the Christian humanization of man. Only through Christ can man develop his full spiritual and life potential. Man is something, an image of God, who is dependent on God for his human purpose.

—*Can Christianity renew a technological society?* There must be a concern for what we could call the redemption of technology. Technologies that are being misused must be identified and envalued according to biblical standards. A technocratic society can experience God's reviving Spirit just as any other culture can.

The challenge is for Christians to begin making a mark on our technocratic society by applying and forcefully advocating a Christian value system that is integrated into the various disciplines coming under the growing influence of technocratic thinking. This can be accomplished only through clear and innovative thinking, effective scholarship, and rational criticism—all founded on God's Word, not based on some feeling or cultural bias. We must face up to the technological challenges and innovations with a faith focused on man's uniqueness in God's creation. A viable Christian humanistic perspective is needed to show the importance of man in relation to the machine. Only it can protect the true value of man, because it has the true perspective of God's purpose for His creation.

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A Dream Come Untrue: The Amazing Story of Kilton Stewart's Amazing Story

Since 1950 two new aspects of sleeping dreams have commanded immense amounts of attention. In 1951 Kilton Stewart first published his now famous article "Dream Theory in Malaya," and in 1952 laboratory workers began their study of sleep stages and the physiology of dreaming. When Stewart became aware of the laboratory results, he claimed that it dovetailed with his own discoveries in Malaya. Few people were aware of these events in the early 1950's, but twenty years later they had revolutionized the subject of dreams.

Stewart's article announced that the Senoi tribe of Malaya has been free of violent crime, armed conflict, stress from culture change, and most chronic mental and physical ailments for probably two or three centuries. These people have almost unearthly psychological integration and emotional maturity because of the way they work with their dreams. Stewart says they are as advanced psychologically as we are in physics and technology.

The story of this new Garden of Eden and its noble savages spread quickly, once it appeared in psychology professor Charles T. Tart's anthology *Altered States of Consciousness* in 1969. Stanley Krippner recounted the story in *Psychology Today* in 1970. In 1972 the story was retold in at least five widely circulated books: *Where The Wasteland Ends* by Theodore Roszak, *The Psychology of Consciousness* by Robert Ornstein, *Dream Power* by Ann Faraday, *Psychology For You* by Sol Gordon, and *In Search Of The Dream People* by Richard Noone and Dennis Holman. Since this 1972 boom the Senoi phenomenon has been mentioned in almost all books and articles that consider the meaning of dreams.

In 1973 Marilyn Ferguson's fascinating book *The Brain Revolution* claimed erroneously that Kilton Stewart had studied the Senoi for fifteen years. She remarked whimsically, "The Senoi have become the objects of such intense interest on the part of anthropologists and psychologists that one wonders if they still have time to dream." She and everyone else assumed that the world of research had been beating a path to Senoi villages. Ferguson reported that several colleges offer courses in Senoi-type dream therapy, that a group of American students lived a year and a half in a Senoi-style communal society, and that some psychologists use Senoi techniques in group therapy.

In 1974 psychology professor Patricia Garfield published *Creative Dreaming* and made the Senoi story especially vivid with her detailed descriptions of their idyllic life in the jungle and her simple explanation of how to use their dream techniques to enhance and enrich life in our socity. The key to Senoi dream theory is to learn to turn all dreams to good account while dreaming. Thinking about this and intending to do it helps it to happen. This is the heart of Senoi education. By discussing the family's dreams at breakfast every morning, the father or older brother teaches the children to recall and value their dreams and to expect to work wonders in their dreams. (None of the Senoi popularizers have mentioned that according to Kilton Stewart the dreams of females are relatively unimportant to the Senoi.)

All enemies in dreams, including uncooperative characters, are seen as potential friends who will bestow worthwhile creative ideas upon the dreamer (either artistic or practical) when the dreamer fearlessly subdues them—fighting to the death or calling helpers when necessary. Dangers such as falling are purposely turned into pleasures such as landing in lovely places or flying. All dreams without enemies, whether neutral or pleasant, are expected to pro-

duce gifts or intense pleasure. Orgasm with dream lovers is encouraged, no matter who they are.

There is carry-over into waking life aside from perpetual sharing of dream gift ideas with the community. If an acquaintance is unhelpful in a dream he is told about it and makes a real gift of some kind to the dreamer. If the dreamer has been unkind in a dream, he makes a real gift to the injured party in real life. If the dreamer sees an acquaintance injured in a dream, he warns him of the danger in real life. The Senoi acquire kindly "spirit guides" in their dreams who tell them more about spirit religion, and they incorporate these ideas into their waking religious beliefs. (Contrary to what Kilton Stewart learned in Malaya, those who write and teach about the Senoi culture often claim that the Senoi do not believe in the reality of a spirit world and recognize these entities as their own projections.)

After breakfast, the village males gather for lengthy discussion of all the village dreams of the night before. This is how they are guided. The resulting society is intensely democratic, cooperative, and resilient; it is safely immune to detrimental cultural influences from the outside world. It sounds like an earthly paradise for males, if not quite that good for females. Malaya has become to many dream enthusiasts what Hunza-land is to many health food enthusiasts.

The story is still being retold authoritatively. In 1976 it was included in *Dreams, Culture, And The Individual* by anthropologist Carl O'Nell. At the end of 1978 it reappeared in *Psychology Today* as told by sleep researcher Rosalind Dymond Cartwright. In her version Kilton Stewart was an anthropologist who visited the Senoi in the 1950s rather than a psychologist who visited them in the 1930s. Whether he is credited with being an anthropologist or a psychologist, Kilton Stewart's very name seems to command unquestioning respect.

Who in the World was this Famous Kilton Stewart?

Stewart was born to a devout Mormon family in Salt Lake City, Utah, in 1903. After graduation from high school, he served as a Mormon missionary in Quebec and Nova Scotia for three years, exhorting everyone he met to discover in personal dreams and visions the truth of Mormon teachings. When he learned that this unusual approach to potential converts was not acceptable in the Mormon church, he left it. As an ex-Mormon he discarded their doctrines about smoking, drinking and sex; he also lost his belief in any afterlife. He came to think of "God" as a natural force center within each man and no more.

Stewart was a warm, outgoing man with a truly extraordinary personality and adventuresome spirit. He never wrote about brain hemispheres, but he wrote ardently against our society's emphasis upon what we now know to be left hemisphere skills and wrote ardently in praise of what we now recognize to be right hemisphere functions. He obtained a masters degree in psychology from the University of Utah and then obtained and lost two research grants. He was a maverick all his life.

Stewart's only book, *Pygmies and Dream Giants*, first published in 1954 and obviously written in a style far superior to Stewart's own prose, tells his life story up to his adventures in the Philippines in 1933 and no farther. To learn a little about his visit to Malaya in his own words one must read the thesis that he completed in 1947, which says that the visit took place in the spring of 1934, although the correct date seems to be 1935. The thesis is hard to obtain because it is the property of Clara Stewart Flagg, Stewart's widow, who keeps it from public scrutiny, perhaps because of its confusion and lack of polish. Mrs. Flagg makes a career of dream interpretation seminars and in her brochures refers to the Senoi of Malaysia as pygmies, although they were in no sense pygmies. She may be purposely relating the Senoi of Malaysia to the Philippino pygmies of Stewart's book to pique public interest, but there is no relationship.

In fact Stewart's knowledge of the Senoi (really the Temiar branch of the Senoi exclusively) came entirely through the eccentric young British anthropologist H. D. "Pat" Noone, who was making a name for himself by studying them. Noone, who had gained publicity from such reports as his alleged ability to communicate with elephants in their language, accepted Stewart as a visitor for a maximum of six months in 1935 and 1936; during that time Stewart did not learn the language of the Senoi and depended upon Noone's accounts. Later, in 1939, the two men met in England to make use of Noone's notes about the tribe for a couple of months. In his thesis in 1947 Stewart gave credit to Noone for thus providing him with most of his data about the Senoi.

According to Richard Noone's book about his brother's career, *In Search Of The Dream People*, and Kilton Stewart's thesis, in May of 1939 Noone made a sensational presentation of his research to a gathering of distinguished scientific scholars in Cambridge. In Stewart's much later essay "You Can Raise Your Dream IQ" he claims to have made the presentation with Noone. When a professor asked Noone how he knew that the Temiar dream accounts were accurate, he replied that he sometimes listened to them talk in their sleep. Noone and Stewart told the assembly that while traveling through the jungle together they frequently listened to Temiar talking in their sleep, confirming the dream accounts of the next morning. This claim alone, in print from both Richard Noone and Kilton Stewart, should have aroused instant suspicions about the validity of the Noone/Stewart research.

In his thesis Stewart added that what he and Noone actually heard was older shamans singing songs given to them by spirits in their sleep. This detail is important because readers of the available literature have thought that Noone and Stewart listened to ordinary Temiar narrating ordinary dreams in their sleep. Of the many questions that are raised by this "proof," one of the most obvious is whether or not the Temiar speak (or sing) in their sleep more frequently and clearly than other people. If so, why have we not been told that extraordinary fact? How could an aspiring anthropologist or an ambitious student of dream psychology, both longing to make major discoveries, fail to note this major discovery and only mention it in passing? One likely answer is that it was only a couple of older shamans who were heard singing at night what they sang the next day. If that is the case, Stewart had to take Noone's word for the fact that these shamans' songs were not ever known before they sang them aloud in their sleep, just as Stewart had to take Noone's word for what was being said and done all the time because Stewart did not know the language. This also raises the question of how Noone and Stewart could determine that the shamans were actually asleep rather than engaging in some of their frequent trance states or purposely pretending to be asleep to deceive or oblige their curious visitors.

Another aspect of this tale is far more important. If the story of Temiar dream-talk is true, it will radically change our present understanding of the universal dream pattern. When people talk in their sleep, they are usually in the deepest level of dreaming, from which dreams are not likely to be recalled. When people recall their dream content, it is usually from the much lighter levels of dreaming, especially the morning REM periods. Stewart claimed in his essay "How To Raise Your Dream IQ," apparently written around 1960, that the discovery of REM dream periods supported his Senoi observations because the timing of the sleep-singing that he listened to coincided exactly with what we now know to be the

REM periods. If, in fact, the Temiar often talked or sang in their REM dreams (or if they often recalled their deep-sleep dreams in detail) this is amazing information which sleep researchers need to work with. It is the opposite of what research has revealed so far about sleeptalking.

Unless Temiar talk clearly in REM periods or recall deep sleep dreams, both options being extremely unlikely, Noone's claim to have monitored their dream life is impossible. If, when asked how he knew that the morning dream accounts were true, Noone had expressed personal confidence in the trustworthiness of the dreamers rather than claiming to have found empirical proof, there would not be such a serious question about the integrity of this scholarship today.

Whatever the truth was about verification of Temiar dream accounts, the sad truth is that Pat Noone returned to Malaya in 1939, and Malaya fell to the Japanese in 1941. Pat Noone joined the Communist guerillas in the jungle and helped them to make use of the Temiar and other primitive tribes. In 1943 Noone became disillusioned with the Communists and left them, planning to live with tribal friends until after the war. But after the war Pat Noone could not be found. He seemed to have disappeared without a trace.

After the war Richard Noone went to Malaya. The Temiar and others were still aiding Communist terrorists, who were now attacking the rightful government. In 1953 Noone took over the Department of Aborigines and in four years he had won almost all of the aborigines away from the Communists with a welfare program. He says he used the Senoi as armed, uniformed forces to eliminate the Communists.

Next, Richard Noone investigated the mystery of his brother's death. He eventually learned that Pat Noone had been savagely murdered by his best friend among the Temiar. The Temiar people had lied to Richard Noone about his brother's disappearance for ten years to protect the killers because in their society killers who flee the area should not be pursued and punished. In that society killers who do not go into self-imposed exile are soon secretly murdered in turn. As "Dream Theory in Malaya" observes, the Senoi have no need for jails.

There is a fair amount of contradiction between Kilton Stewart's idyllic account of "Senoi" life and Richard Noone's swashbuckling account of his family's involvement with the Temiar. Both accounts were written after World War II and both were worked on by co-authors who may not have ever been to Malaysia. Noone's account mentions some of the hard facts of ordinary human life existing among the Temiar long before the war: a modicum of mental illness, feuding, desertion, divorce, rebellion, adultery, fear of evil spirits, and murder—along with a high mortality rate. Stewart's Garden of Eden seems to have been full of snakes.

Finally two Senoi enthusiasts reportedly went to Malaysia to make a documentary about the Senoi dream culture and learned when they got there that there is no such thing. The Senoi told the film makers that only the dreams of shamans have any significance. Richard Benjamin, Cambridge's authority on the Senoi, confirmed the fact that today's Senoi haven't even the memory of a dream-centered culture. Benjamin and some of his colleagues suggest that Stewart's enthusiasm about daily dream polls may have been the direct cause of any dream reporting that took place while he visited the Senoi. If so, Noone may have intentionally misled Stewart to whet his enthusiasm.

Some people believe that Stewart's account was factual in 1935 although it could not have been factual when he wrote it in 1950, much less when it became popular in 1969. Others do not think that the most basic part of this culture could have disappeared without a trace in the span of only forty years, even in the wake of a major war. There are some who think that Stewart's famous article, which begins with a brief fantasy about a spaceship visiting Malaya a century ago to bring the Senoi their dream techniques, was all meant to be an inspirational fiction in the first place. But that seems unlikely to those who read Stewart's thesis, which purports to be dependable research about the Senoi.

Perhaps someone will eventually provide a detailed, dependable account of the actual pre-World War II culture of the Temiar. Better yet, perhaps someone will eventually provide a thorough and accurate account of the unusual lives and characters of both H.D. Noone and Kilton Stewart. Better yet, perhaps someday we will have a sound evaluation of the merits of the dream therapy techniques that Stewart has given us, whatever their source. And, best of all, perhaps some expert will eventually tell us how it was that a variety of experts have repeated and elaborated upon a far-fetched, totally unsubstantiated story for ten years without even checking out the facts. That gives us a lot to look forward to.

If you liked the Piltdown man, you'll love dream theory in Malaya.

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The Human Explorer—A Tri-level Communication Model

What is the true nature of personal existence? Is not a key component of personal existence at its best a continual exploration of one's environment, such exploration taking place in the context of communication with other human beings and with physical reality? A person is thus seen as an explorer, whatever the subject area may be (philosophy, science, art, and religion being particular areas of investigation) who proceeds on his or her quest by means of communication processes. The essence of a person's activity as a communicator is captured in a three-leveled model of human nature illustrated in Figure 1, the outer level being the human body and the inner two levels the essential structure of mental activity.

Human Mind

At this point it should be stressed that modern understanding of human evolution of man as a physico-chemical system does not undercut the appropriateness of the category *mind* as a unique level of reality needed to completely describe man. The human body, in particular the central nervous system and brain, serves as the *necessary embodiment* of the mind; when one reaches the level of material complexity of a human brain new properties and activities of matter emerge which cannot be subsumed or described in terms of languages and concepts appropriate to lower levels of material complexity. This is what *emerge* means in a evolutionary context. At a lower level of complexity the wetness of water as a new property appears when hydrogen and oxygen atoms combine to form the higher level of complexity, water; wetness is a new property not characteristic of the component parts, hydrogen and oxygen atoms.

In the same manner the emergent quality of mind appears. This quality is less obvious than that of "wetness of water from hydrogen and oxygen, or of the first living cell from its constituent macromolecules, because in this instance, and this one alone, in man we are reflecting on that emergent quality which makes reflection on anything possible at all."[1] These uniquely human activities of the brain may be properly termed mental; they are reflected in man's self-conscious behavior, in his use of the word "I" of himself in ways which are, in many ways, semantically peculiar, and in his ability to transcend his own environment. Pascal pointed out that "All bodies, the firmaments, the stars, the earth and its kingdoms, are not equal to the lowest mind, for the mind knows all these and itself; and these bodies nothing."[2] This assertion of the reality of conscious and self-conscious activities is not dependent on any particular philosophy of the relation of the entity called "mind" to one called "body". There are human activities and experiences that take place that may be labelled mental activity and what is referred to is uniquely and characteristically human.

"These include, *inter alia*, the activities referred to when we say men are capable of rational action, of making moral choices, of choosing between beliefs, of forming personal affections; that men are 'persons' in the sense that each is a bearer of rights, is unique and is someone with whom we can imagine ourselves changing places; that men explore the environment and formulate concepts to organize what they find; they are creative and worship and pray; and they have consciously to come to terms with the anticipation of their own individual death."[3]

As Figure 1 shows, the outer level of the human explorer may be seen as the person's body with all one's sensory receptors and effectors by which one encounters reality. The body interacts with its environment by means of three basic communication processes: observation, experiment, and personal encounter, as defined in Figure 1. To understand the meaning of the body's activity one

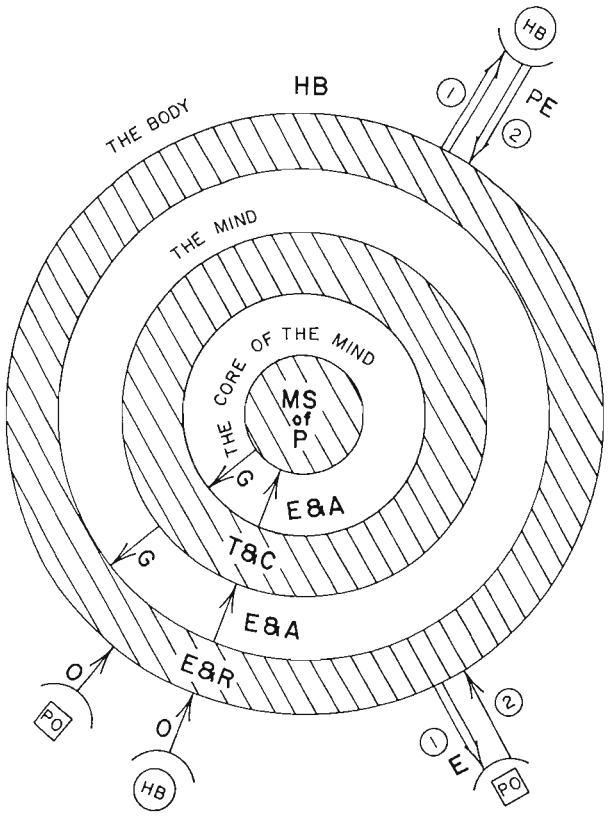

Figure 1. A Tri-level Model of the Human Explorer

Nomenclature:

HB—A human being whose exploratory activity can be described in terms of a three-level structure. *E & R*—Effectors and receptors of the body—the level of human physical existence. *T & C*—Theories and conjectures about all reality formulated in the mind—the level of conjectural thought. *MS of P*—Metasystem of basic human presuppositions forming the core of all mental structures: the level of inspiration and revelation. *PO*—Physical object (including the physical aspects of a human being). *O*—Observation; a simple, one-way message from a physical object or another human being. *E*—An Experiment: (1) Messages which assume the form of measuring processes directed by human theories and conjectures at external reality. These messages are designed as "questions" expressed through measuring processes. (2) Responses are specific "answers" (usually quantitative) to the given measurement probes. These responses, guided by one's theories and conjectures about physical reality lead to further measurement probes. The signals (1) and (2) are *not symmetric* in the sense that in principle (1) is structured freely by the mind and (2) is structurally determined by the inherent order of the object under investigation. (2) represents the completion of a feedback loop with respect to the human communicator; such loops are essential to all true communicative acts. *PE*—A Personal Encounter: (1) Message from one person to another consisting of affirmations and questions. (2) Responses from the other person consisting of both affirmations and further questions. These affirmations quided by one's theories and conjectures about the other person lead to further messages. The messages (1) and (2) are *symmetric* in the sense of both intrinsically being structured freely by human minds. (2) represents the completion of a feedback loop with respect to the human communicator; such loops are essential to all true communicative acts. *G*—Guides. *E & A*—Enhances and alters.

must use the language of the mind viewed as organized at two levels. The structure of the outer level of the mind consists of theories and conjectures about reality which guide and shape the exploration of reality by the body. This guidance occurs as follows. Associated with a given mental state are specific physical states of the brain; these physical states direct (as the brain is part of the body) the body's receptors and effectors to be appropriately activated and deactivated. The inner level, the "core" or "heart" of the mind consists of the metasystem of truly basic presuppositions without which all human thought and exploration of reality around us would be impossible. These basic presuppositions guide the mind in choosing between alternate theories and conjectures about all existence. Note that in this tri-level model of the human explorer communication is both "inward" and "outward". The results of exploration at the level of the body can both enhance and alter the theories and conjectures that guide exploration; and, in turn, the resulting success or failure of theories and conjectures can both enhance and alter basic human presuppositions that guide theory formulation.

The Two-Level Structure of Mind

Let us examine the two-level structure of the human mind in more detail. Some would argue that it is unnecessary to invoke the level of theories and conjectures as providing guidance to observations and experiments; such human activity is completely theory-free. This has been refuted in great detail by N.R. Hanson. He points out that:

". . .The infant and layman can see: they are not blind. But they cannot see what the physicist sees; they are blind to what he sees. . . To say that Tycho and Kepler, . . . , DeBroglie and Born, Heisenberg and Bohr all make the same observations, but use them differently is too easy. It does not explain controversy in research science. Were there no sense in which they were different observations they could not be used differently. This may perplex some; that researchers do not appreciate data in the same way is a serious matter. It is important to realize, however, that sorting out differences about data, evidence, observation, may require more than simple gesturing at observable objects. It may require a comprehensive reappraisal of one's subject matter. This may be difficult, but it should not obscure the fact that nothing less than this may do. . .There is a sense, then, in which seeing is a 'theory-laden' undertaking. Observation of X is shaped by prior knowledge of X. Another influence on observations rests in the language or notation used to express what we know, and without which there would be little we could recognize as knowledge. . .But physical science is not just a systematic exposure of the senses to the world; it is also a way of thinking about the world, a way of forming conceptions. The paradigm observer is not the man who sees and reports what all normal observers see and report, but the man who sees in familiar objects what no one else has been before. . ."[4]

What guides us in our formulation of theories and conjectures about the nature of other people and physical phenomena? Theory formulation is enhanced and altered by the results of one's contact with all reality, but it is guided by one's basic convictions about the nature of reality. This framework of ultimate presuppositions, or metasystem of basic convictions, may be looked upon as the center or core level of mental activity. Pascal called it the heart; it directs the formulation of all conjectures about people and things. As the totality of human experience bears in upon us it inspires in us basic convictions about reality that guide all that we do. We hold to these ultimate convictions even when immediate conjectures about reality seem to deny their validity. Often these ultimate convictions come to us by being tacitly shared with us when we are members of a community formed by people holding common interests, i.e. the scientific or religious communities as examples. This inspiration that we receive from encounter with the totality and richness of human experience is responsible for the creation of these basic convictions is us. Such inspiration may be looked upon as God's revelational activity toward mankind through His continual holding all reality in being and through specific actions He has taken in human history as biblically revealed. These basic presuppositions undergird all human though and resulting action; they are held so firmly that we are often unaware of their existence. Such ultimate convictions tacitly guide all our thought processes. To paraphrase Pascal: Faith indeed tells us what the senses and strictly logical thought do not tell, but not the contrary of what they see. It is above them and not contrary to them.

Ultimate Convictions

What are some of a human being's ultimate convictions about other persons and things without which meaningful exploration of reality would be impossible? The following list is by no means exhaustive but indicates some key presuppositions essential to all human communication with reality.

1. *Another self, another mind like mine exists in the other person before me.*

2. *Human dialogue is meaningful and significant.*

3. *Human thought is meaningful and significant.*

4. *Logical thought is valid.*

5. *Reality exists independent of me.*

6. *The structure of reality is ultimately rational in nature.* It embodies regularities and patterns, often mathematically expressed, that can be discovered by the rational inquiry of human beings. Furthermore, the scientist presupposes that there is a transcendental aspect to reality's rationality. As the scientist explores reality it is at a given time only partially disclosed, but it has an indefinite range of rationality that manifests itself in unthought-of ways in the future. Scientists are strongly motivated by the conviction that the inherent rationality of nature is forever open-ended.

7. *Reality is contingent.* Concerning presuppositions 6 and 7 it can be pointed out that:

". . .There is a very close connection *de jure* between the Christian belief in a God who is both rational and free and the empirical method of modern science. A world which is created by the Christian God will be both contingent and orderly. It will embody regularities and patterns, since its maker is rational, but the particular regularities and patterns which it will embody cannot be predicted *a priori*, since He is free; they can only be discovered by examination. The world, as Christian theism conceives it, is thus an ideal field for the application of the scientific method, with its twin techniques of observation and experiment."[5]

8. *Descriptions of nature are inherently simple in terms of structure.* It is always possible to find explanations of physical phenomena that look toward a central point of reference, thereby unifying a wide variety of experience by the use of a minimum number of primary concepts and interrelationships. Einstein, referring to his relativity theory, pointed out that this approach is a key motivating factor of science:

"The theory of relativity arose out of efforts to improve with respect to logical economy, the foundations of physics as it existed at the turn of the century. . .Our experience hitherto justifies us in

believing that nature is the realization of the simplest conceivable mathematical ideas. I am convinced that we can discover by means of purely mathematical constructions the concepts and the laws connecting them with each other, which furnish the key to the understanding of natural phenomena."[6]

9. *To truly communicate with reality, whether other people or things, you must give of yourself in love to the particular task or encounter at hand.* Love seeks always to act toward external reality in a spirit of cooperation, empathy, and respect; to properly control external reality without destruction resulting you must always first seek understanding of nature's inner harmonies and then work with these harmonies rather than against them. This conviction of the importance of love to all exploration is inherent in the striking analogy that exists between Bacon's formulation of the principle of inductive observation, and Jesus' disclosure of the basic paradox of the Christian life. Bacon pointed out that "We cannot command nature except by obeying her." and Jesus said "He that loseth his life for my sake will find it."

10. *Basic explanations of physical phenomena are truly beautiful in an aesthetic sense.* Concerning Einstein's discoveries in physics Yukawa has written:

"He had a sense of beauty which is given to only a few theoretical physicists. . .Simplicity alone may be reached by mere abstraction, while a sense of beauty seems to guide a physicist in the midst of abstract symbols."[7]

What basic convictions do scientists have about the nature of beauty in science? Two criteria for beauty are suggested in a recent article entitled *Beauty and the Quest for Beauty in Science*.

The first is the criterion of Francis Bacon:

"There is no excellent beauty that hath not some strangeness in the proportion!" (Strangeness, in this context, has the meaning "exceptional to a degree that excites wonderment and surprise.")

The second criterion, as formulated by Heisenberg, is complementary to Bacon's:

"Beauty is the proper conformity of the parts to one another and to the whole."

The article then shows at great length how Einstein's general theory of relativity fulfills the two criteria proposed for scientific beauty.[8]

Conclusions

The tri-level model of the human explorer that has been introduced is an attempt to capture the most significant aspects of how human exploration comes about. What has been shown is that the observations, experiments, and personal encounter present in all acts of discovery are not performed in a random or haphazard manner; they are always guided by one's theories or conjectures about external reality. Furthermore, different theories or conjectures about reality are not created through the evaluation of objective data alone but also are formed and molded by a person's deepest convictions about the nature of reality. Personal commitments to the ultimate rationality of all reality, to standards of intellectual and moral integrity, and finally, to criteria of intellectual beauty: all these play a key role in theory formulation. Therefore it is quite possible for two different scientists exploring the same part of reality to collect and evaluate very different sets of data depending on what their guiding theories consider important. The same reality can possess many different levels of explanation, some dependent on others; each level has its own set of categories of explanation and theoretical conjecture. As an example a human being can quite properly be described in terms of concepts appropriate to the level of mental phenomena, the mind, or at the level of physical existence, the body, with mind states being dependent on body states (not necessarily in a one-to-one manner). It is also possible that two different scientists exploring the same part of reality will collect essentially the same data but each will interpret them in a very different way because each is guided by very different theories about the reality being examined.

These different theories have come about because the two scientists have very different ultimate convictions about the structure of reality. On a broader scale the philosopher, the theologian, the scientist, and the artist explore reality by means of equally valid but very different and unique complementary theoretical structures and presuppositions; they each ask very different kinds of questions of reality and receive very different kinds of answers. If a theologian, an artist, and a purely physical scientist observe the same sunset, each will give very different but equally valid complementary descriptions of it.

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[1]A. R. Peacocke, *Science and the Christian Experiment*, Oxford University Press, New York, 1971, p. 142.

[2]Blaise Pascal, *Pensees*, The Modern Library, New York, 1941, p. 278.

[3]A. R. Peacocke, *op.cit.*, p. 105.

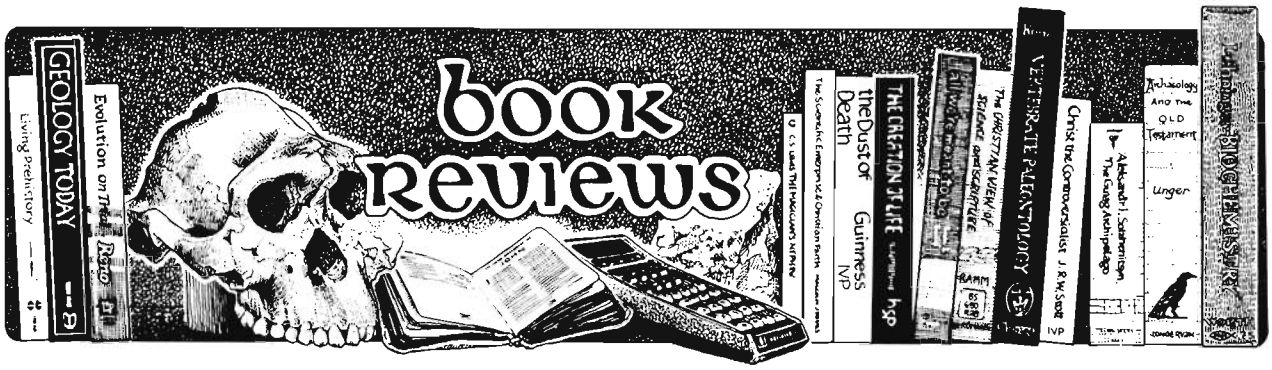
[4]N.R. Hanson, *Patterns of Discovery*, Cambridge University Press, London, 1958, pp. 19-20.

[5]E.L. Mascall, *Christian Theology and Natural Science*, The Ronald Press Company, New York, 1956, p. 132.

[6]Albert Einstein, *Out of My Later Years*, The Citadel Press, Secaucus, 1977, p. 101. Second quote of Einstein found in *Elementary Particles* by C.N. Yang, Princeton University Press, Princeton, 1962, p. 65.

[7]H. Yukawa, *Creativity and Intuition: A Physicist Looks East and West*, Kodansha International, Tokyo, 1973.

[8]S. Chandrasekhar, "Beauty and the quest for beauty in Science", *Physics Today*, July 1979, *Vol.* 32, *No.* 7, pp. 29-30.



PSYCHOLOGY AS RELIGION: ***The Cult of Self Worship*** by Paul C. Vitz. William B. Eerdmans Publishing Company, Grand Rapids, Michigan, 1977.

In *Future of An Illusion*, Freud tried to explain religious beliefs as our neurotic attempts to satisfy psychological needs. Ironically these many years later we find a writer with intellectual roots in Freud arguing that modern humanistic psychology has evolved a certain view of man in order to satisfy religious needs. This came about because secular thought has done away with the transcendent Creator God, thereby destroying ultimate meaning. This present world view begins and ends with man, creating a philosophy of life called "selfism" by Vitz.

The title of the book seems to indict the whole of psychology. However Vitz zeroes in upon four major theorists: Fromm, Rogers, Maslow, and Rollo May, as well as encounter groups of various types. His main thrust appears to be against what in therapeutic psychology could be called Humanistic-Experiential-Existential psychology. The book, especially helpful in critiquing these belief systems, also touches upon beliefs common to the religion of "scientism" in general. Psychologists in the domains of experimental and social psychology also make assumptions or faith commitments about the world but they are not covered in this volume.

The book analyzes selfism by closely inspecting its theory and its goals, which Vitz finds as anti-God and based upon the theory that individuals are purely good. A result of this emphasis upon actualization and innate goodness is the denial of aggression and self-centeredness in ourselves. The "Me" generation wants a psychology that attributes goodness to the individual and destructiveness to society or some "other" who influences the individual. Selfism totally fails to deal with evil and destructiveness in the world and in humanity. Vitz's more classic Freudian though runs through the book, calling upon us to recall the aggressive side of our nature and to come to grips with our inherent problems with socialization. In this regard, the book speaks forcefully and biblically. Vitz uses excellent illustrations and quotations, exposing the religious bases of selfism with clarity.

Author Vitz does a good job connecting the phenomenon of selfism and its social consequences. He suggests that by living only for ourselves, our society has increased alienation, superficiality, and problems with intimacy. Stimulation is the goal. As we use each other as objects for self gratification, love and intimacy become pain. Risks and vulnerability are assumed to lead inevitably to hurt. We conclude that lovers are fools and commitments are irrational. He challenges the Christian community to fill the emptiness in people's lives with the thoughtful presentation of the Gospel and the living out of Christ's love.

Psychology As Religion is a timely and thought provoking book. I suspect that in my early graduate school days I may have bristled at Vitz's attack on humanistic psychology. I heard a number of simplistic "Christian" responses to the major psychological schools of thought. This book, however, is no simplistic reaction. It speaks convincingly of its thesis: that much of therapeutic psychology has quite literally become a religious system, explaining everything from epistemology to ultimate meaning. It calls upon the proselyte to adopt its creed and take instruction from its priests.

On occasion, I sensed frustration and anger expressed between the lines—the kind of feelings I sometimes have when I see Christians being ridiculed and rejected as "dogmatic" by "open-minded" self-described humanists. Having matriculated through a secular graduate program and work setting, I am thankful to author Vitz for articulating the religious nature of certain psychologies. This book deserves wide reading, having a number of applications as a textbook. *Psychology As Religion* should be in your hands if you are in the field of psychology.

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THE HUMAN PUZZLE: ***Psychological Research and Christian Belief*** by David G. Myers, New York: Harper and Row, 1978, 278 pages (including index), $5.95.

This is the first volume in a series jointly sponsored by Harper and Row and the Christian Association for Psychological Studies entitled "Christian Perspectives on Counseling and the Behavioral Sciences." The series title is somewhat inappropriate in regard to this initial book in

that the volume makes only passing reference to applied psychology. At most, reference is made to church life and Christian education rather than counseling. Instead the author directs his attention primarily to basic psychological research and Christian belief.

The book is addressed to two audiences. On the one hand Myers writes for the lay public and undergraduate students who may have interest in the interrelationships among religion and the social/behavioral sciences. In this endeavor he has attempted to distill research without popularizing or over simplifying it. On the other hand, Myers writes for his colleagues in psychology and theology who, likewise, may be involved in relating the two disciplines. My impression is that he succeeds moderately, but not admirably in his intentions. He reports that a critic who commented after reading one of the chapters suggested that his examples and reports of specific studies were easy to remember while his conclusions and arguments were less memorable. I'm inclined to agree. The material has a "spotty" quality to it. The reader is not always clear as to how Myers is relating the two disciplines or whether the chapters build on one another. The substantive sections often fell like quotations tied together with mundane comments. Yet, the concrete illustrations are intriguing, well chosen, clearly presented and not easy to forget.

There are five sections to the book: Human Nature, Mind and Body; Behavior and Belief; Superstition and Prayer; and the Mystery of Freedom. These issues are developed in ten chapters in each of which psychological and theological perspectives are discussed. This structure appears to be more topical than developmental. In fact, Myers admits that most of the material was included in periodic addresses delivered on selected college campuses.

However, these stylistic commments do not detract in the least from the basic soundness of the research so aptly utilized by Myers in building his presentation of the human being as perceived through the eyes of psychology. The author knows the field and is uniquely skilled in organizing conclusions as widely ranging as those pertaining to the effects of behaving on believing, on the one hand, and perceptions of causation in the self and others, on the other hand.

The theology he espouses is well informed by basic Calvinism, considered piety and biblical understanding. Few can find fault with his firm commitment to a responsible presentation of the Christian faith. It matches the quality of his psychology even if, at times, the relationship of faith to science is unclear. This leads him, on occasion, to present psychology and theology as completely disparate and to, seemingly, make no effort to resolve the differences. This tendency is seen most poignantly in the discussion of superstitious behavior and prayer. It is not enough to call for a balanced maturity in praying (for example praise and confession as well as petition). Myers simply leaves undiscussed the devastating impact of the research on the human tendency toward control and perceived causation even when events are unpredictable and random on the question of whether God ever answers prayers. It is not a question of whether these issues *can* be resolved. Myers gives the impression that he has dealt with them when he has simply left the reader confused.

However, he is to be commended in not avoiding the hard issue of the interrelationship of psychology and theology. He tackles some of the enduring concerns. His introductory chapters on religion and science provide a well considered foundation for any who would undertake seriously the task of integration.

In sum, *The Human Puzzle* is a complex, noteworthy, if somewhat scattered approach to the burgeoning field of interest in the interrelationships of the Christian faith and the social/behavioral sciences. It raises as many questions as it answers but, in all fairness, it should be said that the author admits that this is so and perceives himself as raising issues

Books Received and Available for Review

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

Bonner, J.T., *The Evolution of Culture in Animals,* Princeton.

Catherwood, F., *First Things First,* IVP.

Clouse, R.G., ed., *War: Four Christian Views,* IVP.

Cousins, N., *Anatomy of an Illness: Reflections on Healing and Regeneration,* Bantam.

Duddy, N.T., *The God-Men: An Inquiry into Witness Lee and the Local Church,* IVP.

Eller, V., *The Outward Bound: Caravaning as the Style of the Church,* Eerdmans.

Glassman, E.H., *The Translation Debate: What Makes a Bible Translation Good?* IVP.

Gutherie, D., *New Testament Theology: A Thematic Study,* IVP.

Hopler, T., *A World of Difference,* IVP.

Lappe' and Collins, *World Hunger, Ten Myths,* Institute for Food and Development Policy.

Larson, D., *Nothing but Motion,* North Pacific.

Lindsey, H., *The 1980's: Countdown to Armageddon,* Bantam.

MacGregor, G., *The Nicene Creed: Illuminated by Modern Thought,* Eerdmans.

Metzger, W., *Tell the Truth: The Whole Gospel to The Whole Person by Whole People,* IVP.

Nelson, J. Robert, *Science and our Troubled Society,* Fortress Press.

Rifkin, J., *Entropy, A New World View,* Viking.

Roy, R. *Experimenting With Truth,* Pergamon.

Schemmer, K.E., *Between Faith and Tears,* Nelson.

Shelly, J.A., *Dilemma: A Nurse's Guide for Making Ethical Decisions,* IVP.

Sojourners, A Matter of Faith: A Study Guide for Churches on the Nuclear Arms Race.

Stutt and Coote (ed.), *Down to Earth: Studies in Christianity and Culture,* Eerdmans.

Theology News and Notes, March (1981), *Modern Warfare: The Christian Dilemma,* Fuller Seminary.

Toffler, A., *The Third Wave,* Bantam.

Whitehouse, W.A., *Creation, Science and Theology,* Eerdmans.

Wilkes, P., ed., *Christianity Challenges the University,* IVP.

Wilkinson, L., ed., *Earthkeeping: Christian Stewardship of Natural Resources,* Eerdmans.

Yamauchi, E., *Harper's World of the New Testament,* Harper and Row.

more than providing final solutions. Readers will look in vain for the development of a thematic perspective across the chapters of the book but will find within individual sections intriguing reports of research and genuine discussions of theology. In many ways these discussions are seminal and provide the basis for much future dialogue. This volume will take its places as a provocative beginning for what promises to be a very worthwhile collaboration between CAPS and Harper and Row.

Reviewed by H. Newton Malony, Professor of Psychology, Graduate School of Psychology, Fuller Theological Seminary, Pasadena, California 91101.

THE ROAD OF SCIENCE AND THE WAYS TO GOD by Stanley L. Jaki, Chicago: The Uiversity of Chicago Press, 1978, vii + 478 pp. $8.95 paper, $21.00 cloth.

Although science is traditionally viewed as hostile or at best neutral toward religion, a school of historians has emerged in the last half century which asserts that religious factors were central to the 17th century "break through" in scientific thought. Whitehead, Merton, Raven, Collingwood and, more recently, Hooykas, Klaaren and Jakob are among those who support this view.

In *The Road of Science and The Way To God*, Stanley L. Jaki, holder of doctorates in physics and theology, expands this peerspective through an analysis of the thought of major figures in the lineage of science ranging from the Greek philosophers to Einstein and Kuhn. For Jaki, "the birth of science came only when the seeds of science were planted in a soil which Christian faith in God made receptive to natural theology and to the epistemology implied in it." The transition from the first viable birth to maturity was made "in a perspective which was germane to natural theology and which was instinctively adopted by Newton [who was] chiefly responsible for completing that transition." The philosophical developments of the 18th and 19th centuries, "all hostile to natural theology," are seen as forcing science into its great historical blind alleys." Then, in modern times, Planck and Einstein emerge with an "acceptable" epistemology to lead the scientific community back to the "forward road of science."

The heart of Jaki's thought is found in natural theology— "the ascertaining by the light of reason the existence of God, or in short, the proofs." Consistent with "the proofs" are a realistic epistemology and ontology. Jaki's view of science is singleminded: attacks on the traditional proofs of the existence of God reflected on what is the ultimate in intelligibility and being and, therefore, were attacks on science "whenever their principal presuppositons were rigorously and consistently applied in scientific methodology and historiography."

In seeking to demonstrate a single intellectual direction forming both the road of science and the ways to God, Jaki sets out a difficult course, one that will find little support outside the church and some hesitance within. One is asked not only to view science from "the eye of faith" but with a "thomistic" eye.

Jaki finds his fellow historians wanting for paying attention to details rather than considering the effect of the metaphysical currents of the time on scientific thought. His own effort results in a fascinating, wide-ranging account of the men and the times. He pursues his task with vigor and incisiveness and with a flow of language which is both clear and interesting. The book will be of value to the general reader regardless of his view of Jaki's central position.

In the course of his discussion Jaki neatly dissects a number of scientific "Sacred Cows" both past and present. He is particularly effective in the chapter "The Horns of Complementarity." In expounding the philosophy of quantum mechanics Niels Bohr concluded that nature was inevitability irrational (in effect renouncing causality). Something of reason could be saved only when discourse was limited to "aspects" of reality (complementarity) thus barring questions about reality and its objective existence. Jaki aptly demonstrates that this view results in the end of philosophy and science.

It appears inevitable that an effort to equate good science with good epistemology and good natural theology would lead to difficulties, especially as one goes further back in the historical record. Specialists in history and philosophy may well challenge particular interpretations and characterizations or indicate omissions harmful to the cause. It is surprising that the critical English period from 1640-1680 is virtually ignored by the author whereas many students of that period provide support for Jaki's thesis.

Jaki is occasionally forced "to save the appearances" by smoothing over a deficient theology or even atheism (Planck, Einstein) when an agreeable epistemology appears. Good theology has not always resulted in good science. In fact it has been, at times, opposed to science. Jaki may be asking too much of us when he presses the entire history of science to prove his case. The major efforts to establish a relationship in 17th century England have not been received uncritically in spite of the fact that this historical moment appears to have the right ingredients.

Despite clear writing on specific topics the author tends to obscure certain basic themes. Science is never clearly defined; natural theology becomes a collection of abstract terms along with the "proofs." In addition, it would have been helpful to develop a biblical-theological base for the realistic epistemology and ontology essential to his argument.

In the end, good theology, good epistemology and good science stand together, Until that point, science appears destined to move ahead indifferent to theology and philosophy, unconsciously feeding upon the methaphysical traditions of the past.

For those whose theology does not hold that man through "his intellect and will can stretch across the

universe to God" there remains a richness of relationship wherein theistic presuppositions provide a base for doing science. While Jaki may not convert many readers to his position, this analysis of the men of science and their times adds further support to the notion that metaphysics precedes action even though the metaphysics is unconsciously borrowed.

Reviewed by John W. Haas, Jr., Department of Chemistry, Gordon College, Wenham, Massachusetts 01984.

CREATION/EVOLUTION *Issue 1*, Frederick Edwords, Editor, 953 Eighth Ave., Suite 209, San Diego, CA 92101, Summer 1980. 40 pp. $2.50/quarterly issue, $8.00/annual subscription.

"A new journal dealing specifically with the creation/evolution controversy,...is the only journal that answers the arguments raised by creationists." Its "aim will be to answer in simple but correct language all the specific arguments creationists usually put forth in their publications and debates,"...by "reviewing the tremendous array of evidence available supporting the modern theory of evolution." Articles by creationists are also welcome, especially if they are responsibly presented and not already published elsewhere.

In this first issue are included an outline of the creation model which Dr. Frank Awbrey extracted from books and publications of creationists, a book review by Dr. William Thwaites, and two feature articles which will have sequels in future issues. Dr. Awbrey, Professor of biology, and Dr. Thwaites, Professor of genetics, teach a special course at San Diego State University: Evolution and Creation—Constrasting the Two Models. "They present the evidence for evolution in half the course time, and prominent creationists use the other half. The two have also teamed up in two public debates on the creation/evolution question, both times against representative of the Institute for Creation Research" (Drs. Henry Morris and Duane Gish). In his article Awbrey outlined the salient "scientific" or "factual" features of the creation model under four major events or periods: the Creation, the Fall, the Flood, and the Post-Flood Period.

Thwaites critically reviews, *Biology: A Search For Order In Complexity* by Moore and Slusher. Despite "the oft stated purpose of the book—the exploration of alternative 'models',...the book misses the mark as to what science is all about,"...because "co-editor Moore unequivocally states (in the preface) that 'true science' consists of presenting the raw data 'as it is,' " which is "a direct contradiction of their aforementioned purpose." "The real aim of the book seems to be the making of slanderous attacks on evolution and evolutionists." For example, population genetics is incomprehensibly dispatched in slightly over one page in pseudoscientific double-talk. Thwaites feels "that the authors, because they fully understand the extreme frailty of their model, have chosen to discredit evolution rather than make any case for creation." "In addition to muddling the facts, the authors make serious errors," Thwaites argues. "The director of curriculum development at the Institute for Creation Research has publicly stated that this book is an embarrassment to many creationists because of the large number of errors it contains." Thwaites lists several flaws in reasoning in the section, "Difficulties With the Geologic Timetable." "First, there is no known way of assigning a complexity index to any organism." "Next, it is obvious that the strata could be ordered correctly even if the index fossils showed no apparent complexity gradient at all." One assumption needed would be that a fossil confined to one type of stratum "enjoyed wide distribution during one period of time." Only one more assumption needed is "that most deposits are found right-side up." Thwaites concludes "that creationist claims of circular reasoning" (allegedly used by evolutionists in the case of index fossils) "are possibly pure subterfuge, or they may indicate an incredible lack of common sense."

In one of the two comprehensive lead articles, Fred Edwords presents the case for "Why Creationism Should Not Be Taught As Science" on the basis of legal objections, which he calls "an air-tight case." Fred Edwords has also "lectured and debated widely on the creation/evolution issue, has designed a two-model slide show on the subject, and is Administrator of the American Humanist Association." He explores the history of the legal conflict. "Even though the legislative track record of creationists was poor (they never won a constitutional battle), they had an impressive long-term success in convincing teachers and publishers to soft-pedal evolution," until the reawakening in science education in the 1960's. Previous unsuccessful tactics of creationists were antiscience, efforts to ban evolution, and purely religious invective. "Their new tactic is to declare creationism scientific," and acceptable to science curricula and textbooks by hiding the fact that the Bible is the source. However, Edwords contends that "creationists have been rather clumsy in sticking to their new tactic of secularizing creationism by avoiding a clear exposition of their own model and in concentrating their attack on evolution or on any science of origins which doesn't give creationism equal time as an alternative scientific view or an excluded religion." Edwords presents the legal case against creationism.

> Those on both sides who have really looked into the matter can see hopeless flaws in the legal case for creationism. Right off the bat is starts out with a basic contradiction. First the creationists try to define science so narrowly that it leaves out evolution. This renders evolution a religion, right along with creation. Then they try to so broadly define science curriculum that it allows both 'religions' to be taught in a scientific context. Putting it another way, creationists demand equal time for creation on religious grounds, so they can get it into schools, and then demand equal time on science grounds, so they can get science instructors to teach it!...The banning of evolution on religious grounds has the unenviable legal status of being totally unconstitutional.

After discussing a released time plan and admitting to its weakness, Edwords backs down when he states, "Probably the best solution would be to set aside one science class (for conscientious objectors) wherein origins would not be discussed at all (which is what most creationists really

want). Such a plan would effectively remove all 'offense' and 'burden on free exercise,' while still leaving the rest of the students free to learn a *complete* science." This compromises his position in view of his statements that, "Students cannot be adequately prepared for scientific careers if they are left in the dark about"...evolution as the great unifying principle of science. "And if it is 'balanced' with a non-scientific theory (creationism), then they will get an inaccurate picture of science and be misled into believing there is a significant split of opinion among scientists on the issue, when there is not."

In his conclusion, Edwords states, "It's not the business of the legislature to determine what is and is not science. This task belongs to the scientific community." Creationists "have made little effort to work through the scientific community, to participate in the peer review of the journals, to do more than just token field research." If evolution is a religion, creationists will have to prove that "using scientific means, submitting their arguments to peer review, and actually showing that evolution is untestable and non-scientific in nature." Finally, Edwords calls for scientists to inform the public of the facts.

> The public never fully accepted evolution. We can study the creationist arguments to learn where evolution is being misunderstood or feared. We can then tell the public *why* scientist accept evolution, instead of telling them merely *that* they do. We can improve the public relations of science in general, and thereby bring it back into respect. Respect for science in America is waning. The popularity of both creationism and mysticism are symptomatic of it.

In a future issue Fred Edwords will explore the Educational Issues in Part 2 of his article.

In the second feature article Christopher Gregory Weber points out "The Fatal Flaws of Flood Geology." He is a computer programmer and amateur geologist who has followed the creation/evolution controversy for seven years. After summarizing the flood geology model, Weber shows its inability to explain desert deposits, fossil forests, facts about the heterogeneity and uneven distribution of sediments and sedimentary rocks in the earth's crust, the bouyancy of granite slabs of continental crusts on the earth's viscous mantle, the growth of coral reefs with their heterogeneous structures, ocean terraces containing fossil-bearing marine conglomerates, the slow formation of shales and evaporites, and fossil species which are extinct. In presenting geological evidence alongside details of the evidence presented by flood geologists, Weber argues that creationists play fast and loose with the facts. He admits that his initial article "covered a small sample of the many types of geological evidence that flood geology cannot easily explain." He is persuaded "that flood geology is totally erroneous." In spite of attacks on orthodox geology by flood geologists, they "misunderstand the nature of sedimentary facies, and there is plenty of physical evidence having nothing to do with fossils that the Lewis Overthrust is genuine. Creationists often quote their sources badly out of context, sources that prove thrust faulting is very real." "But it will have to be the task of a future article to investigate these and other alleged difficulties in detail." Weber concludes, "For now, it is sufficient to say there are fatal flaws in the creationist flood geology model, flaws that render it inadequate to scientifically support the Flood or tell us anything about the age of the earth."

In addition to those already mentioned, other articles for future issues of *Creation/Evolution* include: "Are scientific creation and evolution testable theories? Are they both religious theories?" "Have creationists abused the second law of thermodynamics?" "Dating methods: Is the universe really only 10,000 years old?" "Are transitional forms really found in the fossil record?" "Is evolution statistically possible?" "Are there really human footprints found in dinosaur strata? Did man and dinosaur walk the earth together?" "Did life evolve by random processes or was it uniquely designed? What does the evidence show?" Anyone interested in these questions will enjoy future issues of this journal, and anyone interested in this ongoing controversy should not miss out on stimulating reading from this new perspective.

Reviewed by Jerry D. Albert, Research Biochemist, Mercy Hospital Medical Research Facility, San Diego, CA 92103.

PSYCHOLOGY FROM A CHRISTIAN PERSPECTIVE by Ronald L. Koteskey, Abingdon, Nashville, 1980, 175 pp., $5.95, Paperback.

This book contains a discussion of the main areas of psychology reinterpreted from a Christian perspective. The author believes that the various systems of psychology, when placed within a Christian perspective, are complementary rather than conflicting. According to Koteskey, psychology is fragmented and can be integrated only by placing its schools of thought into a Christian world view.

The author recommends that psychologists and Christians drop their defenses. The dichotomy between the two is artificial and should be eliminated. Christianity is the umbrella which can bring unity to the various aspects of psychology and even provoke previously unasked questions. Ultimately, a Christian psychology seeks to better understand God and his creation thereby enabling humans be become more like God.

Five popular systems in American psychology are discussed (structuralism, functionalism, psychoanalysis, Gestalt psychology, and behaviorism) with their contribution to Christianity highlighted. A scheme from Francis Schaeffer is used in showing a relationship between God and the various orders of God's creation. This paradigm states that humans are finite, created beings who are similar to animals and God in some ways while different from them in other ways. In keeping with this scheme, adjustment is defined as being like God while maladjustment is being unlike God. Although the model chosen by Koteskey is simple and obvious, he deserves a great deal of credit for illustrating it in the areas of psychology.

Written for those who want to develop a Christian perspective on psychology, Koteskey cautions that his is not a finished system. He asks for positive alternatives, not

criticism. General psychology students, who are the primary targets of this book, will not benefit from much of it. It is over their heads. For the psychology major, the book will provide a challenge at synthesis while for the professional, it will provide fresh insight into an old discussion.

Seven of the eleven chapters have been published before in journals. The author is professor of psychology at Asbury College.

Reviewed by Richard Ruble, Department of Psychology, John Brown University, Siloam Springs, Arkansas 72761.

THE GIFT OF DREAMS: A CHRISTIAN VIEW by Kathryn Lindskoog, Harper and Row (1079). 202 pages. $7.95

Perhaps the most superstitious ground an evangelical Christian walks on is that belonging to the world of dreams. Dismissing a valuable asset, Christians tend to either over-mysticize or completely secularize their dream life. The *Gift of Dreams* has thrown a bright (and funny) light on the scary, never-mentioned-because-you-might-be-entertaining-demons, world of the night life.

The book reveals both an intense interest by Lindskoog (who has dutifully recorded her own dreams for the past 25 years), and a comprehensive overview of every major dream expert from Freud to Progoff. As *Kirkus Reviews* stated though, "In the end, it is Lindskoog's personality—warm, bright, witty, slightly scatterbrained. . .that structures the book and makes it go."

Lindskoog succeeds very well in addressing her book to Christians who have never regarded their dream life as a gift to enjoy and use as a tool for personal growth, as well as to those who are well versed in the subject. It is an adventure to explore, without trepidation, the mysteries of our own humanity. Lindskoog's view of dreaming will set a precedent for more books, as she boldly and with a great sense of humor, challenges the Newtonian world view and dares *cum gratia* to meld the "irrational" aspects of life (dreams, precognition, etc.), with the rigors of a detailed study of all the available data on dreams. While her book is not exhaustive, it is certainly not boring.

A common objection to the book is the way she flits from dream to dream (including those of C.S. Lewis, Hitler, Dag Hammarskjold, as well as her own), and from author to author (Aristotle, Thomas Merton, the Talmud), but the content is rich enough, the humor wry enough, to keep one thirsting for more.

Again to quote *Kirkus Reviews*, "(the book is) Quirky, lively, absorbing."

Reviewed by Elizabeth Waggoner, Board Member, Coordinator for Orange Cty; Evangelical Womens Caucus, (Southwest Chapter), 26691 Las Ondas Mission Viejo, California 92692

PENTECOSTAL GRACE, by Laurence W. Wood. Wilmore, Kentucky: Francis Asbury Publishing Co., 1980. 276 pp., $8.95.

Laurence W. Wood teaches systematic theology at Asbury Seminary and has recently served as President of the Wesleyan Theological Society. Knowing the author's professional affiliations should provide a hint as to what to expect in his book if the title is not all that revealing.

This is not another discussion of the charismatic gifts of the Spirit, which many immediately associate with any mention of Pentecost. For Wood, Pentecost has a more fundamental theological significance. This is apparent from the thesis of the book, which is "that the Wesleyan doctrine of Christian perfection can be best understood in the light of the Exodus-Conquest, Resurrection-Pentecost events of salvation history" (p. 13).

Such an understanding of Pentecost rules out any tendency to interpret it as an isolated event. Old Testament background is obviously important since Pentecost is seen as the New Covenant fulfillment of the conquest. Just as the Exodus prefigured the resurrection of Jesus, so the conquest of Canaan prefigured the spiritual reality to come at Pentecost. Moreover, Resurrection-Pentecost, like Exodus-Conquest, are two stages of a larger whole, and are to be understood in that relation.

Thus, a considerable amount of stage-setting must be done if the deeper significance of Pentecost is to be appreciated. Wood sets the stage by painstaking exegesis of key passages in both Testaments. His argument here is impressive for its breadth. He builds his case by drawing on the works of Old and New Testament scholars and theologians of several persuasions, including Jewish.

While this book is sure to be welcomed by those in the Wesleyan tradition, it deserves attention from the wider Christian community as well. Chapter Seven, for instance, is devoted to pointing out the "remarkable similarity" between the Roman Catholic and Anglican doctrine of confirmation, and the Wesleyan doctrine of Christian perfection. Wood also addresses the Reformed view of baptism in the Spirit. The writings of Karl Barth and James Dunn on this subject receive detailed treatment, and large areas of agreement are indicated as well as points of difference.

Journal ASA readers will perhaps be most interested in the chapter entitled "Space-Time and a Trinitarian Concept of Grace." Here is an admirable example of maintaining the Creation/Redemption tension, recently discussed by Richard Bube in *Journal ASA* (March, 1980). Wood shows why it is necessary to have a proper understanding of creation *ex nihilo* in order to comprehend the nature of grace. He also stresses the importance of grasping the biblical view of time, which is a synthesis of the circular view and the linear view. This illuminates not only the history of God's self-revelation, but also the sequence of grace in the lives of individual believers. These insights are particularly brought to bear on the Wesleyan position, and some of the popular misconceptions of it.

All in all, *Pentecostal Grace* can be enthusiastically recommended to anyone who seeks a fuller biblical-theological understanding of the Christian life. My only complaint is that several printing errors got by unnoticed, to mar this otherwise outstanding book.

Reviewed by Jerry L. Walls, STM Candidate, Yale Divinity School, New Haven, Connecticut.

OUT OF THE SALTSHAKER AND INTO THE WORLD by Rebecca Manley Pippert, Downers Grove, Illinois: Inter-Varsity Press, 1979. 188 pages. Paperback. $3.95.

Yet another book on Evangelism? Inter-Varsity staff worker, Rebecca Manley Pippert, has written a challenging book on the subject, which is a sore one with both Christians and non-Christians. This book is no simple quoting of Matt. 28:18-20, Acts 1:8, etc., followed by exhortations to get out there and *do* it. Nor is it a collection of simple formulas along with snappy answers to agnostic questions. Instead the author challenges the reader to see *evangelism as a way of life* (the subtitle of the book).

Pippert introduces the book with a couple of marvelous stories about her own early experiences trying to *do* Evangelism. Her point is simply this: the only people more uptight about Evangelism than non-Christians, are the Christians trying to do it. There has to be a better way and she offers a potent suggestion. The next five chapters focus on the life of Jesus in the context of seeing Him as both the message and the messenger. The author gives a clear picture both of Jesus as Lord and Jesus as Evangelist. While her contention is that we should model our own efforts after those of Christ, Pippert has not forgotten that Jesus was perfect and we are not. The next two chapters talk about God's enabling us to overcome our shortcomings (personal shyness, and inability to see beyond externalities, etc.). In the next three chapters she goes on to discuss the simple mechanics of talking with another person. Her treatment of various styles of conversation seems designed to make the reader a fisher rather than a hunter of men.

The final chapter explores the witness of Christian community. The discussion of Bible Studies is effective, but the role the local church ought to play, while not minimized, is inadequately developed. Two appendices have been included: the first is a concise outline of the Christian message together with the Scripture references associated with each point; the second is an excellent annotated bibliography.

Rebecca Manley Pippert has a simple, anecdotal style of writing which she uses to present her thesis that: "Evangelism involves taking people seriously, getting across to their island of concerns and needs, and then sharing Christ as Lord in the context of our natural living situations". Her book is not only worth reading, it is worth taking to heart.

Reviewed by Robert H. Seevers, Medicinal Chemistry, College of Pharmacy, University of Michigan, Ann Arbor, Michigan 48109.

Founded in 1941 out of a concern for the relationship between science and Christian faith, the **American Scientific Affiliation** is an association of men and women who have made a personal commitment of themselves and their lives to Jesus Christ as Lord and Savior, and who have made a personal commitment of themselves and their lives to a scientific description of the world. The purpose of the Affiliation is to explore any and every area relating Christian faith and science. The *Journal ASA* is one of the means by which the results of such exploration are made known for the benefit and criticism of the Christian community and of the scientific community.

A closely affiliated organization, the **Canadian Christian and Scientific Affiliation,** was formed in 1973 with a distinctively Canadian orientation. The **CSCA** and the **ASA** share sponsorship of the publication. **CSCA** subscribes to the same statement of faith as the **ASA** and has the same general structure. However, it has its own governing body with a separate annual meeting in Canada.

Members of both organizations endorse the following statement of faith: (1) *The Holy Scriptures are the inspired Word of God, the only unerring guide of faith and conduct.* (2) *Jesus Christ is the Son of God and through His Atonement is the one and only Mediator between God and man.* (3) *God is the Creator of the physical universe. Certain laws are discernible in the manner in which God upholds the universe. The scientific approach is capable of giving reliable information about the natural world.*

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