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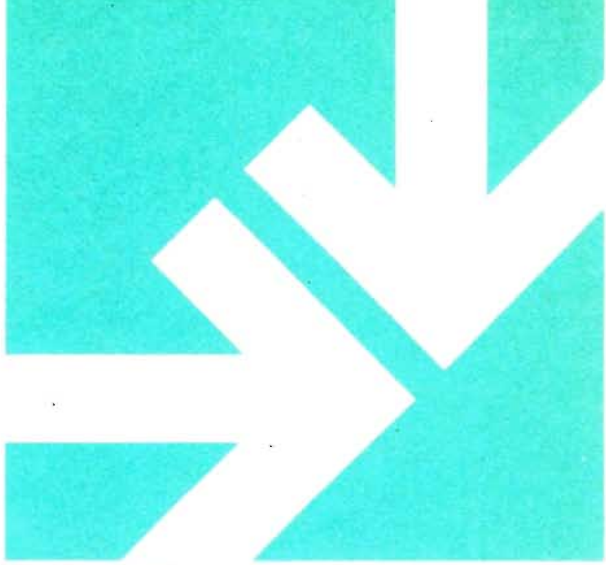

An evangelical perspective on science and the Christian faith

"Hear the word of the Lord, O people of Israel; for the Lord has a controversy with the inhabitants of the land. There is no faithfulness or kindness, and no knowledge of God in the land; there is swearing, lying, killing, stealing, and committing adultery; they break all bounds and murder follows murder. Therefore the land mourns, and all who dwell in it languish, and also the beasts of of the field, and the birds of the air; and even the fish of the sea are taken away." (RSV) Hosea 4:1-3

"The earth mourns and withers, the world languishes and withers; the heavens languish together with the earth. The earth lies polluted under its inhabitants; for they have transgressed the laws, violated the statutes, broken the everlasting covenant. Therefore a curse devours the earth, and its inhabitants suffer for their guilt; therefore the inhabitants of the earth are scorched, and few men are left." (RSV) Isaiah 24:4-6

ECOLOGY

"The whole creation is on tiptoe to see the wonderful sight of the sons of God coming into their own. The world of creation cannot as yet see Reality, not because it chooses to be blind, but because in God's purpose it has been so limited–yet it has been given hope. And the hope is that in the end the whole of created life will be rescued from the tyranny of change and decay, and have its share in that magnificent liberty which can only belong to the children of God! It is plain to anyone with eyes to see that at the present time all created life groans in a sort of universal travail." (Phillips) Romans 8:19-22

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

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JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

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THE CHRISTIAN AND ECOLOGY

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"We do not believe that the ecologist has anything really new to say. His task, rather, is to inculcate into the government and the people basic ecological attitudes. The population must come, and very soon, to appreciate certain basic notions, For example: a finite world cannot support or withstand a continually expanding population and technology; there are limits to the capacity of environmental sinks; ecosystems are sets of interacting entities and there is no "treatment" which does not have "side effects" (e.g., the Aswan Dam); we cannot continually simplify systems and expect them to remain stable, and once they do become unstable there is a tendency for instability to increase with time. Each child should grow up knowing and understanding his place in the environment and the possible consequences of his interaction with it."[1]

This quote places in a different perspective the current topic of general conversation relating to the environment and the broader science of ecology. If the ecologist has nothing new to say, what about the Christian and his responsibility to his fellowmen? Basically, this paper reiterates an old concept in Christianity, namely "am I my brother's keeper"? (Genesis 4:9). It is the awareness of the individual, and especially of those individuals of the Christian persuasion, to the broader aspects of human behavior, which will bring some semblance of order and progress out of the highly charged and emotional reaction currently expressed over environmental concerns.

A brief examination of the major terms of this paper is in order, if not necessarily for agreement on the definition of the terms, at least for a point of reference for thought and discussion. First of all, who or what is a Christian? A cardinal rule in linguistic studies of the meaning of words refers to their original use in the

Prepared for presentation at the 26th Annual Conference of the American Scientific Affiliation at Spokane, Washington, August 17-20, 1971.

The responsibility of the Christian to his environment is no more nor less than that of any knowledgeable and concerned individual.

setting in which the word was formulated. In this case, the first use of the word "Christian" refers to the group of disciples at Antioch who were voluntarily together following a year of teaching by the missionaries, Paul and Silas (Acts 11:26). The important point to note is that this term aptly described a group of people of common belief, action and goals. In essence a Christian is an individual who has been taught about Jesus Christ as the Messiah or Savior of mankind and has knowledgeably and willingly accepted this teaching for himself. He has become committed to a thought and belief process which transcends the physical boundaries of life. The term Christian should then be used in its pristine meaning to describe a personal relationship between an individual and Jesus Christ. However, it has been given a broader application to describe some more or less nebulous parameters of action, thought or life style. Thus, it is fraught with misconceptions and misunderstandings and the definitiveness of the word in application has been diluted. "Christian" is now more or less synonomous with western culture or some specific branch of religious activity or thought, i.e., the many diverse groups of Protestantism, Catholicism or the Coptic churches. In addition, groups of people have appropriated (or misappropriated) some aspect of Biblical instruction and formulated small and less defined groups or communes apart from the more formally organized congregations or organizations.

The word "Christian" describes a relationship to Jesus Christ; any other use is a subversion of the term even though it is commonly accepted and can communicate a thought or idea. It is the ascription of attributes of particular individual desire to the Christian that causes difficulty in society. Christianity is often blamed for human action where it is not warranted. Under the guise of Christianity many causes of human activity have been promoted or perverted to individual desires and individual gain.

Much of what has previously been noted with respect to Christianity has a parallel with the understanding of ecology or the environment. An ecological system concerns the interaction of all living species of organisms with each other within the specific geographic niche or location where they are located. The human being is an integral part of this system and is not above nor divorced from it. The human, however, often has a disproportionate influence on the environment and other species present. Given enough time, an ecological stabilization occurs depending upon specific environmental parameters of temperature, moisture, soil type and many other factors.

The basic plant life under the stabilized condition is termed the climax vegetation, which supports a varying combination of animal forms. The animal life present also varies according to the relative number of prey and predators, but exhibits some degree of stabilization with slight oscillations.

When man enters the picture, however, this condition may change rapidly. Many reasons have been given for the rise and fall of civilizations. Most of these civilizations exhibited a rapid deterioration, often completely disintegrating within a generation or two. Whatever the reason for the decline, one factor is generally present: a failure of the civilization to maintain an environmental balance. The factors often cited include failure of a proper provision for food, water, or waste product disposal. These failures were often parallel with a breakdown in societal relations, moral, spiritual and personal.

Christians have often been concerned with the aberrant social and moral patterns of the populace, but have generally overlooked other facets of the social organizations. Thus, many Christians have a simplistic answer to all the vagaries present in human activity, chiefly a moral judgment. It is my contention that citizens in general bring a similar attitude to most of our problems, particularly to the recent concern for the environment.

If we can accept that man individually and collectively is basically responsible for his actions relative to his environment, then it becomes apparent that there should be no difference in perspective between the Christian and the non-Christian. It is a matter of good stewardship and economics to utilize to the fullest extent all the raw products which are needed to provide the material for civilization. The idea of the "single use" or disposable concept needs to be transformed to a multiuse or recycling concept for all materials. Under this concept, garbage and waste products are elevated to the status of a resource improperly utilized. Unfortunately, current economics are such that it is more profitable to acquire new raw materials rather than to recycle used materials.

If the Christian accepts the idea that to "subdue the earth" does not mean "to exploit the earth", but to manage the finite resources available for the greatest human benefits possible, then we have the potentiality of fulfilling another basic Christian tenet of being our brother's keeper and a good neighbor to all. Therefore, it is suggested that the responsibility of the Christian to his environment *per se* is no more nor less than that of any knowledgeable and concerned individual.

A concerned and committed Christian will be alert and aware of environmental deterioration and will do his part to maintain the environment in a suitable condition for the welfare of all men. The past emphasis upon medical missions, sanitation, and improved agricultural practices leading to higher standards has shown an underlying desire for a better relationship between man and his environment, even though this relationship was not fully recognized at that moment.

Thus, the Christian should be alert to the total environmental picture and to preserve its integrity to the fullest extent for future generations. God has given us a unique planet and we should work in harmony with the principles of utilization of our resources without deterioration for the total betterment of all mankind. This is our individual and collective responsibility.

[1]William Murdoch and Joseph Connell, All About Ecology, p. 37. *Omega*, by Paul K. Anderson, Wm. C. Brown Co., Dubuque, 1971.

MAN HAS A POSITIVE RESPONSIBILITY TO MANAGE NATURE

1. The Christian's Positive Mandate

A. Man has *a positive responsibility to manage 'nature'* and to mold it for his own good. (Genesis 1:28, 2:5 and 15). This was as true before the Fall as after it. Man has still an ongoing responsibility, or mandate, to control and use natural resources for his own *corporate* good and for posterity.

B. *Since the Fall* there is added a lack of some degree of harmony between man and his environment which makes the task harder and at times distasteful. The environment is not entirely friendly and it needs to be tamed as well as used. This, however, only alters man's role in *degree* and not in principle. For most purposes the principle (A) is an adequate rule. However well man had behaved it is hard to see how he could have avoided an ultimate problem of population and use of scarce resources.

C. The Christian should hold any constructive *work as honorable.* Jesus was a carpenter, the apostles mostly fishermen and Adam was a gardener even before the Fall. Most constructive work is, in the end, deriving from 'nature' what we would not otherwise have without molding it to our purposes. Such work is good and, since the Fall at least, essential.

D. In an imperfect world, in which many do not have a proper standard of living, the Christian must have *a compassionate aim of material progress* as a part of his desire for the good of all men. As long as people suffer from diseases, lack of basic education, food, physical facilities for family and personal life, etc. we must work for progress, within the limits outlined below.

E. The Christian cannot therefore accept a call to revert to a state of 'nature'. That is animal not human. We must boldly insist that man is intended to rule his environment and mold it for his own good. That in itself is not selfish; it is a duty. The back-to-nature movement is like asceticism in sex. It denies our God-given calling.

F. The Christian's outlook will in these respects differ from that of some non-Christians in each of the above points. His view will also differ as to what is the '*good* of all men'. The Christian cannot see it as merely material. Most non-Christians will agree, in theory at least, but will value things in a different way. Because Christians value the family so highly, for instance, it will alter their view of 'progress' that may disrupt family life.

2. Limitations and Priorities in That Mandate

In Genesis 1:28 man is commanded to multiply without qualification. The qualifications, such as marriage and the family, come later. In the same verse he is called to have dominion without qualification, but qualifications are later given in the Bible.

A. *We are to love the Lord our God* and we are *stewards* of *His* world (Genesis 9:1-9, Psalm 8, Leviticus 25:23). This means: 1. That we must not waste God's wealth; we are to use His gifts as He does and as He commands us; and 2. we are (Psalm 8) His vice-regents and we are to make a *constructive* use of nature consistent with *respect* for it as His.

B. *We are to love our neighbor as ourselves.* The Christian's mandate is for the whole of mankind. It is not sectional and it includes future generations. This limits us severely but constructively.

C. *We must beware of love of self.* Many of the abuses have arisen from *selfishness* and *greed,* etc. Some are due to *ignorance* and in that case only become blameworthy when we discover our fault and do nothing about it. The Christian must constantly speak out, especially when his own group or society or country is guilty of greed, luxury and selfishness. (Man's fallen nature is very evident here.)

D. *The methods used must be ethical.* Not everything that can be done should be done. Wholesale abortion for instance is not a Christian option. The break up of family life or euthanasia are not methods that we can accept any more than war, famine or genocide.

E. Everything created by God is good (1 Timothy 4:4). Therefore our management must be conservative. The creation has a wonderful balance and richness which is all too easily destroyed thoughtlessly. We want to *preserve a natural state and balance as far as these are compatible with other positively good aims.* Like the ideal of physical health (which may involve sanitation, extermination of certain species, etc., etc.) there is an ideal of human wellbeing which includes for the Christian at least a recognition that man, if he is to be altogether *healthy,* needs beauty, contact with trees and birds and animals, human community, mental and physical recreation, etc. and a life which can be open to God and His truth. If not all are available then we must compensate by art, etc. We therefore want to change nature as little as possible and to preserve the diversity of nature and a state of

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Sixty Christian Research Scientists (from RSC Fellowship) drawn from many fields of pure and applied science and meeting in London on October 23, 1972 issued a statement in which they declare that man has a positive duty to manage nature within certain moral limits. The statement reflects a day-long conference held at Bedford College and chaired by Dr. R. J. Berry, Reader in Genetics at the Royal Free Hospital Medical School, London. Four papers prepared by groups of scientists in St. Andrews, Cambridge, Manchester and Bristol were discussed.

balance. Man's aesthetic sense is not altogether misplaced. What men value as beautiful should be highly prized.

3. Some Practical Applications

A. We must use the best knowledge and methods available to avoid destruction and establish a reasonably natural state of equilibrium. Biological resources (e.g., whales) should be managed as long term assets. Mineral resources must be used economically.

B. Scarce resources especially, but all natural resources, should be used as a trust. Conservation and re-cycling of many waste products should have a much higher priority than at present.

C. The extinction of species and of natural habitats is a cause for concern; they represent a loss of natural diversity and often upset the balance of nature more than is expected. Even if tigers have to be confined to game parks and yellow fever mosquitoes extirpated from areas where they might carry yellow fever, we should hope to preserve the species if possible. Even malaria has its medicinal uses against other diseases. There is here a question of balance and even if *Bacillus tuberculosis* has its uses we would all be glad to see it extinct unless we can completely control it.

D. Population growth may need to be checked artificially if natural falls in reproductive rates do not operate adequately. If we cannot give the next generation a wholesome life if their number is too large, we should avoid their increase. This is a corporate responsibility. As nearly all parents at some stage say 'Enough! We cannot adequately look after more children', so the community must do the same.

E. Governments will need great reinforcing in their resolves to do good because every government is tempted to find favor by taking more out of 'nature' than is necessary at the expense of future generations. Christian opinion is needed to help to create a whole attitude to natural resorces that will enable governments to do what in their responsible moments they would like to do, but dare not, because of popular greed. There is a stage between personal motivation and legislation in which Christian opinion should be influential. This stage is the creation of public opinion on which legislation can be based.
The existentialist mood of living only in and for the present has to be fought here. Rational long term planning is necessary.

F. Christians will need to set an example of abstemiousness in consumption (i.e., standard of living), perhaps in family size, and in respect and love for the creation, even when it requires extra effort and self-sacrifice to do so.

Biblical Perspectives on the Ecology Crisis

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INTRODUCTION

Is There a Crisis?

Professor Kenneth Hare of the University of Toronto recently answered the question[1] by dividing people and publications into 3 categories. First, and perhaps most vocal today, are the alarmists, many of whom are profiting immensely by writing and speaking on a kind of apocalyptic level, who see the technological society as having created a monster which, if unchecked, will swallow up both man and nature within a few short years. Hare suggests that much of this group's concern is with what he calls "nuisance pollution", i.e., the kind of thing like cloud or smog factors created by man in a city resulting in a slightly decreased aesthetic or comfort state, but hardly a major threat to life.

A second group consists of those who attempt to debunk the whole pollution effort. There is still land for more people, there are still many resources for development, and we have always been able to develop new methods and resources when the old were exhausted. After all, when coal supplies ran short, we hardly noticed the loss. Why not recognize that new forms of energy, new synthetic materials for construction, new ways of increasing our ability to feed ourselves, and new social structures making it possible for even greater

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A paper presented at the annual ASA Convention at Whitworth College, Spokane, Washington in August 1971.

numbers to live on this planet are all just around the corner?

In a third group (the golden mean) Hare places himself. His concern is with what he calls "transcendent" pollution—i.e., the relatively few but vitally important factors that affect not one area but the entire ecosphere. In such a category he would include the population explosion, the problem of non-renewable resources, and the problem of atmospheric and water pollutants now present in the world-wide system of the earth's surface.

It is not my purpose to referee this debate. Rather, I should like to suggest that, whatever our view of the seriousness of the problem, there is an area in which we must develop a response. Even the most optimistic 'de-bunker' of the ecology crisis is functioning on the basis of a philosophy—usually a philosophy built on an unlimited confidence in man and his ability to control his own destiny. And, because our response inevitably involves values, and values in our Judeo-Christian society have always related to Biblical religion, I feel we can and should begin our search for a value-structure at that point. Especially for us, as evangelicals, there is a mandate for a fresh look at our sources, partially because they are under attack in ecological circles, but more basically because we purport to find in them "all things necessary for life and godliness".

What then does the Bible say to guide our response to the problems of ecology? Does it speak with a clear voice in favor of concern or does it, perchance, leave us in the embarrassing position of 'drop-out' from the company of the concerned, or worse yet, does it provide us with a mandate for exploitation of the worst sort? To these questions my paper will attempt an answer.

Approach to the Crisis: Ecological or Theological?

Perhaps at this point we should pause to consider the criticism of the "theological strategy" offered by Prof. Richard Wright in a recent article.[2] Dr. Wright suggests that an "ecological strategy" (i.e., educate people to see that a proper use of their environment is beneficial in terms of their own quality of life) is more effective than a theological one, as Christian churches have neither the ability to agree on a particular theological strategy, nor the ability to influence the secular majority in our society. The theological approach must be, therefore, merely a supplement to the more pragmatic, realistic appeal to self-preservation which secular man can understand.

I question whether one can separate the two, even to the limited extent proposed by Dr. Wright. If ecological decisions are to be made at all they must be made in the context of a human value system. Who is to say that self-preservation is a strong enough motive for action, especially when, for those in affluent parts of the world, it usually is a problem of assuring the next generation's survival, not our own? What will convince the consumer of wood and paper, the traveller in his fume-spewing automobile, or the land-speculator protecting his investment that to modify his behavior severely is necessary? I suggest that a theological conviction, though traditionally limited in its appeal, may make more sense in the context of an increasingly apocalyptic debate than even the appeal to an enlightened self-interest. Though we may never convert the world, we may, as Christians, better set our own response and activity in the context of a Biblical world-view, and thus convince contemporary leaders to follow

If ecological decisions are to be made at all they must be made in the context of a human value system.

after what we believe is good. It was not, after all, through the conversion of all England that Granville Sharpe, William Wilberforce and John Newton brought about the end of child labor and the slave trade. It was rather by formulating a course of action growing out of a Christian world-view, convincing themselves and some influential contemporaries of its rightness, and then seeking legislation on the subject. Thus, I opt for a theological approach. But, which theology shall we espouse? At least three options are available and I shall discuss them in turn.

Theological Approaches

1. *Attack the Judeo-Christian tradition.* Attacks on the Judeo-Christian tradition and its view of nature are by now familiar to most of us. Wright (and others) quotes Ian McHarg's *Design with Nature*[3] in which man's "bulldozer mentality" is traced to Genesis 1 and its alleged "sanction and injunction to conquer nature—the enemy, the threat to Jehovah". We shall have more to say presently about this kind of reasoning; suffice it to note for the moment that such a charge is certainly open to question, Biblically if not also historically.

2. *Modify the Judeo-Christian tradition.* Not all attacks on Biblical theology have come from outside the Christian church. It is significant that Lynn White, in some ways the father of modern discussion of the subject, recognized that the roots of the problem were religious and himself claims to be a faithful churchman[4]. His thoughts on the subject have been reprinted in the *Journal ASA* and the questionable nature of their claim to represent Christian dogma faithfully has already been examined.[5] However, it should be noted that many who claim to follow the Christian tradition are, in one way or another, supporting the contention made by White. A United Church minister in Vancouver recently called for a rejection of Genesis 1 as the basis of a new theology. On a more academic level, Frederick Elder, a Presbyterian minister, in his book *Crisis in Eden*[6], has zeroed in on the so-called "J" account of creation, as contained in Genesis 2:4b ff., with its anthropocentric view of the world, as the real culprit. Elder sees some hope for redemption in the "P" document from Ch. 1 (despite its offensive vv. 26-27), an account in which man is at least placed on some equal level with other parts of creation. Man is at least chronologically last in the "P" version, in opposition to the "J" document wherein Adam is first to appear and he then names the animals (a very significant function in light of Hebrew psychology surrounding the name.)

Elder goes on to divide mankind, and especially theological mankind, into two groups. The "exclusionists", represented by such "traditional" Christians as Harvey Cox, Herbert Richardson, and Teilhard de Chardin, advocate the kind of anthropocentrism of Genesis 2. To them man is king, his technology represents the height of redemption from the old "sacred grove" concept, wherein God and nature were never distinguished, and his dominance of the physical world is but a step in the direction of the ultimate kingdom of

God. Of course, there are major differences among such thinkers as I have mentioned, and Elder would be the first to acknowledge such, but all have in common a view that God has somehow ordained that man shall be the master of nature and, as its despot (whether benevolent or otherwise is debated) does the work of God in subduction of what is basically a godless and hostile entity.

His second group, styled the "inclusionists", represents Elder himself, along with such Christian and marginally Christian thinkers as George H. Williams, McHarg, Rachel Carson, and Loren Eiseley. Theologically he finds roots of the position in Calvin and H. R. Niebuhr, in each of whom there is present that holy regard for Mother Earth that Rudolf Otto has called a "sense of the numinous".

Elder is suggesting that Christian theology must rid itself of its anthropocentrism and begin to see the earth as a self-contained biosphere in which man is little more than a plant parasite (to use McHarg's terminology). He must see himself no longer as "custodian of" but rather a "part of" the environment. Along with this dethroning, or more properly abdication, of the king of the earth, will come a fresh sense of man's worth as an individual, unique in his ability to perceive eternity in various forms of natural history, and set over against a view of man as the collective, the mechanical, the technical master of the world's fate. In short, there must remain in man that mysterious sense of wonder as he stands before the burning bush, though that bush be the heart of a simple seed.[7]

A critique of such a view must consider first whether it is Biblical and second, whether it has drawn adequate and accurate conclusions from the sources it has used. Turning to the second point first, I would contend that Otto's "sense of the numinous" is by no means restricted to persons with a so-called "biocentric" world view, nor is there any real conflict between a truly Biblical anthropocentricity and the concern for ecology Elder sets forth as a goal. Certainly Calvin, for one, quoted by Elder as having an "inclusionist's" sense of wonder at creation, was firmly in the anthropocentic camp when he wrote "as it was chiefly for the sake of mankind that the world was made, we must look to this as the end which God has in view in the government of it"[8]. Although any attempt to see in Calvin the concerns of modern ecology is doomed beforehand, there is still here a valid example of what I should like to show as a Biblical anthropocentrism combined with the necessary attitudes for dealing with today's heightened concerns.

Elder's view has many other problems, but rather than offer a critique of Elder I will suggest a Biblical alternative. Let me say at the start that I am convinced that all talk of man's abdication, of a biospheric world-view, and of a sense of mere equality with the animal and plant world is not Biblical, Christian, or practical. In the appeal to St. Francis of Assisi, in the blur created between man and nature and in the almost personalization of the natural world one senses more than a hint of a pantheistic response. I suggest that, in a Biblical view, nature has a derived dignity as the separate and subordinate creation of a transcendent God. Man has his God-given role as under-Lord, as manager and keeper, and is possessed of a cultural mandate which includes submission of any hostile forces and just as importantly, dominion over friendly forces. In this he is a partner with God who created him and, were it not for the Fall into sin (which Elder and most theological writers on the subject seem to ignore), he might have brought about the kingdom of God on earth and found out the deepest secrets of his biosphere en route.

Our love of nature must be in the context of it as the handiwork of the Almighty and not as some part of God.

BIBLICAL VIEW

God

Any Biblical perspective on ecology must begin with a Biblical view of God. In this sense, a Biblical world-view is really theocentric rather than either anthropocentric or biocentric. Significantly, Genesis 1 begins at this point and I argue that any value system or truth structure without such a starting point must quickly reduce to subjectivity. The very extent to which nature is meaningful, whether in a pantheistic, animistic, or Christian sense, is a derivative of the view of God espoused. The God of the Bible is a God who is there prior to any and all creation. Though He can stoop to converse with his creatures (witness the anthropomorphisms of Genesis 2, to say nothing of the incarnation of Jesus Christ) he is still consistently presented as above and beyond any and all of his works. In a masterful summary delivered on the Areopagus in Athens, St. Paul said of this God that He made the world and everything in it (Acts 17:24). He is the source of life, breath and everything else and He is the determining force in created history, but never can be reduced to any spatial context that man can identify and enshrine. Thus, our love of nature must be in the context of it as the handiwork of the Almighty and not as some part of God (i.e., pantheism).

Such a view is important because it has not always been universally held, and we are in position to examine the results of alternate views. It should be self-evident that such a view of a Creator-God endows nature as well as man with a real dignity, but dignity for nature, at least, can also be derived from pantheism. But what are the implications if we lower God to the level of nature or raise nature to the level of God?

We have a model for this in the Babylonian view of the universe. "Enuma Elish", representing Babylonian cosmology in the 3rd and 2nd millenium before Christ, has the usual pagan pantheon, but the notable fact is that the world was created out of certain gods and each element in the universe furthermore represented the personality and will of a particular deity. Thus, deriving from its view of god, the society came to view nature not as an "it" but a "Thou".[9] Such language, reproduced on a more sophisticated plane, and overlaid with a residual Judeo-Christian world-view, is seen again in many of Elder's favorite "inclusionists", and even Lynn White himself seems to long for the good old days when the groves were sacred.

For the Christian, however, God must be the God of creation. The grove may be perceived as a wonder of order and beauty, but it must never be given the robe of divine dignity. Its meaning to man must be derived from the fact of its createdness rather than its essence. Its mystery must be that God has created it, and given it properties for man to study and marvel at,

but never worship or fear. For the Babylonians no such confidence in the grove existed. It was feared, not appreciated. It was irregular and capricious in its personality, not in any sense the ordered subject of scientific investigation we know today. It possessed a sense of authority, but even that authority was no guarantee against the sudden return of chaos. All of this, which we call cosmology, is clearly dependent on one's view of God, and I can hardly emphasize sufficiently the force and majesty of the Hebrew concept of a dependable and transcendent Creator as presented in Genesis chapter 1.

Nor is the transcendence of God absent in the so-called 2nd account of creation. In Genesis 2:4 we find God again completely in control of His work, creating (lit: "making"; Hebrew *'asah*) the earth and the heavens. No primitive mythology is here; rather there is a God who can be close to his creation and even direct its affairs personally, but who Himself is above it, beyond it and outside it. Again the view of the world is theocentric rather than anthropocentric or biocentric. It is this God who tells Adam to till and keep the garden.

Nature

The "inclusionists" tell us we must rid ourselves of Biblical views of nature and return to a kind of neo-pantheism, a resurrection of the sacred grove, which has to mean some kind of independent element of deity within the natural order. But what is the Biblical view? Is nature a worthless mass of material to be exploited and left to rot as man sates himself in luxury, while trampling underfoot his environment? Some would have us believe that this is the implication in Genesis 1:26-28. Elder attempts to convince us that the Biblical picture degrades nature at the expense of exalting man, but does the Genesis account actually reflect such a state of affairs?

We have already seen in both Genesis accounts that the created order is radically separate from God. Up to the sixth day, with its creation of man, each natural element brought into being finds its meaning in fulfilling a role cast for it in the benevolent order of things. Light dispels darkness and we have day. The firmament keeps the waters separated. The dry land provides a platform for vegetation which in turn feeds all the living creatures. The seas become in their turn an environment for the fish and swarming creatures. The two great lights rule (or give order to) the principle parts of the cycle: day and night. And finally man, as the highest of the created order, serves to keep all of the rest in order, functioning smoothly. In fact, it is in Genesis 1 with its penchant for order and its transcendent and over-arching concept of a purposeful universe, that a truly balanced cosmological system can be found—and this in the very document that is supposed to downgrade nature by its command for man to subdue and have dominion. In this document creation is seen as orderly (note the structure in the chapter), it is repeatedly stated to be good, and it is throughout seen to be serving a great and noble purpose.

In both Genesis accounts, the created order is radically separate from God.

Genesis 2 has relatively little to add, as it is, fundamentally, a treatise on the nature of man and his meaning in the structure. However, contrary again to what we might expect in an "anthropocentric" account[10] Genesis 2 also argues for a healthy respect for environment. Indeed for most ecologists who concern themselves with the Bible at all, Genesis 2 is more palatable than Gen. 1. Here the garden is full of "every tree that is pleasant to the sight and good for food" (v. 9). Here man's mandate is even expressed in more ecologically desirable terms. No longer is he to conquer and subdue, but rather to "till (lit: work) and guard (Hebr:*shamar*, keep)" the treasure entrusted to him. True, its value is cast in terms of its usefulness for man, but at least one tree had a value totally separate from any use man was to make of it. Note however, that Harvey Cox and Herbert Richardson, with their anthropocentric universe, are really closer to the mark here than is Elder and his so-called "biocentrists", though neither has grasped the full fact that theocentrism must precede either second option. Cox and Richardson sometimes lose sight of the fact that it is the garden of God, not Adam, no matter how central Adam may appear in the story.

Further testimony to the value and wonder of nature is not wanting in other parts of scripture. There is the familiar and majestic Psalm 19, "The heavens declare the glory of God and the firmament showeth his handiwork . . ." Add to this the prologue of Psalm 8—"When I consider Thy heavens, the work of thy fingers, the moon and the stars which thou hast ordained—What is man . . ." Or Psalm 104, a marvelous Creation hymn in which nature's beauties are celebrated so graphically, but the whole is carefully set in a context pointing to man's utilization of nature as the real purpose of all its beauty and productivity. The springs in the valleys give drink to the beasts of the field and the earth is satisfied with the fruit of God's creative works. But all is ultimately for the service of man (v. 14) whether directly (as when man drinks water) or eventually (as in the wine and bread made from the plants which drink from the springs). Any suggestion that the relationship is exploitive or that nature is degraded by relegation to a utilitarian function is, of course, nonsensical. It is only when man's greed and lack of appreciation of his own proper role becomes a factor that nature is trampled underfoot. In fact, again nature's real meaning comes from her role in the sphere of created orders, and in her proper role she shines.

One final word should be said on the destiny of the natural world. Biblical theology is well aware that we live in no pristine Garden of Eden and that we are not likely to restore such a paradise, as things now stand. The reasons for this I discuss in more detail presently. But the Biblical writers never lost sight of the fact that God's original purpose for nature was that it should freely reflect His glory in a state of untrammeled beauty. Man was, from the beginning, to be the center of this paradise, and all things were to function in a harmonious relationship to man. Thus, when the prophet Isaiah speaks of the new heavens and new earth, (ch. 65:17) his covenant includes terms for harmony within both plant and animal kingdom: vineyards bear fruit, wolf and lamb feed together and none hurt or destroy in all God's holy mountain. This ideal of a cosmic element in redemption, combining the theme of creation from

There is no such thing for Biblical man as unlimited freedom or unlimited rights.

Genesis and that of redemption from Exodus, is nowhere more pronounced than in the later chapters of Isaiah and is taken up in Paul's letter to the Romans, Ch. 8 vv. 19-25. There the whole creation is seen with an earnest or eager longing (lit: an uplifted head in expectation) for the day when she shall be freed from bondage and obtain liberty to function without her present decay. Just when this shall become a reality, and particularly the relation it has to our own environmental efforts, is not clear. What it does say is that God's purpose for the natural world is not abandoned, and the very "hope" which is here expressed for the natural order should lend continuing dignity to our efforts in the field of ecology. When we work to free nature from some of the effects of man's sin we are upholding that which is "good" in God's sight, and expressing a commitment to a program which will find its consummation in some form of eschatological kingdom of God. That we can never hope to complete the process no more renders the charge futile than does our inability to finally eliminate poverty, racism, broken homes, or disease. In fact, by the demonstration of a Christian concern we are witnesses to the continued expression of God's ultimate purposes in the world.

Man

The key to the discussion lies in a theology of man. We have already sensed that the fly in the ecological ointment is man himself—his greed, his self-centered economic motivation, his desire for the kind of "freedom" which regards any restraints as odious.

For the inclusionists the answer seems to be found in reducing man to the level of nature, in ridding him of this Biblical anthropocentrism where he sees himself as something inherently of more value than "many sparrows". My own, and I think the Bible's, answer lies in quite the opposite direction. Both creation accounts place man at the pinnacle of creation, whether in terms of its climactic event (as in Ch. 1) or its primary intermediary (Ch. 2, in which man is first formed and then completes creation through his naming of the animals). In the former account he is given dominion which separates him from the animals and is thus a primary element in working out the *imago dei* within him. Thus, by his creation, he already represents the highest potential for biological development and we may not, with Loren Eiseley, expect that something greater may yet come along.

As the highest form of the created order, he is to be lord of nature, not part of it. Herein lies the origin of science and technology, and the inclusionists seem at times to be calling for a return to the state existing prior to the neolithic revolution, where man would again take his place as a gatherer and predator, but would abandon his role as organizer, producer, and planner. Such an option is, of course, a practical impossibility, as I'm sure most inclusionists would admit. We simply know too much science and technology, and furthermore we have the brainpower to duplicate the process again, even if rolled back to square zero by some catastrophic event.

But what are the Biblical restraints on man in his lordly role? I think herein lies the key. Herein is the forgotten element in most of human development, and herein is the weakness in any truly anthropocentric world-view. For, as C. F. D. Moule has so cogently pointed out in his small but weighty book, *Man and Nature in the NT*,[11] man is never seen just as lord, but as lord under God. Moule uses the term *vice-gerent* or sub-manager. Man derives his meaning from God whose program, though it from the beginning offered man the kingdom, included a recognition of God's ultimate lordship over all creation and saw man as a responsible steward, not an independent tyrant. Every tree of the garden was given to man, but there were rules. Dominion was given (never, by the way, as a license to exploit) but it was dominion within (as Elder himself does point out) a created order, the violation of which would naturally lead to imbalance and disaster. There is no such thing for Biblical man as unlimited freedom or unlimited rights. His freedom is that of the operator of a beautifully functioning machine. As long as he treats the machine with respect and uses it in a way consistent with the functions and properties of the machine, he may continue to exercise his managerial function with no problems. But when he ignores the rules and decides he can ignore the complexities of his machine and the instructions left by its maker, his freedom is lost and he becomes the destroyer both of the machine and his own function as its lord.

Now man, through his overthrow of the rules (Biblically summarized in Genesis 3) has brought slavery both to himself and his universe. Of course, enough of God's image remains within him so that he can still exercise a powerful technical control and he can for a while appear to be creating a kingdom of his own quite independently of that kingdom promised "wherein dwelleth righteousness". But now the books on the city of man are beginning to be audited, and it appears that this city has one grave and mortal fault. It simply cannot overcome the selfish desires of its own citizens, even when those desires threaten to destroy the whole kingdom.

The options we are given are all insufficient. Ecologists (and Richard Wright) appeal to self-preservation, but existence without meaning becomes a farce. Lynn White, Richard Means and others seem to be calling for man to abdicate his role as king of the world, but this would simply leave the whole process with no government.

I believe the only real solution is to restore to the created order that freedom it lost, by freeing men from their bondage to sin and self and then showing how they, in turn, may progressively set their environment free from the bondage into which it has been placed. This will demand a realistic view of man's problems and perhaps the Achilles Heel of almost all modern theological attempts at solution is that they discuss creation in terms of Gen. 1 and 2, but ignore Gen. 3.

In setting a man free Jesus Christ did not promise an instant return to paradise. Though the head of the serpent has been bruised, thorns and thistles continue to come forth. I do not believe we will ever see a real ecological, or social harmony, until that day when the glorious liberty of the children of God shall become universal for all creation. But let us never forget that, in Christ, we are already free, and we can, despite the weaknesses of the "flesh", began to demonstrate our freedom by applying it to the many institutions of our

social order. Christians have often failed to live as free men (hence the continued presence of race prejudice and materialism among us) but where they have grasped the meaning of redemption (as witness the Clapham Sect in England or the Abolitionist preachers of New England), the effect on their world has been magnificent. The kingdom of God still awaits an eschatological consummation, but this has never prevented citizens of that kingdom from acting out in this kingdom the principles of that other. And the unique Biblical fact is that in some mysterious sense, that new order, the new heaven and the new earth, seem to be a re-creation or restoration of that order we now know! What exactly is the connection I cannot tell, but the very fact of the identification lends tremendous force and dignity to my weakest efforts at freeing this order from its bondage to sin.

REFERENCES

[1]In lectures given at Regent College, Vancouver, B. C., Summer, 1971.
[2]*Christian Scholars Review* (Vol. I, No. 1, pp. 35-40).
[3]Garden City, N. Y.: Natural History Press, 1969, p. 26.
[4]*Science* (Vol. 155, 1967), as quoted in the *Journal of the ASA.* (June, 1969, Vol. 21, No. 2, p. 45)
[5]*ibid.*. 43-47.
[6]Nashville: Abingdon Press, 1970, p. 87.
[7]Much of this terminology comes from Elder's favorite "inclusionist", Loren Eiseley.
[8]*Institutes of the Christian Religion,* Bk. I, Ch. XVI, Sect. 6.
[9]T. Jacobsen in *Before Philosophy* (H. Frankfort, *et al,* eds.), Pelican Books, 1949, p. 142.
[10]Elder, *loc cit.*, p. 84.
[11]Philadelphia: Fortress Press, 1967

The Population Explosion

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In 1951 a Northwestern University centennial program devoted a session to discussing the population problem. Since that time much literature has appeared stressing the dire consequences of the population explosion. This is a problem for science inasmuch as improvement in medical services has reduced infant mortality and increased the life span but has also made available the means for controlling family size. If space and food were unlimited and waste products of civilization could be disposed of in a way to increase soil and stream production rather than to pollute our air and fresh water, the number of people on earth could continue to increase without our concern.

Statistics of Population

The statistics of population are impressive. In 10,000 B. C. the world's people numbered somewhere around one million. By 33 A. D. there were 275 million plus or minus a third. By Mohammed's time, 570 A.D., there was no increase, but by 1650 there were 475 million people which was a doubling of the world's population in 900 years. In 200 more years the population doubled again to reach 1 billion people in 1850. Only 90 years were required to add another billion and 40 years more brought us to the more than 3 billion living in 1971. Estimates of future trends suggest 9 billion people by 2050 A. D.

Consider the situation in America. In 1938 Professor A. Franklin Shull of the University of Michigan listed estimates for the United States, "A population of 202,000,000 may be reached by 1980; or the maximum may be only 138,000,000 reached by 1955 with a decline thereafter to 129,000,000 in 1980 or a population of about 155,000,000 may be attained by 1980." Now we see that the largest estimate was the more realistic. The rate of increase in the United States was 3% in the early days of our Republic, down to 1.2% during the 1920's, only 0.59% in 1932-33, but by 1950-51 it was 1.76%. If it continued during the next twenty years at an average of 1.33% we would have 217,000,000 in 1975. This agrees with figures from the projections of the Bureau of the Census. In 1968 the total reached 200 million for the first time. The census of 1970 revealed a population of 204,675,000. A recent report by a radio commentator gave our birth rate for the 1969 year as the lowest ever. Perhaps this trend will continue. It is

It is especially important that the U.S. population be checked. "In 1966, the United States, with only 6% of the world's population consumed 34% of the world's energy production, 29% of all steel production, and 17% of all timber cut."

A paper presented at the annual ASA Convention at Whitworth College, Spokane, Washington in August 1971.

especially important that the U. S. population be checked. "In 1966, the United States, with only 6% of the world's population consumed 34% of the world's energy production, 29% of all steel production, and 17% of all the timber cut."[1]

In any country the amount of growth in population is a balance between birth rates, death rates, and immigration. We may disregard immigration which is increased in a Hungarian crisis and reduced in a depression. Death rates have been going down. The Metropolitan Life Insurance Company announced that in 1957 the average age at death is the three score and ten mentioned in Psalm 90. Birth rates have been increasing. With static or increased birth rates and a lowered death rate, the total population increases. Mexico, for example, has a birth rate of 42.2 per 1000 and a death rate of 13.3. Such rates will permit a doubling of the population in 21 years.

Why Care?

Why should the U. S. care about the area south of the Rio Grande or on the other side of the earth? The former premier of Pakistan said, "America cannot long remain an island of prosperity in a sea of poverty." President Eisenhower commented, "The economic need of all nations—in mutual dependence—makes isolation an impossibility; not even America's prosperity could long survive if other nations did not prosper." Christians the world over have cared for the underprivileged and endeavored to advance their physical comfort as well as to give them the Scriptures for spiritual comfort.

The world falls into three groups, according to Warren Thompson of Scripps Foundation for Research in Population Problems. The first is Western Europe, North America, Australia and New Zealand. Here low birth rates, low death rates, and low rates of natural increase will permit food and energy reserves to keep up with human needs. A second group is Eastern and Southeastern Europe, Japan, Spain, Brazil, and Argentina. These have moderate death rates, high birth rates, and a high rate of natural increase. This segment will become a larger part of the world's people. The third group represented by India, China, South and Central America already has three fifths of the world's numbers and very high birth and death rates. There is growth in population when subsistence increases and no increase or decline when there are epidemics of disease or scarcity of food. The first group has a good economy, the second will have an improved economy, and the third group will probably increase its members as its means of subsistence increases so their level of living will not be improved. If it were improved, the improvement would be in education, which would make the people aware of their poor lot by comparison with more fortunate countries and could stimulate them to produce the means of waging war in an attempt to improve their economy.

Recall, too, that dissatisfied peoples are likely to listen with sympathy to the promises of Communism. China is an example; Egypt has a treaty of friendship with Moscow. The United States cannot indefinitely make up the difference between satisfaction and restlessness in "have not" nations by means of dollars. The control of population is essential to prevent this social unrest. "Today the population bomb threatens to create an explosion as disruptive and dangerous as the explosion of the atom, and with as much influence on prospects for progress or disaster, war, or peace."[2]

Food Suppliers

Well-fed Americans have difficulty imagining a time when there will not be enough available food. With the government asking whole farms to lie idle and surpluses stored with lack of demand for them, it seems unlikely that America could be headed for famine. Probably we will not reach that extreme state, but there are reasons for thinking that our population is increasing at a more rapid rate than our ability to supply it with both food and energy for its industry. The problem is much more acute in countries other than ours, notably India and China. Furthermore, missionary activity must be accelerated if we are to reach the proportion now hearing the gospel each year or make any advance in winning people to Christ. 165,000 new people are being added to the world each day. Are we reaching that many new hearers each day with the Word of Life?

Man was told in Genesis 1:28 *to replenish the earth. He has done this with remarkable ability, one of the few commands of God which he has fully obeyed!*

"Famines in diverse places" are predicted in Matthew 24. They are inevitable unless mankind can develop a way to balance the increase in numbers of people with more abundant sources of supply. Man was told in Genesis 1:28 to replenish the earth. He has done this with remarkable ability, one of the few commands of God which he has fully obeyed! But will Christians be able to "go into all the world and preach the gospel to every creature" when the population greatly exceeds its present numbers?

How much can supplies be increased? Dr. J. Murray Luck of Stanford University has made an extensive study of this.[3] Only 2 to 3 billion of the world's 36 billion acres are under cultivation, and 6 billions are in pasture land. Any increase in cultivatable land would come at the cost of vast sums "to maintain the stability of such soils, to prevent erosion, and to provide irrigation, or drainage, and fertilizers." Because cattle, sheep, and swine eat about 3 times as much as man, we will eventually reduce their numbers and fortify our foods with factory made amino acids which now come from animal products in our diet. From leaves we may be able to extract our proteins. Fisheries may be extended into the southern hemisphere which now gives only 2% of our fish catch. Bacteria, yeasts, and algae will supply additional foods. But population has increased more rapidly than our improved food sources. "The director general of the United Nations Food and Agriculture Organization was forced to report in 1951, that even though the world's production of food had increased by 9 percent since 1934-38, the population had increased by 12 percent. In consequence, available calories were reduced from 2380 to 2260 per capita per day, and hunger and food shortages increased."

When cultivatable land is increased, the promoters must be aware of the effect of using this land for agriculture upon the value it may have as part of the balance in nature. The provost of Michigan State University, one of our leading agriculture colleges, reminds us that "if the recommended agricultural strategies continue to focus on ever larger areas of the

earth's surface converted to narrow, intensive approaches for maximizing food production and continue to ignore broader ecosystem relationships, we are bound to seriously aggravate the later stages of the 'people-food crunch' whatever its magnitude."[4]

Other Needs

But other needs besides food are intensified with population rise. Dr. Luck mentions fibers used for fuel, clothing, housing, paper and packaging. Probably we shall have sufficient supply during the next century. Synthetics will give us 50% of our needs but sometimes at increased prices.

The equivalent of 10 tons of coal is used for each person in the U.S. for heating, to drive machines, and to run our industrial plants. This is about 9 times the world average. Our consumption of energy-yielding fuels is going up. Between 1940 and 1950 we increased by 50%. Dr. Luck estimated that by 1960 it would become 25% above 1950 and "by 1975 we will be using energy at the rate of over 2 billion tons of 'coal equivalent' per year, which is about that of the entire world at the present time." What is the possibility that our resources will last? Considering coal and oil, our fossil fuel, he says, "It becomes pretty clear that fossil fuels as sources of energy will have almost disappeared by the end of the next century if present trends continue."

Fortunately atomic energy offers some relief. "In our own country there will be at least 1 million kilowatts of generating capacity in commercial atomic power plants by the end of 1960," and much more today. The Argonne National Laboratory maintains that atomic power plants are safe. Someone commented recently, "We are all environmentalists until there is a brown-out." "Solar energy, at fantastic costs, can produce only 2 to 5% of our needs."

We use a considerable quantity of minerals. Most of the good grade ones will have been used up within the next century. Low grade ones offer new supplies but much of our power resources would be used in exploiting them.

Christians have had definite ideas in the past about slavery, alcoholism, crime and war. They need some realistic thinking about this oncoming evil.

The solution offered by Dr. Luck is "found in the maintenance of a very delicate balance between industry and agriculture and by a world-wide reduction in birth rate." The reduction would be accomplished by abortion at the request of a prospective mother, contraception, and decreasing tax exemptions for children. He would give foreign aid only to such countries as would show a program for controlled population. Nor should our country continue to "drain the rest of the world of many of its previous natural resources until we initiate measures to reduce our own rate of population increase."

Optimistic Views

You have noticed that I quoted from an article written in 1957. This gives credit to some of the pioneers in predicting future resources. Moreover recent articles tend to give the same pessimistic picture. However some optimistic attitudes have been published. Consult the one by Thomas Nolan in 1958.[5] He believed that we had reached a state of conservation where a sustained yield was possible. The reserves of petroleum were greater by sevenfold in 1958 than in 1923 but he foresaw that oil would not last forever. Even so he thinks technology will produce synthetic liquid fuels from oil shales, tar sands and low grade coals, subgrade and ultrasubgrade materials will yield metallic and nonmetallic minerals, uranium deposits have been found more extensive than expected; raw materials for our civilization can be obtained for a long period in the future." A 1970 newspaper report by Lester Brown of Overseas Development Council, gives encouraging results on improving grains such as wheat and rice so that Asiatic countries which previously imported cereals may have a surplus.[6] Any improvement is most welcome, but we need to be alert to the predictions of doom given by such authors as Georg Borgstrom in *The Hungry Planet* and the Paddock's in *"Famine - 1975! America's Decision: Who Will Survive?*[7]

Water resources have both diminished and been contaminated, according to recent writers, but again Nolan is optimistic. We may be able to prevent evaporation from surface sources by spreading a film over ponds and reservoirs; research seeks to recharge underground aquifers; and the changing of salt water to fresh water holds promise. Such desalination is the hope of William Pollard, the director of the Oak Ridge National Laboratory, who predicts the world can care for 10 billion people but he thinks we do not have time enough to develop our system. Already on the Persian Gulf and Caspian Sea the Russians are building plants to care for the communities living near the oil fields. Gale Young gives estimates that the cost of fresh water from salty seas is 25 to 36 cents for 1000 gallons. At Key West, however, the present cost is $1 per 1000 gallons. After comparing the costs of water and the amounts needed to grow rice and other grains, Young concludes that "desalination is a fresh water source of broad potential applicability" and "desalination agriculture is in the realm of practical possibility, rather than being far afield."[8] Such results are not considered realistic by several writers from Resources for the Future, Inc.[9] In similar view, Robert D. Gerard of Lamont-Doherty Geological Observatory reports that 57% of the desalination plants cannot produce water below $3 per 1000 gallons and only 5% show costs below $1. He recommends extending intake pipes to a considerable distance off shore to take advantage of the cold water in marine depths, a process which he thinks will cut the cost.

Edward Teller, father of the hydrogen bomb, believes our technology can keep up with our fertility. He writes, "I suspect that ultimately the population of the earth will be limited not by any scarcity but rather by our ability to put up with each other."[10] Teller's words are echoed by Paul F. Sears in his presidential address to the American Association for the Advancement of Science.[11] "In 700 years, if the present rate of increase in the United States continued there would be standing room only, 6 square feet, with 4,646,400 people in each square mile just about 22 generations from now. A little after this the hypothetical human population would weigh more than the planet." At present, Paris has 142,000 per square mile, New York

390,000 per square mile and Hong Kong 800,000 per square mile. Sears states that farm surpluses will be only a memory by 1978. We absorb agricultural land in the U.S. at a rate of some million acres a year. His final words were, "Our future security may depend less upon priority in exploring outer space than upon our wisdom in managing the space in which we live."

Twenty-two years later the presidential address of the American Association for the Advancement of Science had this advice,

> The next step in space must be directed toward the earth. We must turn our newly discovered skills toward the construction of world systems that make the planet earth even better than it now is for the burgeoning numbers of people. We must invent new world technologies. We must commit the resources of space science, directly and indirectly, to the achievement of an optimum balance of man and nature on this magnificent but imperiled planet.[12]

A sample of the attitude of Americans on limiting population size was obtained from a questionnaire given to students and faculty at Cornell University.[13] Although 84% agreed that family size should be limited, yet 65% said it wanted three or more children, only 30% favored two children and 5% preferred one or none. If this is true of Americans at large, then the probability of controlling the population growth is unlikely. It is the American child who uses fifty times more of the world resources than an Indian child does. With 1/6 of the world's population we use 40% of its natural resources and cause 50% of industrial pollution. So controlling the growth in numbers of the affluent is the main problem.

Possible Solutions

What must be done? Education is obviously necessary, not only of the masses through the news media, but even of the collegiate crowd. The Cornell Survey revealed both ignorance about the reproductive system and unwillingness to cooperate in population control.

In Latin American countries many men want large families in order to show their manliness. Futhermore undeveloped countries tend to feel that America wants them to control their population size so that Americans can have a better chance to get the products of the foreign soils and mines and sea than would be available to America if population pressure made it necessary to retain the food and minerals in the foreign countries. Hence America must be the first to slow its population growth before it can expect other countries to accept advice and techniques from us. We have the problem of not only adding to the knowledge of means of reproductive restraint but also of changing the psychology of those who prefer large families.

Suggestions for curbing the population boom include the following programs.[14]

1. Vigorous education about the population problem and its consequences.
2. Widespread information about birth control measures.
3. Legalization of abortion for any who wish it.
4. Invoke penalties for having more than two children per family such as limiting tax exemptions to four to a family and higher school taxes for large families.
5. Provide double exemption for adopted children.

In a comprehensive discussion of solutions, Joseph J. Spengler objects to number 4 (penalties for more than two children) because this would penalize the children. "Means for the rearing and training of these children might be unduly reduced by such a tax." He recommends that the need for large families to give economic support to the parents in old age could be replaced by a social security system in underdeveloped countries. Promised benefits could go to those with small families. Even a bonus could be given 20 years after the birth of the first child if no more than the target number of children had been produced. He also suggests threatening those with large families with "not sharing in retirement benefits upon reaching age 65 if the number of living children should be excessive."[15]

Paul Ehrlich, whose book, *The Population Bomb*, was a best seller, recommends sterilizing capsules for women which would be removable, and introduction of sterilizing chemicals into food and water. These chemicals could be counteracted if reasons for reproduction were desirable. Lawrence Slobodkin, head of the Department of Ecology at the University of the State of New York at Stony Brook advocates giving girls equal pay for equal work so they need not have baby production as a career. Also child care centers for working mothers would encourage them to give up having more children. He cited Ireland and Sweden where social reforms have resulted in very little population growth. Slobodkin feels that Paul Ehrlich is vocal for the catastrophic school and doing a disservice to his cause.[16]

Christian Attitudes

What are Christian attitudes? Christians oppose abortion,[17] are divided in attitudes on birth control, but certainly can be foresighted enough to realize that a population spiral upward is not desirable. Said Robert Cook in the Bulletin of Atomic Scientists, "The population bomb is as great a threat to mankind as the nuclear bomb. Fortunately its fuse is longer." Christians have had definite ideas in the past about slavery, alcoholism, crime, and war. They need some realistic thinking about this oncoming evil.

The ultimate solution does not lie with man. Dr. Luck believes "that man, in the wisdom with which he has been endowed, will continue to triumph in the never-ending struggle to sustain the individual and the species." But Christians are confident that Christ will return to earth to reign in righteousness and give the final solution to the problems that man has brought on himself. In the meantime we can favor those trends that ameliorate the living conditions of our nations.

REFERENCES

[1]The Population Crisis: Rising Concern at Home, Luther J. Carter, *Science*, 7 November 1969.

[2]*The Population Bomb*. Hugh Moore Fund.

[3]*Science*, 1 November 1957.

[4]John E. Catton, *Science*. 19 December 1969.

[5]Use and Renewal of Natural Resources. Thomas B. Nolan. *Science*, 19 September 1958.

[6]Desalted Seawater for Agriculture: Is it Economic? *Chicago Daily News*, January 9, 1970.

[7]Georg Borgstrom, Collier Books. New York, 1967 and William and Paul Paddock. Little Brown and Company, Boston. 1967.

[8]Gale Young. *Science*. 23 January 1970.

[9]Marion Clawson, Hans H. Landsberg, Lyle T. Alexander, *Science*. 6 June 1969.

[10]*Science*. 19 September 1958 in article by T. B. Nolan.

[11]The Inexorable Problem of Space, Paul B. Sears, *Science*, 3 January 1958.

[12]After the Moon, the Earth. Walter Orr Roberts. *Science*, 2 January 1970.
[13]Editorial, *Science*. 23 January 1970.
[14]G. Bruce Lemmon, M.D. *American Medical News*. January 12, 1970.
[15]Joseph J. Spengler. *Science*. 5 December 1969.
[16]In a speech at National Audubon Convention, Seattle, May 16, 1970.
[17]Kenneth J. Sharp. *Christianity Today*. June 4, 1971.

Christian-- It's Your Environment Too

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How should the Christian and the Christian community relate to the current and impending environmental crisis and the environmental movement? Scripturally, three points of emphasis should guide each of us in answering that question.

1. *The disrespect for and degradation of the environment is a direct manifestation of man's sin, man's rejection of or separation from God; which creates disharmony with God, hence disharmony with nature (our environment) a product of God (Psalms 24:1 and Genesis 3).*

2. *Man is commanded by God to have dominion over and be a responsible steward of God's creation, which, of course, must include the presence and functioning of both living and nonliving components of nature (our environment) (Genesis 1:1, 29, 30, 28b, 31a and 2:15).*

3. *In the New Testament we are told that our bodies are the Temples of God (I Corinthians* 3.16, 17); *hence we must protect and take care of that possession of God. Many scriptures command us not to subject ourselves to moral pollution and the danger of certain other harmful things entering our bodies (Temples of God). We should be equally concerned about what the body enters, moves, and lives in; hence we need to maintain a quality external environment, as well as a quality internal environment, if we are to "present our bodies a living sacrifice, holy and acceptable to God" (Romans 12:1). Since these scriptural admonishments, plus many others, compel the Christian to get involved in the battle for a quality environment, several suggestions of action are given. As evangelical Christians and concerned citizens of society, we cannot ignore this social issue, in which God even promises rewards, if we do our part (II Chronicles 7:14).*

Why Get Involved?

Why should a Christian get involved in the current crusade for a quality environment? Is there a Christian perspective on the environmental crisis? Can we apply a Christian-based purpose or purposes to our participation in the environmental movement, in addition to the well-founded reasons established by other influential elements of our society? As Christians, are we obligated, for some reason or reasons, in addition to being well-informed, concerned citizens of society, to get on the environmental bandwagon? Is there any unique reason or reasons that would compel the Christian and Christian community to participate actively in this issue of common concern? Or can we justifiably get involved or ignore the movement according to our own personal dictates rather than because we are Christians? All of these questions say the same thing, only in different ways. How should the Christian and Christian community relate to the environmental movement?

Scriptural Prediction

We all recognize that it is abundantly predicted in Scripture (Matthew 24, Mark 13, Luke 21, Ezekiel 36-39, Daniel 11 and 12 and the book of Revelation, among others) that there will be an end time, an end of the age as suggested in, among many others, Matt.

28:20b, II Tim. 3:1, Matt. 13:40, and II Peter 3:7. According to Scripture then, the eventual destruction of the world and man is inevitable. Certainly some of the environmental events of today make the seemingly symbolic language of eschatology (doctrine of end times) appear almost realistic now. Consequently we could easily view the increasingly accelerated deterioration of the environment as part of the process of end times. Therefore, why worry or fight it? Such an attitude of indifference ("so what", "I told you so") should not characterize Christians at this critical moment in history, when all others cry out for clear-cut guidelines and goals. If our witness for Christ and His claims is to be effective, we had better get into the environmental fight or else we'll justifiably earn a stigma for our generation of Christians that condemns us for deliberate inactivity and indifference toward a serious social need that involves all human beings through the quality of the environment in which we live and have our being. In the long run, according to God's time table, our efforts may not save the existing world, but we can still save souls for an eternity, which is supposed to be our primary responsibility as confessing Christians (Matt. 28:19, 20, Acts 1:8).

Secondly, we must avoid being sensitive and defensive about Genesis 1:26-28. Because individuals in the non-Christian world, which comprises over three billion people, chose to appropriate these verses, construe the translation or interpretation of them to meet their purposes, and then apply them to the total worldwide environmental situation does not mean that the entire cause of the crisis need be blamed on our Judeo-Christian heritage. In modern jargon, such an approach is a copout by those who haven't guts enough to recognize and admit their part in a worldwide problem, not necessarily confined to the erroneously labelled Christian nations of the western world. God deals with and saves individuals, not nations. Of course, we recognize the basic cause of the crisis can be explained with the uniquely Christian concept of sin, but the crisis has developed because we have failed as Christians and not because Christianity has succeeded, as charged by many writers. We have failed to evangelize the world as commanded, hence the majority of people are out of harmony with God, which contributes to disharmony with nature, and the environment is abused a result.

Scriptural Basis for Involvement

Why should you get involved? There are several Scripturally based reasons why you should, both as a responsible citizen living in this world and as a Christian preparing for a better world. This paper touches briefly upon only two of the main underlying thoughts that recurred throughout the 1971 ASA Convention, "Man and the Environment," and then emphasizes a scriptural directive that uniquely should compel us as Christians to speak out and work for a quality environment. We hear enough about the seriousness of our current environmental situation and the dire portent of things to come, much of which is true and well documented, though we may question the manner in which the situation is presented. We do need to hear more about what we, as individual citizens and as Christians, need to do as far as our attitudes and actions are concerned, instead of waiting for some massive miraculous governmental involvement.

1. No one can deny that our current and impending environmental crisis is a manifestation of man's sin, man's rejection of or separation from God; which creates disharmony with God, hence disharmony with nature, a product of God (Psalms 24:1). As the Genesis 3 account reveals, the first God-conscious man in the Garden of Eden chose to disobey God; consequently, thereafter man was an egocentric creature alienated from God. Hence sin was born. As a creature separated from God, man is self-centered, selfish, and greedily in pursuit of self-gratification, all of which contributes to a lack of respect for the environment, God's handiwork. The ultimate solution, of course, is to get into harmony with God through the redemptive act of Jesus Christ (I Cor. 15). Through this step of faith (Eph. 2:8) comes the recognition of a Christian's responsibilities, including respect for God and the environment he provides; and hopefully, a concern to protect it.

An attitude of indifference should not characterize Christians at this critical moment in history.

2. Certainly man is directed by God to be a responsible steward and caretaker of the natural heritage (Genesis 1:29, 30, 28b, 31a; 2:15). A thorough study of Scripture reveals that nothing is man's, yet man treats the natural heritage as if nothing is God's. Since the Bible tells us in Genesis 1:1: "In the beginning God created . . ." and continues to relate the events of creation, then man must recognize that what is here, including the functioning of nature, is a manifestation of God the Creator. Consequently, man cannot continue to ignore or violate the laws of nature (as laws designed by God for the functioning of his creation) by abusing the environment without facing some serious consequences. Man has lost sight of this relationship of God's role as Creator and man's responsibility as steward, hence another contributing factor toward environmental degradation. An intermediate solution is for the Christian community to incorporate this relationship in its entirety into its philosophy and then translate it into meaningfulness for the non-Christian community. Then all of us must recognize and appreciate our environment in this relationship as part of our respect for and worship of the Creator, which in turn should motivate us to protect and preserve the environment as part of our stewardship.

New Testament

These previous two points are well established and well defined Old Covenant understandings for the Christian, but what is our New Covenant responsibility in relation to the environment? How does the New Testament relate man to the environment?

Christianity has always been in an environmental battle, whether we realize it or not. Christianity's basic objective is to make the individual right with God by cleansing the soul of man through the blood of Jesus Christ (Titus 2:11-14, 3:5-7). Redemption is nothing more than saving the entire man for eternity (I Thess. 5:23, I John 5:13); this producing a cleansed internal environment acceptable to God (II Tim. 2:21).

But what about the external environment in which

that man moves, lives, and has his being? Are we not told in I Cor. 3:16, 17: "Do you not know that you are God's Temple, and that God's Spirit dwells in you? If anyone destroys God's Temple, God will destroy him, for God's Temple is holy, and that Temple you are." Christians accept the fact that we are created and sustained by God (Genesis 1:27, 2:7), and we accept the same claim for nature, which is actually our environment (our surroundings, which includes both living and nonliving components). Since we believe that the environment is of God as man is, doesn't it also need cleansing or saving, as much as the man who lives in the environment needs cleansing or saving? In Numbers 35:33a and 34a it states that "You shall not thus pollute the land in which you live . . . You shall not defile the land in which you live . . ." Let's look at this holy Temple, which we are, and the environment in which it exists; and in turn analyze how we use, abuse, or misuse this holy Temple by the way we treat our environment or let our environment treat us.

We as Christians are greatly concerned about moral pollution, and rightly so. Material in magazines, books, movies, TV, situation ethics and other sources enter our body through our senses and pollute the mind, thus affecting this Temple of God. Paul tells us in I Cor. 6:18-20: "Shun immorality." In II Tim. 2:22 we are told "So shun youthful passions and aim at righteousness, faith, love, and peace, along with those who call upon the Lord from a pure heart."

What about some of the other forms of pollution (or contamination) that enter our bodies about which we are concerned? Think about the three most obvious ones that have been with man for a long time, and then reflect on how each of us (and the organized church) feels about the use of tobacco, or alcoholic beverages, or even gluttony? We are even Scripturally admonished to avoid excesses of the last two (Proverbs 23:19-21a). If we expect these things to harm this Temple, then why not other things like pollutants that enter our bodies through the air, water, food or other ways (radioactivity)? For the most part, we do not permit these pollutants (or contaminants) to enter our bodies (the Temple of God) intentionally or deliberately, but they can be equally as harmful as excesses of tobacco or alcohol or food. So if we are going to protect this Temple of God and ". . . present our bodies as a living sacrifice, holy and acceptable to God . . .", as commanded by Paul in Romans 12:1,

A thorough study of Scripture reveals that nothing is man's, yet man treats the natural heritage as if nothing is God's.

Christians must, by Scriptural dictate, get into the environmental battle, consciously and conscientiously. We must do all we can to protect the Temple of God from the very same harmful substances causing environmental pollution. We, as Christians, have a great concern about what enters the body, so we should be equally as concerned about what the body enters. The external environment of the Temple of God (your body) is as important as the internal environment of that same Temple. A body entering and existing in a polluted environment, intentional or not, is being subjected to desecrating substances as much as the body that permits undesirable material to enter the internal environment; whether it be the mind, the spirit, or the physical functioning body itself. Consequently, the New Testament teaches us that the body is the Temple of God and that it must be protected against internal and external contamination (pollution). Therefore, Christians are compelled to be involved in the quest for a quality environment for all people. Dr. Sherwood Wirt, editor of *Decision Magazine* and author of *Social Conscience of the Evangelical,* writes in that book,

> Christians who think of themselves as stewards of the mysteries of grace are, by the same dispensation, stewards of the realities of earth. Their search for a "better country" in heaven does not justify their littering or spoiling this one while they are here—or allowing others to do so if it is possible to stop it.

How About You?

As a Christian: Are you really concerned about the environmental issue? About what kind of stewards we are? How we care for the Temple of God entrusted to us? And the environment in which that Temple exists?

If so, and if this paper presents a clarion call to action, what must each of us do? In general, there are eight categories of action, called the big E's of Environmental Quality, which must be pursued collectively in order to achieve a quality environment.

1. *Enlighten* by informing. Be concerned enough yourself to get informed and then help others become aware of the need to protect the environment. This step helps create concern, which, of course, is essential if any further steps are to be pursued.

2. *Educate* through the schools. Be insistent that environmental topics be considered in the curriculum at all levels so students gain an appreciation for the value of a quality environment. This step helps change attitudes, which, of course, is essential if any modifications in life style are to be achieved.

3. *Enact* legislation. Be persistent in encouraging governmental authorities to produce reasonable realistic regulations protecting the environment and us from environmental abuse. This step serves to coerce environmental abusers into realizing that we recognize their contribution to the problem, which, of course, is essential if any prevention is to be achieved.

4. *Enforce* regulations. Be diligent enough to see that environmental users are obeying the law rather than ignoring or abusing it; even if this step requires courtroom action and penalties. This step compels compliance, which, of course, is essential if any meaningful results are to be realized.

5. *Entice* anti-pollution investments. Be realistic enough to realize that financial encouragements through such provisions as tax relief stimulates participation in the campaign for a quality environment. This step helps develop cooperation from all environmental users, which, of course, is essential if meaningful progress is to be initiated.

6. *Emphasize* the wisdom of cleanness. Be consistent in showing that it is more economical and healthier for all of us to live in a clean environment rather than a polluted one. This step hits us in the pocketbook, which, of course, has a profound influence on our attitudes and actions, which are essential to stimulate a community endeavor toward correcting environmental problems. The statistics substantiating this

We as Christians have a great concern about what enters the body, so we should be equally as concerned about what the body enters.

step are astounding and validate the merit of it. There are numerous documented examples, but the following two were taken from *Controlling Pollution, The Economics of a Cleaner America,* edited by Marshall I. Goldman and published in 1967 by Prentice-Hall, Inc., as one of its Modern Economics Issues. Pittsburgh, Pa., spent $200 million to clean up its air pollution and the first full year after completion of the project $26 million was saved in medical, household, cleaning, replacement, and similar types of expenses caused by pollution previously. Secondly, people living in a polluted area spend $200 more per person on those kinds of expenses than people in nonpolluted areas, and they live shorter, less healthy lives.

7. *Envision* wisely by planning ahead. Be sensitive to and demand controls on developments by environmental users that tend to abuse the environment through inadequate planning and safeguards. In fact, our present pollution problem could be cut in half by just employing the technology we now have. This step of anticipation requires foresight, patience, perseverence and planning; which, of course, is essential to prevent problems and to provide proper protection for the environment because our environment and our lives are at stake, too.

8. *Each* of us get involved. Be an example by teaching and practicing what each of us recognizes as necessary things we can do to preserve the quality of the environment where we are. Many books are available on this step, but probably one of the more readable and helpful ones is *Everyman's Guide to Ecological Living* by Greg Cailliet, Paulette Setzer, and Milton Love, sponsored by the Santa Barbara Underseas Foundation and published in 1971 by the Macmillan Company. This step gives us something positive to do to help conquer a social problem through individual cooperation and participation, which, of course, is as essential as stimulating the institutional machinery of our society into action.

Dr. Wirt in his book says,

> The challenge to the evangelical is not to seek some esoteric panacea of his own, but to put his shoulder to the wheel and get into the struggle as a working member of the 20th century society. He has a contribution to make; in the name of the Lord, let him make it!

All of this effort should help us, as Christians, to develop concern, care, caution, and a can-do-it attitude. We've got to do it (environmental degradation) in before it does us in, or else man will write the last chapter of Genesis sooner than necessary.

Genesis . . . Last Chapter

In the end,
There was Earth, and it was with form and beauty.
And man dwelt upon the lands of the Earth,
The meadows and trees, and he said,
"Let us build cities" and covered the Earth with concrete and steel.
And the meadows were gone.
And man said, "It is good."
On the second day, man looked upon the waters of the Earth,
And man said, "Let us put our wastes in the waters
That the dirt will be washed away."
And man did.

And the waters became polluted and foul in their smell.
And man said, "It is good."
On the third day, man looked upon the forests of the Earth
And saw they were beautiful. And man said,
"Let us cut the timber
For our homes and grind the wood for our use."
And man did.

And the lands became barren and the trees were gone.
And man said, "It is good."
On the fourth day man saw that animals were in abundance and
Ran in the fields and played in the sun.
And man said, "Let us cage these animals for our sport."
And man did.

And there were no more animals on the face of the Earth.
And man said, "It is good."
On the fifth day man breathed the air of the Earth.
And man said,
"Let us dispose of our wastes into the air for the winds shall
Blow them away."
And man did.

And the air became filled with the smoke and the fumes could
Now blow away.
And the air became heavy with dust and choked and burned.
And man said, "It is good."
On the sixth day man saw himself; and seeing the many languages
And tongues, he feared and hated. And man said,

"Let us build great machines" and the Earth was fired with the rage of great wars.
And man said, "It is good."
On the seventh day man rested from his labors and the Earth was still for
Man no longer dwelt upon the Earth.
And it was good.

(*Courtesy of Kenneth Ross,* Idaho Wildlife Review, *May-June,* 1967).

Eight categories of action: Enlighten, Educate, Enact, Enforce, Entice, Emphasize, Envision and Each get involved.

Such a cataclysmic early end can be avoided, or an early end of the age delayed, if we act aggressively and positively as evangelical Christians. Even God assures us of that in II Chronicles 7:14: "If my people who are called by my name humble themselves, and pray and seek my face, and turn from their wicked ways, then I will hear from heaven, and will forgive their sin and *heal their land.*"

(*Note: All Scripture quotations are from the Revised Standard Version.*)

The Engineer, the Consumer and Pollution

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The relationship between the techniques of the engineer, the demands of the consumer, and the capacity of nature to dispose of wastes requires careful scientific analysis before realistic solutions to pollution can be found.

It is the duty of the engineer to minimize the depletion of natural resources, to optimize re-cycling processes, to consider side effects of technical proposals and thus to control and develop the resources of nature for the use and benefit of a maximum number of people. Only by rationally developing practical solutions and realistically following optimum priorities will man prevent waste disposal from causing an ecological catastrophe.

It is the engineer who develops technical solutions, but it is the consumer who must pay for them. By deciding where he spends his earnings, the consumer ultimately determines what goods are produced and services rendered and how much they effect the environment. The consumer who holds the value of material goods and natural resources in perspective should be willing to pay his share of pollution control costs. Such a responsible perspective, however, is possible only when man enjoys a proper relationship with the Creator.

Consumer Wants

To satisfy the basic necessities in life and the compulsion in man to accumulate material possessions and power, engineers have controlled and developed nature's vast resources of materials and energy for the use and benefit of mankind. As new sources of raw materials and energy were discovered and ingenious methods, machines and processes developed, making man more affluent, his urge to accumulate material possessions increased. Realizing the great potential of this urge, marketing and sales organizations fostered and nurtured man's desire for goods and services in order to sell more and thereby reap a larger profit.

The desire for more and more material goods led to an emphasis on quantity and looks rather than on quality; reliability and endurance began taking second place to low price. Throw-away items replaced reusable containers and repairable gadgets. Built-in "obsolescence" was a natural consequence; if people wanted the latest model and were too lazy to have an article fixed, why not reduce the price of the item by designing only for its expected life? Heavy duty models would serve the professional who requires durability, and the limited duty models would serve the casual user who needs the item only occasionally and so does not want to pay the price of a durable model.

The engineer's role in this scheme was to minimize the prime cost of an article by technical breakthroughs, cost reduction techniques, and more efficient processing. The salesman's role was to maximize the distribution of the article, decrease the unit cost through volume sales and thus increase the profit or decrease the selling price. In this way business firms increased the availability of a product for their benefit and their customers, since even the low wage earner could now afford some luxury goods.

The need to satisfy the drive towards accumulating wealth and material possessions also became evident in the desire for higher wages. Most often a raise was demanded by the worker without a corresponding increase in productivity on his part. Through ignorance or indifference, he failed to accept the fact that the price of articles is determined by the sum of the earnings or wages of the people directly or indirectly associated in any way with the article. Ultimately, only an increase in productivity can increase earnings or decrease prices. Otherwise, a wage raise must be offset by a price hike. Price hikes, in turn affect international transactions. Without a corresponding increase in the purchasing power of the country importing the goods, a price increase reduces sales and therefore fewer articles will be produced.

To maintain a high export volume, which incidentally also benefits the local consumers by giving them lower priced articles, it is necessary to maintain low prices. Fringe benefits and unproductive expenditures must therefore be kept at a minimum. Some unproductive expenditures which have traditionally been avoided are the costs incurred in converting waste materials into biodegradable or harmless forms, or disposing of them in safe containers.

The capital investment required to install and operate pollution control equipment is often a significant proportion of total production costs. In a highly competitive field there is often only a slight profit margin so that the additional expense of purchasing and operating pollution control equipment would bankrupt the company.

Pollution control costs must be added to the cost of the goods produced or the services rendered. These additional expenses have the effect of decreasing the purchasing power of the consumer and thereby reducing the volume of goods on the market. This holds true no matter who provides the cost outlay initially—be it the government, the company directly involved, or the consumer. Ultimately the buyer pays for all unproductive as well as productive expenditures.

Along with the affluence made possible by innovations, cost reductions and high productivity, came prodigality and indolence. Lost was the true value of goods and services received. Clothes were discarded without being worn out. Leftover food was thrown away. Containers were not reused. Overpowered cars were bought for appearance, not function. Unneeded lights were left on. Affluence had distorted and diminished the value of goods and work. People had become lazy.

The natural desire for material possessions and the necessity of making a profit were not the only factors leading to the indifference towards an improper use of nature. Contributing to pollution was the emergence of the impersonal corporation. In the old family firm there usually existed a personal approach and a personal responsibility in the activities and reputation of the company. The few people in control of the firm were usually content with a reasonable level of affluence.

The mammoth corporation, with many shareholders to satisfy, is insatiable and amoral. Whereas a million dollars profit is a large income for one extended family, it is a small income when divided among a thousand shareholders. The necessity of showing a large profit, which is never enough, may cause the directors to make decisions collectively which are contrary to individual convictions.

The establishment of some mining or manufacturing companies is often based on marginal appraisals. If unproductive expenditures for pollution control equipment were necessary, the promoter could not project a profit and therefore his shares would not sell. Consequently, provisions for environmental safeguards are few and possibilities for the misuse of nature are many.

Consumer Over-reaction

It is obvious that our culture has chosen pollution as the crisis of the decade. The destructive potential of arsenal satellites each with clusters of H-bombs orbitting a few hundred miles above our major cities, ready to disperse death and destruction within minutes, is not at present considered as significant as pollution. But, what is not clear at the moment is whether "ecology is an old science, a new religion, or a fad which will go to join the technocracy of the 30's in history's museum of naive and outmoded ideas."[1]

Ultimately the buyer pays for all unproductive as well as productive expenditures.

In creating an awareness of the problem even biased information has been valuable. Impulsive action based on misinformation, however, can be dangerous. But now that the pollution problem has been exposed it is necessary for man to act less emotionally and to support the development of scientific solutions. If action is initiated before scientific solutions are available, the "cure" may cause more damage than the problem. An example of this is the ban on DDT. Because of a sudden public emotional desire for action, the use of DDT was banned and the balance of nature again changed. Gypsy moths, formerly controlled by DDT, now threaten to destroy much of the hardwood timberland in a belt spreading from New England to Pennsylvania and Maryland[2]. In a few more years the pests will probably be controlled biologically by breeding sterile moths. Meanwhile, the ban on DDT is causing foresters great concern.

Consider also air pollution. Emissions from industrial plants and cars can be registered on an air quality or mass level basis. Figures presented by Robert F. Sawyer show that

> On a mass, or ppm (part per million), basis the motor vehicle is responsible, as of 1965, for 61% of pollutants, with industry responsible for 16% and powerplants for 14%. Taken on an air quality basis, a more legitimate scale according to Sawyer, we find that motor vehicles are responsible for 12%, industry for 37% and powerplants for 36% of our bad air.[3]

The importance of basing priorities on a proper comparison is obvious.

Social benefits of technology have a price tag attached. The initial social benefit usually costs very little but refining the benefit costs increasingly more. Take air pollution from automobiles as an example. The cost of reducing pollution emissions of the early 1960's by 50% was less than $20, while a reduction of about 80% cost $80. Further reductions will be increasingly expensive. Heinen[4] estimates that an outlay of about $110 per car would cut hydrocarbon emissions by 88%, carbon monoxide by 76% and nitrogen oxides by 66%. To meet the 1975 U.S. standards (reduction of hydrocarbons by 98%, carbon monoxide by 97% and nitrogen oxides by 90%,) cars could cost $500 more and increase gasoline consumption by 10-25%[5].

These figures show the costs as a function of air quality based on a reduction of hydrocarbon emissions. Extrapolating to the proposed 1980 U.S. exhaust emission standard indicates that the cost of pollution control then will be as much as the car itself costs at present.

Besides increasing its price, more restrictions on the engine decrease the practical utility of the automobile. Already the power and fuel economy of cars have been decreased and engine adjustments have become more

critical. As the number and severity of the restrictions increase, the usefulness of the car decreases and the law of diminishing returns catches up very quickly. This means there is an optimum number of restrictions for the greatest social benefit. A completely exhaust free car, for example, would be prohibitively expensive and would probably have to be built like a tank to safely carry all the equipment, chemicals and controls necessary. It is possible to build a one horsepower pollution-free car using a thermo-electric convertor powered by solar energy, but who wants to drive only when the sun is shining?

Obviously a compromise is necessary. The consumer must decide what price he is willing to pay for a healthier environment. Ultimately the cost of pollution control devices and processes must be born by the consumer. The workers, shareholders and governments cannot bear the costs for very long before passing them on to the consumer. In cases where the by-products which are removed in controlling emissions become a source of income, sometimes even exceeding the cost of the emission control equipment and its operation, the consumer of the by-product helps meet the cost of pollution control.

The necessity of providing pollution control devices reduces individual freedom. The privilege of spending earnings freely is being restricted as governments collect a larger portion of the public income for environmental engineering such as sewage treatent, garbage disposal and urban transportation. The versatility of certain products and services is affected when the number of technological constraints they must meet is increased. Society has already dictated that certain restrictions such as regulated rubbish burning, noise suppressors and exhaust emission controls be accepted by the individual in the interest of the group as a whole.

Often government action is necessary because individual motivation is lacking. A recent study by General Motors showed that individuals are reluctant to have a pollution-control kit retrofitted to existing automobiles. In a limited test market a major advertising campaign to encourage individual owners to install a $20 kit to reduce exhaust pollution by 50% cost G.M. $100 per kit sold.[5] Individuals must either freely sacrifice some earnings for the benefit of society or else governments must step in and make pollution controls compulsory.

Christian Responsibility

The basis of Christian ethics is man's individual responsibility towards God and man. Each person must account for his actions and attitudes. The individual is to exercise responsibility in his God-given dominion over nature. If this dominion continues to be misinterpreted as exploitation, an ecological catastrophe could result as punishment for man's sin.

Social benefits of technology have a price tag attached. . . . The consumer must decide what price he is willing to pay for a healthier environment.

The Christian engineer, therefore, must be aware of the consequences of his actions. He cannot blindly fulfil his technological functions and ignore their moral consequences. The decision he makes as an engineer in industry is simultaneously made as a human being in society and as a son in God's family. The Christian premise is that the secular and the religious spheres are one. The Christian must act with a sound mind and a compassionate heart. In a society where ecology has been adopted as a popular religion, and where individuals are easily motivated to mob action by fear and hatred, the Christian engineer must be technically knowledgeable, socially aware, and rooted in fundamental Biblical truths.

The first responsibility of the engineer is to examine himself and his motives. Without a cleansed life he cannot act on the highest motives. A spiritual life along with technical abilities are credentials necessary for validly understanding problems and proposing feasible solutions.

The action undertaken to avoid an ecological dilemma should be based on rational principles.

1. The value of nature for man is in its potential to benefit and satisfy him. The power man has over nature carries with it a responsibility for thoughtful stewardship. Property is necessary and good but held in trust, to be used under God for the benefit of all.
2. Man grows to full status in his responsibilities to others, toward nature and to God through personal involvement in various natural groupings such as family, neighborhood, school, job and worship.
3. What is natural is not necessarily good and what is divine is not necessarily in accord with man's laws. Man's compliance with secular authority is not to be in conflict with divine revelation.
4. Laziness and waste are sins before God, no less than selfishness, greed, envy and lust.[6]
5. God has a definite plan for each individual. Finding that plan through the confession of sins and acceptance of Christ as divine restorer brings freedom from fear, true purpose for the existence of man and nature, and a divine perspective for intelligent action.

Christian Response

These principles should affect attitudes toward the control of nature and the disposal of wastes.

1. The accumulation of material goods should not be the main goal of people whose basic needs of food, clothing, shelter and security have been met. Instead, people should seek spiritual and social goals, keep nature beautiful and use durable goods. This preference for durability would create the need for an entirely new group of high or medium quality products.
2. People should not become indolent, wasteful, litterbugs but use their time creatively.
3. Motivation for action should be based not on fear but on the desire for responsible stewardship.
4. It is not yet time to relax when politicians have found the "courage" to compel the whole country to use pollution control devices and to ban man-made "poisons" such as cyclamates and DDT, despite great commercial pressure. Considering the evidence that led to the hasty ban on cycla-

The Christian engineer cannot blindly fulfil his technological functions and ignore their moral consequences.

mates, Gerald Leach writes in *The Observer:*

> The only conceivable explanation for this extraordinary saga is that the government and its advisers were pressed too hard by mounting public fears that we are all being slowly poisoned by food additives, pesticides and the like. When a convenient scapegoat came along, they threw it to the wolves to keep them quiet.[7]

Another convenient scapegoat was the United States automobile industry which will be required to install expensive emission control devices on all cars, irrespective of where the cars are to be used. It makes little sense to compel the farmers of the Dakotas to purchase the same $500 device which the commuters in Los Angeles need.

5. It is the Christian engineer who can and must sort out symptoms and causes, and offer solutions and judgments. For modern man's viewpoint in a post-Christian culture is, as Francis Schaeffer contends, "without any categories, and without any base upon which to build."[8]
6. Engineers must be concerned with ways of meeting human needs by conserving depletable natural resources and by optimizing the recycling of waste materials. Long term side effects should be considered and analyzed.
7. Engineers will find new usefulness in moderating the interaction between the individual, society and technology. To develop what he calls the "technological morality", Phillip Meyers suggests three types of group activities for engineers:

   a) Provide qualified, unbiased group judgment on technological costs and thus indirectly on technological feasibility.

   b) Provide qualified, unbiased group judgment and evaluation of proposed national policies involving technology and of the action or lack of action by government agencies charged with overseeing and executing the technological aspects of government policies.

   c) Educate the lay public (including public officials) in a factual, unbiased manner on the technological problems and judgments facing our society.[9]

8. Those who have not made the wonderful discovery of a personal God and are therefore often compelled by fear must be shown the way to achieve freedom, worthy goals and a new perspective. It may be that more Christians will dedicate their lives to sharing their Christian experiences. Many non-Christians are dedicating their lives to a search for solutions to poverty, education, bigotry, congestion and pollution. But the elimination of the pollution of the human mind and heart must be accomplished before society can properly chart a course for the elimination of environmental pollution.

Conclusions

In regard to pollution, it is the responsibility of the Christian engineer to

1. Be a conscientious, diligent professional.
2. Share his Christian experience to bring man into a proper relationship with God and so give perspective to the ecological crisis.
3. Understand conditions and causes of pollution and develop solutions and provide judgments on their technological feasiblity and and costs, educate others and embark on a reasoned course of action based on proper priorities.

It is the responsibility of the consumer to:

1. Demand, and be willing to pay for the necessary pollution control devices on products purchased and on the factories and equipment producing the goods and services used.
2. Act intelligently to help solve existing problems at the opportune time.
3. De-emphasize the competitive accumulation of material goods and substitute more worthy goals for the benefit of mankind.
4. Be diligent, not wasteful and value work.
5. Praise the Lord.

REFERENCES

[1]Angus MacBeon quoted by Mark Wilson "Ecological Zeal Decried", *The Province,* Dec. 2, 1970.

[2]Bob Stedfeld, "The Gypsy Moth", *Machine Design,* No. 12, 1970, p. 131.

[3]"Just Between Us", *Gas Turbine International,* March, April 1971.

[4]"How Clean a Car and How Soon?", *Life.*

[5]Sumner Alpert, "The Engineer & Society, New Challenges–New Responsibilities", *Auto Eng.,* Nov. 1970, Vol. 78, No. 11, p. 28.

[6]World Council of Churches, meeting in Evanston, 1954, reported in D.L. Munby, *Christianity and Economic Problems,* London, Macmillan, 1956, pp. 252-266.

[7]Reprinted in *The Vancouver Sun,* November 14, 1969, p. 5.

[8]Francis A. Schaeffer, *Pollution and the Death of Man,* Wheaton, Tyndale, 1970, p. 13.

[9]Phillip S. Meyers, "Technological Morality and the Automotive Engineer", *Auto. Eng.,* February 1971, Vol. 79, No. 2, p. 26.

Homo sapiens *has no more claim on God's love than the aphid on the rose bush. Out of pure grace, pure unmerited love, God chose to relate to our species, one of over a million on this earth. He only asks that we show one another the same unmerited love that he has showered on us–that our response of love to him be redirected to our fellow human, whoever he may be.*

Harold F. Roellig
The God Who Cares, Branch Press, N.Y. (1971), p. 165

Galileo and the Church: Tensions with a Message for Today Part I

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Introduction

The Copernican revolution began in the first decade of the Sixteenth century in an unpublished manuscript, entitled the *Commentary*, by a rather obscure household physician in a bishop's palace in northern Europe. Some thirty years later the seeds of its heliocentric reformation of astronomy were to find a stony reception in the minds of two other reformers: Luther called its author a fool[1] and Melanchthon was prodded by it to remark that "wise governments ought to repress the impudence of the intellectuals".[2] In 1543 there appeared in print Copernicus' full defence of his unsettling scheme, the *Revolutions of the Heavenly Spheres*. Seventy-three years thereafter the *Congregation of the Index* in Rome was to find its doctrines of the centrality and immobility of the Sun philosophically absurd and formally heretical, its thesis that the Earth exhibited a daily and annual motion incorrect in philosophy and erroneous in theology. Another seventeen years brings us to the condemnation of Galileo, guilty said the Holy Office of holding and defending these evidently false and unscriptural beliefs in his *Dialogues on the Two Great World Systems*, which resulted in the banning of his great book and his spending the remaining years of his life in house arrest.

This century and a quarter, as sketched, suggests a rather unfavorable future for the relationship of the church, Protestant or Roman, to the new astronomy. The origins of the evident tensions and their context in the second half of the Sixteenth and the first half of the Seventeenth Centuries require some examination, for neither the Copernicans nor the churchmen of the time could see any necessity for the conflict. Each was convinced that it recognized clearly the proper means to a reconciliation. It was the failure to achieve their ambitions, the methods each recommended being so different and unpalatable to the other, which resulted in the impasse and left the horizons so clouded. So much would have been evident to anyone observing events that historic day in June of 1633 when Galileo was sentenced before the Congregation of the Holy Office in the convent of Santa Maria Sopra Minerva. With the benefit of nearly three hundred and fifty years of perspective we cannot, however, avoid assessing that appraisal. Astronomy was to move in directions as unforeseen by either churchman or Copernican as they were recalcitrant to the techniques prescribed by each camp for harmonizing their mutual concerns. Certainly new principles of accommodation have been offered over the long interval, often fostered by developments in other sciences as each has undergone its revolutionary modern changes. About these too we shall make comment.

The Instrumentalist View of Astronomy

Our account must begin with some remarks on the traditions within which Copernican astronomy was to appear so revolutionary. One of these, the assumption that the astronomer's task was to employ whatever mathematical devices afforded a convenient description of the observed behavior of the heavens and reasonable predictions of future events, without any considerable regard for their correspondence to the actual state of affairs obtaining, was of long standing. It is apparent in the astronomy of the Seleucid period in Mesopotamia, which followed the conquests of Alexander, when the positions of the Sun, the Moon, and the planets at various occasions useful for astrological or calendar purposes were calculated using techniques which involved in essence the plotting of these bodies as points of light moving across the stars as across a graph paper. Nowhere do we find any indication that their motion in 3 dimensions was considered, any suggestion of a guiding model of their movements in space.[3]

Even earlier at the beginning of the Fourth Century B.C., the Greek philosopher Plato had developed a model of the universe by means of which he intended to illustrate the planning and design of the world but which he took to be no more than suggestive of how nature might have achieved whatever order observation

The year of 1973 *has been designated Copernican Year in honor of the* 500*th anniversary of the birth of Copernicus in* 1473. *In keeping with this commemoration, the* Journal ASA *offers a four-part publication of a paper presented by T. H. Leith at the* 1972 *Convention of the American Scientific Affiliation at York University.*

revealed. Beyond such convenient myth he would not go, for he took the senses to be incapable of revealing the truth about affairs on the Earth as in the skies.[4] Examining his scheme and developing one of its ideas, a younger contemporary, Eudoxus, described the motions of each heavenly body as the resultant of clever combinations of eternal and uniform movements in circles centered upon the Earth.

In the next few decades, Callippus offered further refinements. Though these schemes introduce 3-dimensional geometrical models into astronomy, which is missing in Seleucid studies, the models are akin to these studies in spirit: apparently no attempt was made to argue that the set of inter-connected circular motions combining to move any given planet or the Sun or the Moon were real, nor was any explanation sought as to why each member of a set should have the particular angular velocity, sense, and axis of rotation suited to it. The models remained no more than useful fictions convenient in aiding our imagination as we predict the paths of the heavenly bodies across the stars.

Of course it was a remarkable feat to show that the complex motions of the heavens were apparently resolvable into components all of which are alike in being uniform, circular, and concentric. If the fit were inexact all that was necessary was to adjust the relative tilts of the imaginary axes of rotation, to revise the rates of rotation properly, or perhaps to add a further circular motion to the set. The ideal of explaining all heavenly motions as the result of uniform circular motions around the Earth could be maintained to indefinite precision. However, the technique was intended only to predict properly the paths, speeds, and directions of the heavenly bodies against the starry background. It could not predict the changing size of the Moon as it appears to a careful observer nor the great variations in brightness so noticeable on observing the planets. All require a scheme providing for changing the distances of these bodies from the Earth.

That need was fulfilled in the epicyclic astronomy introduced by Heracleides of Pontus in the time of Callippus and developed further by Apollonius in Alexandria during the second half of the third Century B.C., by Hipparchus at Rhodes a century later, and by Ptolemy again at Alexandria, in the Second Century A.D. Like the geocentric models, the movements of the heavenly bodies were interpreted as the product of combinations of uniform and endless circular motions except that here each body would be taken to move on a circle whose center itself moved at a different angular rate on another circle of different size, the center of which in turn might itself be circling the Earth. The Earth was now central only to the imagined shell of the stars[5].

As with the geocentric schemes, epicyclic devices were capable of indefinite refinement to fit improved observational data and, as with those schemes, epicyclic astronomy saw itself as inventing its devices merely as convenient predictive fictions. Ptolemy took this to be a necessary evil, informing generations of his followers that the complexities of observed heavenly motion seem to defy the ability of philosophers of nature to fathom them. Their causes and their true nature, therefore, remain matters of speculation and controversy. His assessment of the limits of astronomy was still widely accepted by workers in the field in the days of Copernicus fourteen centuries later and for many years thereafter. It provided a major challenge to Copernican astronomers from their own colleagues.

Aristotelian Cosmology

Difficulties for the heliocentric scheme arose also from a source of equal antiquity, the philosophy of Aristotle. His great mind had, in the mid-Fourth Century B.C., introduced a magnificent and systematic natural philosophy which still attracted many as late as the Seventeenth Century of our era. We cannot attempt to outline it here but various aspects require some mention.

In the heavens, Aristotle employed the devices of Eudoxus and Callippus to interpret motions of the stars, the Sun, the Moon, and the planets with one major revision: these motions were now taken to arise from the combined effect of physically-real but invisible shells moving endlessly at their own angular rates and directions about the Earth. Connected ultimately to the starry sphere revolving rapidly around us once each day, the shells carrying these bodies therefore exhibited both the effects of that daily revolution and the influence of the four or five shells which gave to each its particular drifting path across the stars. From the Moon outward, our cosmos became a vast mechanism eternally carrying the heavenly bodies in their cycles about the Earth.

All of this Aristotle saw as quite rational. Only a spherical world could revolve in its own space and exhibit simple symmetry: the former was necessitated by what he took to be the impossibility of a void and the latter by the requirement that the influence of stellar motion must bear equally upon the bodies within the starry sphere in all directions. Only a finite universe could revolve within the finite period of 24 hours, infinite speeds being impossible. Only a mechanism involving a nest of transparent shells could move the heavenly bodies, give them their cyclic sidereal periods and explain how these periods increased as the bodies lay at greater distances from the starry shell, itself moved by the Unmoved Mover, and the source of motion elsewhere in the heavens.

The centrality of the Earth seemed equally necessary. Beneath the Moon, the natural motions of the elements were quite different from the eternal movements of the heavenly and transparent ether. They were linear and had a beginning and end: earth and water naturally move toward the center of the cosmos, and air and fire naturally rise toward the shell carrying the Moon. The natural place of earth is as close to the center as possible and above it should lie the successive shells of water, air, and fire. Observation appeared to confirm this except that various forces prevent the separation being perfect: the Earth he knew to be spherical and it did seem to be equidistant from the stars in all directions, water and air do lie successively above it, and the presence of fire was indicated when extraneous matter entered its realm and burned as in the case of the aurorae, meteors, and comets.

To Aristotle the motion of the Earth seemed quite irrational. Were it to be translated through the sub-lunar region some force in contact with it would be necessary and he could find no basis for accepting its presence. Were it to rotate, an equally gratuitous force would be required for rotational motion is not natural to it, and Aristotle's physics of motion required that all movement in any event be caused by some internal or external force. Even a falling stone is moved by its potential to become more earthlike being actualized as it passes

toward its natural place in the scheme of things. Clearly he had no concept of inertial movement, of gravity, or of angular momentum.

So coherently did his arguments on these and other matters appear to fit together and to arise from premises which seemed intuitively evident to the mind that his cosmological scheme was destined to find many adherents[6]. One weakness at least is, however, apparent: Aristotle's model of the cosmos cannot explain the apparent variations in distance of the heavenly bodies from the Earth. It was revised to provide for this. In the Second Century, Theon of Smyrna suggested that these bodies be immersed eccentrically within transparent ball-bearings each rolling between concentric shells, a scheme which at once gave physical intelligibility to the epicycles which we have mentioned and carried any body to varied distances from us. A later variant moved the planets themselves along tracks between shells eccentric to the Earth. And, as late as the 1530's, Girolamo Fracastoro in a book dedicated to the same Pope as was Copernicus' *Revolutions*, introduced a shell of variable density between us and the Moon. This he not only utilized to explain the variable brightness of the planets and the apparent changing size of the Moon as seen in solar eclipses but to preserve the pristine simplicity of the Aristotlian heavens.

Neither the Copernicans nor the churchmen of the time could see any necessity for the conflict.

These sorts of endeavors might have been of only casual interest to most members of the small astronomical fraternity by the mid-Sixteenth Century, intent upon their predictive Ptolemaic devices rather than on speculations about the physical nature of heavenly motions, but matters were rather different among certain groups of philosophers and theologians. For these it was more important that Thomas Aquinas in the Thirteenth Century had brought Aristotelian philosophy and its attendant cosmological system, by various adjustments, into seeming accord with the generally accepted tenets of the Christian faith.[7] Aristotle's teachings therefore played their part in forming a full-orbed Christian philosophy inclusive of both science and philosophy. If the Copernicans had to provide a serious critique of Aristotelian astronomy and its physical bases they also had to meet the challenge, flung at it by those who followed Aquinas, of indicating just how the novel heliocentric scheme might be reconciled to the teachings of Scripture in the face of their own synthesis involving a very different system.

Scientific Scepticism

A third difficulty facing Copernicus and his followers deserves comment at this time. It arises in the context of the relationship of faith and reason. For Aquinas, faith had been the necessary approach to Biblical teaching, while reason provided both the necessary route to understanding those matters on which the Bible was silent and a means to sustaining the credibility of revelation. With reason came a coherent pulling together of our experiences with nature; in this Aristotle was to prove of considerable value. However, Aquinas' analysis was called into question by the debates of the Fourteenth Century.

One of the seminal minds of that period, Duns Scotus, carried the conclusion that propositions regarding the purposes and nature of God, the immortality of the soul, and similar doctrines were matters of faith to the point that faith became an act of will rather than intellect. We accept, then, revelation because it is prescribed by God and not because it is rational. In turn, this implied that the will of God was not constrained by the implication that His decisions must be reasonable. Rather, they are reasonable because they are willed in accordance with His nature.

To William of Ockham that implied further important ideas. If God's will, and nothing else, determines the character of the world among other things, it will then be impossible for us to use reason to lead ourselves back to the nature of God or to His purposes. Reason ceases to support our faith and the goal of uniting philosophy and theology has proven to be a chimera. Further, Ockham believed that only particular things exist and only propositions about these deal with reality. The attributes which one finds in common among the objects and happenings of the world are merely one's concepts and have no claim to reality; they are abstractions and they lie wholly in the mind. The statements, then, which are found in science about these abstractions deal only with names which one has given to them and not with reality directly. The same problem faces the temporal sequence of events which are found in nature. When science discusses the causes of these sequences, which are not directly observed, it is reduced to guessing at the relationships which obtain. Many hypotheses may be offered, none of which can with certainty be said to be true. Our views of the world not only fail to sustain our faith but they are thoroughly fallible.

Ockham's teachings were prohibited in certain quarters such as the University of Paris, but at the new universities in Prague, Vienna, Heidelberg, and Cologne they were widely followed and carried influence far beyond their doors. The results were not entirely salutary for the advancement of science. Often there was a loss of interest in careful observation when it was concluded that the hypotheses to be derived were merely speculative. Again, it turned the attention of many to imaginary situations, such as motion in a vacuum was taken to be, which revealed only how God might have done things had He wished or to the sort of purely abstract studies such as those found at the Universities of Oxford and Paris in kinematics. The latter tendencies were reinforced by the Paris condemnations of 1277 of numerous theses suggesting that God could not have created a world or indeed a plurality of worlds, different from our own.

Jean Buridan, in the first half of the Fourteenth Century, lived under both the impact of these condemnations and the teachings of his contemporary Ockham. His writings reveal the speculative atmosphere occasioned by the former and the continual tentativeness demanded by the latter. For example, the question of whether the Earth or the heavens turned daily he left quite open: different theories may always be employed to explain what is observed. Likewise, around 1380, Nicole Oresme may be found arguing that science must remain incapable of deciding upon the motion of the Earth and that only Scriptural revelation can settle the matter.

No speculations of the years shortly before Copernicus are as startling though as those of Nicolas of Cusa, a scholar and church official who died within a decade of Copernicus' birth. In a work dealing with the limits of human knowledge and in a later note, Nicolas points out a variety of difficulties in conceiving the world in traditional and supposedly rational terms. There was the impossibility of understanding the conception of a finite and bounded spherical universe. Given the realization that the universe must be taken to be indeterminate in size, he asked what sense there was then in talking about the Earth as if it lay in the middle. Again, he suggested that when motion is perceived it requires that some reference be treated as if it were at rest; but no reference can be chosen, except abitrarily as tradition had done because we inhabit the Earth, as being absolutely at rest. Thus he concluded that both the heavens and the Earth were in motion in some manner which gave the appearance of a single revolution of the stars counter-clockwise about the Earth's axis of rotation, as we look north, every day.

In the end, Nicolas was to conclude that even the world-view of every thinker is determined by his place in time and space. Because none of these is privileged, he reasoned that it was completely impossible to arrive at a true picture of our world. On that thoroughly sceptical note, epitomizing the extremest form of Ockhamism, he culminates the tentativist trend of numerous thinkers in the pre-Copernican world. It was this sort of attitude which Copernicus had to face for he was equally convinced of the truth of his ideas.[8]

(To be continued)

FOOTNOTES

[1]*D. Martin Luthers Werke,* Weimar edition, Tischreden, I, p. 419. The comment appears in a Table Talk where the possibility always exists of a reporter misunderstanding Luther or quoting him out of context.

[2]*Corpus reformation,* IV, p. 679. For background read W. Elert, *The Structure of Lutheranism,* St. Louis, 1962ff.

[3]*The Exact Sciences in Antiquity,* O. Neugebauer, New York, 1962 provides a fine summary.

[4]See *Plato's Cosmology,* F. M. Cornford, London, 1937.

[5]Surveys of geocentric and epicyclic astronomy are available in *A History of Astronomy from Thales to Kepler,* J.L.E. Dreyer, New York, 1953 and *The Physical World of the Greeks,* S. Sambursky, New York, 1962.

[6]Details are provided in *The Philosophy of Aristotle,* D. J. Allan. Oxford, 1970; *Aristotle's Cosmology.* L. Elders, Assen, The Netherlands, 1965; *The Physical Philosophy of Aristotle,* M. G. Evans, Albuquerque, 1964; *Aristotle, The Growth and Structure of His Thought,* G. E. R. Lloyd, Cambridge, England, 1968; and *Aristotle's System of the Physical World,* F. Solmsen, Ithaca, 1960.

[7]See *Aquinas,* F. C. Copleston, Harmondsworth, England, 1955.

[8]The medieval period is surveyed in *Augustine to Galileo,* A. C. Crombie, Harmondsworth, England, 1969 and *Medieval Thought,* G. Leff, Harmondsworth, England, 1958.

Abstracts Only

The abundance of good manuscripts awaiting publication in the Journal ASA *makes it impossible for us to publish all possible papers dealing with a given theme in the same issue. On this page we list by title and abstract only, five papers which are relevant to the general theme of ecology and the Christian. In those cases where these papers are not published elsewhere in the meanwhile, eventual publication in the* Journal ASA *may occur. Readers interested in the full text of these papers immediately are encouraged to find them where published, or to contact the authors directly.*

MAN COME OF AGE: Bonhoeffer's Response to the God-of-the-Gaps

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The fallacy of the God-of-the-Gaps has been often expounded in treatments of science and Christian faith. These discussions usually consider the fallacy in terms of the activity of physical or life scientists who properly do not need the "God-hypothesis" to fill the gaps in their physical or biological knowledge. In this paper the radical concepts of Dietrich Bonhoeffer in his letters from prison: "man come of age," "religionless Christianity," "without God before God," are considered as the results of his attempt to envision the consequences of an extension of the fallacy of the God-of-the-Gaps into the spiritual area as well. When viewed in this perspective, it is easier to see how the evangelical author of *Cost of Discipleship* is related without a profound change in thinking to the radical author of the letters from prison. The questions Bonhoeffer raises are of increasing importance for us as scientists and Christians.

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OPTIMISM AND PESSIMISM: SCIENCE AND ESCHATOLOGY

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A view of the future calls for a perspective on the relationship between the present and the future. Varieties of Christian eschatology have established this relationship in different ways in spite of the fact that all Christians share in the ultimate optimism of God's finished work of redemption and new creation. Among those concerned with the role of science and technology in the shaping of the future, there has arisen a neo-post-millennialism in which growth of scientific understanding is seen as grounds for optimism in the present, leading to the construction of a world suitable to receive its returning Lord. This neo-post-millennialism tends to minimize the ultimate work of God in the future in comparison with the present work of God through men, rests on a false idealism as to the potentialities of science in a sinful world, and creates frustration leading even to violence and despair among Christians who believe that they are God's only instruments for bringing in the Kingdom. Christian realism, on the other hand, avoids both optimism and pessimism based on false premises in the present, and permits a Christian to be free to work constructively for the betterment of a world destined for destruction.

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MAN AND THE ENVIRONMENT: AN APPRAISAL OF INTERNATIONAL ORGANIZATIONS; THEIR DEVELOPMENT, PLANS AND PROSPECTS

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Concern with environmental deterioration is an old story in human history. Overtones of it are found in the prophecy of Jeremiah. But it is within the last few years that the environmental crisis has become sensed the world over. Two major events are giving it current prominence. One is the intergovernment conference of experts on the scientific basis for rational use and consideration of the resources of the biosphere, organized in Paris by UNESCO, 11-13 September, 1968. The other is the United Nations Conference on the Human Environment, held in Stockholm, June 7-21, 1972. This may lead to the creation of a new United Nations Council on the Environment with far-reaching measures for dealing with the global threats we now face. Three major topics are discussed: environmental aspects of human settlement, the rational management of natural resources, and environmental pollution. I therefore wish, in this paper, to outline the background to international intervention in environmental issues, and the challenge that these developments and issues present to Christianity today and tomorrow. This is, of course, an immense subject, so we shall only be able to outline the subject matter very broadly.

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SOCIOBIOLOGY AND POPULATION PROBLEMS: PERSPECTIVES

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Populations of most species of animals do not increase to abundances which are excessive for their habitats and consequently reflect controlling influences. The mechanisms of regulation vary but three basic forces have been shown to influence population size. These forces are natality, mortality, and movements. While it is clearly evident that these three major forces regulate populations, data are accumulating implicating influences developed intrinsically in populations which modify the action of these forces.

The information obtained thus far from experimental laboratory studies of several species is that populations do not continue to increase indefinitely even though provided with excess food and water. Rather, each reaches a point at which growth is curtailed. Populations of small mammals as well as of most other forms characteristically grow in a manner described by the logistic curve with growth beginning slowly, rapidly increasing and eventually slowing markedly or completely ceasing. This leveling off of the population growth curve is referred to as the population asymptote. An understanding of the mechanisms by which population growth is controlled is far from complete. There are, however, certain characteristics of populations at asymptote which are noteworthy in this respect. The first such characteristic is that the numbers of animals present when growth is controlled varies widely between populations even though conditions of the physical environment are maintained as nearly identical as possible between populations. A second characteristic related to the first is that in spite of the marked differences in numerical levels when growth is controlled, the physiological alterations appear to be similar between populations. For example, the weights of the adrenal glands and spleens of animals from asymptotic populations tend to be larger than for isolated pair controls and the eosiniphil numbers and weight activity of reproductive organs are less. These data, therefore, suggest that those factors which control the growth of populations may produce physiological effects directly related to the approach of a population to asymptote and *not* to the numbers of animals present *per se*. Thus density is relative to social factors and we must think of the numbers of animals in a population in a qualitative as well as in a quantitative sense. Mechanisms of control thus appear to be related to a kind of "social pressure" developing intrinsically in each population which may be communicated through one or more of the senses of touch, smell, sight, hearing and taste.

The human population is now in the logarithmic phase of a typical curve similar in many respects to the theoretical curves of experimental populations cited above. This rapid increase in the human population is the result of advances in medical knowledge which have centered attention upon decreasing mortality while doing little to regulate natality.

At the present time we have little data suggesting that intrinsic mechanisms of population control may produce sterility in human populations similar to that found in the experimental populations of deermice. In a sense, the question of whether the human population possesses the capability of developing such intrinsic mechanisms of control is irrelevent because if our experimental data tell us anything with respect to the human population, it is that we *must* regulate before such mechanisms of control operate. The simple reason is that most of us would not wish to live under the conditions which would exist when such mechanisms of control would be functional.

The social, political, ethical and religious implications of the problems which face us in the regulation of our population are multiple and complex. Many of these problems do not have clearly discernible answers. Further, there is very little specific guidance in the Scriptures with respect to many of these problems. Nevertheless, urgency requires that we make decisions. Our population *will* be controlled either by mortality or by reduction in natality. As Christians and humanitarians, we cannot accept the former means. The choice for a short time is still ours!

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ECOLOGICAL CONSIDERATIONS IN RELATION TO THE HOLY LAND'S PRODUCTIVITY

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An ecological cause is proposed as the answer for the decline of cultural achievement and depopulation in the Middle East in general and the Holy Land in particular between antiquity and the twentieth century. The theory of progressive dessication advanced by environmental determinists is believed to be inadequate as an explanation for the overall deterioration of the area. Rather, the decline is seen as the result of political injustices, instability, and wars which caused vital conservational techniques to be abandoned with consequent removal of vegetation and the destructive erosional effects. Two lessons are suggested in this analysis. The first is that productivity of misused land can be restored as demonstrated in the contemporary state of Israel. The second lesson is that God uses the environment-man relationship to communicate spiritual truths in addition to those, or supplementary to, the truth He reveals to man, especially His chosen people.

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BOOK REVIEWS

IS REVOLUTION CHANGE? Brian Griffiths, Editor. Inter-Varsity Press, London (Downers Grove, Illinois, in USA) (1972). Paperback, 111 pp. $1.25.

Brian Griffiths, the editor of this book, is Lecturer in Economics at the University of London. He has shared the writing with four other authors: Sir Frederick Catherwood, formerly Director General of the National Economic Development Office; Alan Kreider, professor of history at Goshen Collegs, Indiana; Dr. Rene Padilla, Associate General Secretary for Latin America of the IFES; and Samuel Escobar, editor of *Certeza,* a magazine for Latin American students published in the Argentine. Writing separately, the authors assess the fantasy of revolution as a panacea for evil, and at the same time strongly stress the social responsibility of Christians. The result is a challengeable and readable book that would be ideal for study and discussion groups of young people and adults. The constant theme throughout the book is the basis for all non-Christian social alternatives in the false assumption of the intrinsic goodness of human nature.

Brian Griffiths analyzes the three systems of thought among modern dissenters: socialism, anarchism and the Hippie love-philosophy. Socialism frequently leads to the advocacy of violence because it is argued that violence is necessary because de-colonization must be a violent process, that violence is a method for unifying oppressed people, and that violence is a cathartic force. Anarchism is the only possible choice for people who believe that man is corrupted only by his institutions. The Hippie approach is strongly anti-intellectual and non-rational. Griffiths argues that a society without an authority structure is unthinkable; the major question is whose authority. Of the Christian, on the other hand, Griffiths says,

> It is the realistic analysis the Christian has of the state of man which enables him to see the need for greater justice in society, while at the same time upholding law and order as a necessity in a fallen world.

Catherwood argues against the position taken by some Christians that *only* a change in human nature can change human behavior, and that therefore participation in attempts to change society and its structures is not appropriate for the Christian. He sees the following four reasons for Christian action: the sovereignty of God, historical evidence for the positive influence of Christians in the past, the truth of the Christian faith which combines order and freedom as no other position can, the general activity of God's Spirit to some extent in all men. Revolution, however, is no solution.

> The force necessary for effective revolution is immensely destructive. Because it requires men to change their actions without changing their minds, everything has to be imposed by force.

The British origin of the book comes through in amusing fashion when the author says,

> As for George Washington's historic breach in the English-speaking nation, it is at least arguable that the world would be a better place if the breach had never taken place and that to the extent that we have ignored the breach it has been a better place.

Kreider argues for middle ground between church radicals and church reactionaries. He points out Jesus' rejection of the Zealot program of his time, but then goes on to show that Jesus' program was far more revolutionary because it was far more radical (root-based). The church institution, however, has turned this revolutionary spirit into Christendom and into a defense of the status quo. He sees the need for the church to be a community of Christian individuals engaged in demonstrative action, a self-giving, reconciling and prophetic body.

Padilla recognizes the positive contribution of the spirit of revolution in recognizing the need for radical changes in social structures, but faults it for presupposing "a faith in man's ability to create a new world." He sees the preaching of the "gospel of revolution" by such contemporary theologians as Cox, Shaull and Lehmann as "a human attempt to create here and now the perfect society that God has promised to create at the end of the present age."

> The 'theology of revolution' idealizes man and consequently converts the gospel into a utopian ideology that employs theological terminology but has little relation to the eschatological message of the Bible.

This is the resurgence of a neo-postmillennialism that may be detected in so many modern statements on eschatology.

> They assume that the world *has been reconciled* and that all that now is asked of men is to recognize that *they are in effect living* under the sovereign rule of Jesus Christ.

Escobar sees the pattern of incarnation to be guiding one for the Christian. He agrees with John Stott's

Photos in this review were taken at the end of a relatively "quiet" Spring Quarter 1972 at Stanford University.

assessment that the greatest weakness of modern evangelicals is their failure to obey Christ's words, "As the Father sent me into the world, so send I you." He calls for a prophetic voice from evangelicals against exploitation of native peoples, against capitalist abusers, against corruption and dishonesty in politics and high places in government, rather than just sitting in and lending ecclesiastical approval to "prayer breakfasts." He calls for an attack not only on overpopulation, but on the unequal distribution of wealth and unjust social structures. But his view is balanced,

> We should not expect to build the kingdom of God here on earth or 'Christianize' society. Our hope is future; but at the same time our service and our witness are signs of this hope and of the lordship of Christ in our lives.

There will be many who will be offended with this book because it is either too conservative or too radical. I think that's a good sign.

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

A second review of Is Revolution Change?

We live in a revolutionary age. Revolutionary struggles for decent food, decent housing and self-determination gain momentum in this time of social upheaval. The hunger-swollen stomach and glazed eyes of a starving child—a sight not uncommon to the "free world" whether in the ghettos and barrios of Brazil, Biafra, Angola or America—bear mute witness to the degradation and oppression, the out and out violence inflicted daily upon masses of humanity—1972 years after Christ's death. Something is wrong—criminally wrong—in a schizophrenic world of Cadillacs and carts, suburbs and slums, corporations and colonies, riches and rags. The same corporation that heats American homes heats Indochina with flesh-tearing plastic pellets.

What is the solution to injustice and inequity? Is there one? Should the Christian challenge an unjust social system? Can the Christian stay above the battle, neutrally viewing the conflict between oppressor and

oppressed? How does the Christian relate to a society permeated with exploitation? What is the Christian role? These are the questions challengingly posed by *Is Revolution Change?*, a collection of essays by five Christians, and then disappointingly avoided.

As an activist for social change and as the son of a Lutheran minister I have wrestled with the preceding questions often. Unlike the authors of *Is Revolution Change?*, I have found no contradiction between my Christian upbringing and my commitment to revolutionary change. On the contrary, one grew out of the other. On that basis this small book (111 pages) interested me.

Jesus Christ lived his life for mankind. His life and crucifixion comprised a flesh and blood parable of compassion for the poor, the weak, the downtrodden, even for the rich man and his materialistic sickness. So Christians today must love and that love must be a real compassion; a true attentiveness to the very real suffering of our sisters and brothers. In the words of Alan Kreider, co-author of the book, "We cannot separate the proclamation of the gospel from the demonstration of the gospel." The world shall know the Christians by their fruits; all the weekly offering checks and perfect attendance pins will not make an iota of difference in the eyes and stomach of a starving people. This is a real world of poverty and plenty—Christians must feed mankind's stomach before they can deal with its soul.

On what terms has Christianity met the earth's population? Was there truth in the Wobbly condemnation of "pie in the sky preachers" who blithely preached of heavenly rewards while the lumber and railroad tycoons ruthlessly deprived working men of their just earthly desserts? Co-author Alan Kreider, in his essay "The Way of Christ", states emphatically that,

> Instead of being a consecratedly obedient and irresistible attractive minority, most churches have been socially conservative buttresses of a status quo no matter how unjust. They have sided with the oppressors. They have dispensed half a gospel, often unconsciously to act as a sedative, an opiate. The church not only has been found to be indifferent to social injustice, it has rightly been seen as an integral part of the problem.

In its origins Christianity was fundamentally an egalitarian religion. Throughout the long history of the Jewish people, the prophets castigated the rich man and spoke in defense of the poor, the oppressed and the helpless. Witness the ancient words of the prophet

Other Books Received and Available for Review

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

Baylis, R. H., *Romans: A Letter to Non-conformists*, IVP, 1972.
Benedict, R. P. *Journey Away from God*, Revell, 1972.
Custance, A. C., *Is Man an Animal?*, Doorway Papers, 1972.
Goody, R. M. and J. C. G. Walker, *Atmosphere*, Prentice-western, 1972.
Morris, H. M., *A Biblical Manual on Science and Creation*, I. C. R., 1972.
Reichenbach, B. R., *The Cosmological Argument*, C. C. Thomas, 1972.
Schouls, P. A., *Insight, Authority and Power: A Biblical Appraisal*, Wedge, 1972.
Siegler, H. R., *Evolution or Degeneration: Which?* North-Hall, 1972.
Skoglund, E. *Where Do I Go to Buy Happiness? Insights of a Christian Counselor*, IVP, 1972.
Wells, D. F., *Revolution in Rome*, IVP, 1972.
Wilder-Smith, A. E., *The Creation of Life*, Shaw, 1970.
Willis, C. D., *End of Days*, 1971-2001, Exposition, 1972.
Young, Louise B., *Exploring the Universe*, Oxford, 1971.

Amos,

> they sell the innocent for silver and the destitute for a pair of shoes. They grind the heads of the poor into the earth and thrust the humble out of their way.

As editor Griffith states, Isaiah does not shirk from denouncing injustice,

> Shame on you, you who make unjust laws and publish burdensome decrees, depriving the poor of justice, robbing the weakest of my people of their rights, despoiling the widow and plundering the orphan.

Jesus Christ himself walked among the lowliest classes of society healing the sick and enabling the lame to walk. In short, Christianity developed with a real concern for the needs of the oppressed classes.

Yet, today, most American churches are the exclusive domain of the middle and upper classes. Sunday services, apart from being fossilized rituals, provide an expedient gathering place for the local businessmen, professionals and their families to intermingle. Large corporations find it advantageous to place public relations men in the large local congregations. Surely a company with "good Christian men" must be an honest one; such is their logic.

While the church serves as a social gathering place for the upper classes, usually provides ample justification for the government's wars a la Graham, and has often destroyed cultural patterns of Third World peoples (thus directly or indirectly serving the needs of American corporate expansionism), it has shown little or no interest in the plight of the oppressed. This the authors admit. In the minds of authors Griffith, Catherwood, Kreider, Padilla, and Escobar, a Christian's faith is evidenced by his fruits and few Christian fruits have been forthcoming in the vast nation of the poor exploited.

Two choices exist for those concerned with altering the oppressive status quo, say the authors: reform or revolution.

Unanimously they choose reform over and against revolutionary methods. Their case for Christian reformism lies not in the positive merits of reformism but in the negative aspects of revolution. From a doctrinal standpoint, we are "to render unto Caesar what is Caesar's". Even the apostle Paul told slaves to return to their owners, states Griffith. Governments are scripturally defined as agents of God, hence we must acquiesce in their rule. However, an interesting loophole is reserved; God's law is superior to that of Caesar and in the event of conflict between the earthly and the divine we are to choose the side of God. But who is the interpreter of God's will? Who decides what governments do and do not exist in accordance with God's law?

If the Christian is to support blindly any government from Hitler to Franco to Nixon, then the doctrinal question is resolved–Caesar must be blindly obeyed. If, however, the Christian supports governments only when they exist in harmony with God's law, as the authors state, then obviously each individual Christian must decide for himself whether a particular government exists in harmony with God's will. Hence, no objective criterion exists. Subjectivity reigns supreme. Revolutionary change then, cannot be doctrinally outlawed to the Christian on the basis of the biblical interpretations presented in *Is Revolution Change?*

The crux of the book's attack upon revolutionary change lies not in questions of doctrine but in a basic choice of worldviews. The authors contend that all social ills stem from what they consider man's sinful and depraved nature. Social injustice in their view, will always exist. As their argument progresses, it becomes evident that their adoption of this myopic view is a reflection of their negligible commitment to social justice.

Can social injustice and the nature of man in the free world be alleviated by changing the social system? Or are the related phenomena of poverty and oppression simply, as the authors believe, the result of man's unchangeable sinful nature? If man's sin and depravity are accepted as inherent features of man's character, then structural change of the fabric of society will produce little. In Griffith's prose.

> All injustice, unrest, war and violence is the result of sin. And sin for the Christian is not the self-interest, pettiness or unconscious mistakes of society, but the sinful nature of each individual and his consequentially deliberate sinful actions.

Is the solution then to eliminate sin before we can combat oppression? No! Poverty and oppression have readily identifiable social causes–a black sharecropper in Georgia or a Vietnamese peasant working French-owned land in Vietnam are denied their produce beyond subsistance by oppressive property laws enforced by the state in the interest of the owners. Low income housing is unbuilt not because of a lack of demand, but because it is not a profitable field of investment. In an economic system based not on human needs but on human greed–the profit motive–the criterion for social progress is what sells and nothing else. Is it then any wonder that Cadillacs and color TV exist across the tracks from malnutrition, wretched housing and emotional breakdowns?

Social problems have social origins and social solutions–Christians must act on their faith if it is to speak to others in real terms and not as token gestures designed to lull and appease the oppressed. To theologize piously from privileged positions about sin being the cause of all such abstractions as injustice and poverty, all the while refusing to commit oneself, is to play the role of modern day Pharisees.

Griffith offers the following prescription for reformist action.

> Depending on interest and ability he (she) will be involved in all facets of the life of a society whether it be as a suburban housewife organizing a playgroup, a conservationist campaigning for the protection of the environment, a trade unionist representing his fellow workers, a student giving time to the Students Union and student societies or as an elected representative on

a local council or in parliaments.

Griffith offers a comfortable, pious formula for safe middle-class Christianity—a Christianity divorced from the real world of politics. Playgroups indeed! Have trade unionist politics, student unions or elected parliaments significantly curbed the power of corporations —those mammoth agglomerations run for the benefit of a few—to make economic decisions which affect the lives of millions? Have reformist politics ended this nation's war which over ¾ of the citizens oppose? Have they eliminated poverty and unemployment in a nation rich enough to spend 80 billion dollars yearly on "defense" gadgets? Millions of people in the industrialized west are suffering because there has been no alternative to reformist politics. What should be the Christian message to these people? Do Christians minister to the urban poor through Thanksgiving and Christmas food baskets, or do they offer real political alternatives of collective action?

What political advice does Griffith and other coauthors offer people of the Third World who often starve under regimes so thoroughly autocratic that reformist politics, let alone revolutionary politics are prohibited? What political advice do Christians offer the slum dwellers of Buenos Aires living under the iron heel of an American supported dictatorship? We obviously cannot offer them Griffith's advice, to play reformist politics.

The body of mankind is diseased—sick with the curse of overwork, hunger, destitution and oppression. Diagnosis is not difficult. Splintered economies brutally maintained by American-supported dictatorships and geared to serve the rapacious needs of the mother country corporations and compradors are no accident. They are manifestations of the same disease evident in every slum, barrio or "underprivileged" area, as the overfed term it in mother America. A socio-economic system not based on freely-given human cooperation but rather on economic coercion and exploitation directed by a small owning class—such is the essence of capitalism. Until the body is cured, millions will fall victim to the guns of My Lai and the bloated stomachs of Biafra. A band-aid, an aspirin, a Care package, bankrupt the reformism of *Is Revolution Change?* These are not cures for social ills, they are only miserable tokens. They express not true Christian concern for the suffering but the striving of comfortable liberals to assuage their social consciences. The disease must be banished and the body restored to health. Those who have a vested interest in mankind's sickness and oppression must no longer be allowed to steal the work of others. Christians are called upon to light many candles and indeed torches in the fight for justice and equality—the implementation of Biblical principles in the society of men.

Ultimately there can be no neutrality, Christian or otherwise, in a society rife with exploitation. Either the institutionalized violence of the ruling powers is supported by our actions and inaction or the striving of the oppressed people for liberation is embraced. There is no middle ground. Whether the church continues to bless America's wars, sanction Franco's dictatorship or support oppressors depends entirely upon those good Christians who unlike the authors of *Is Revolution Change?* are willing to abandon the comfortable armchair of the oppressor and give their life for the liberation of their needy sisters and brothers. Revolution against an unjust social order is a supremely Christian act of love.

Reviewed by Peter Knutson, currently at New School for Social Research, New York City.

ETHICS AND THE NEW MEDICINE, by Harmon L. Smith, Nashville and New York: Abingdon Press, 1970. 174 pp.

Since the appearance of Joseph Fletcher's *Morals and Medicine* a few years ago, a number of books have focused upon the ethical dilemmas created by recent medical advances. Without going beyond the title of the work reviewed here, one knows roughly what the author is about: he will discuss such issues as abortion, organ transplantation, euthanasia, and AID (Artificial Insemination by Donor), and he will point out that these and other procedures, whether presently legal or not, raise serious questions of ethics—questions, moreover, for which traditional Judeo-Christian morality has no clear-cut answers.

In pointing out that *Ethics and the New Medicine* does not tell us much that we do not already know, I do not mean to suggest that it has nothing new or valuable to say. One good feature of Smith's book is that it comprehensively surveys what others (including physicians) have said concerning the various issues discussed. Both Protestant and Roman Catholic thinkers are taken into account here.

Another merit of Smith's work is his insistence on looking at the issues squarely. In talking about death and the care of the dying, for example, he pleads for a recognition of the fact that death is usually a *process,* rather than a specific biological moment, and that "there is a time when it is appropriate for a human being to die" (p. 133). Making this plea does not lead Smith to unequivocal approval of euthanasia, though he clearly wishes that the legal restraints on euthanasia might be removed. What Smith *does* ask for throughout his book is a rejection of the traditional assumption that what happens "naturally" is somehow right or synonymous with God's will. One finds his logic convincing when he argues that we cannot escape responsibility for making hard decisions in matters of birth and death simply by identifying what is with what ought to be. (e.g., from the fact that a girl is pregnant, it does not automatically follow, irrespective of other considerations, that she ought to give birth).

Smith is not afraid to challenge certain assumptions that conservative theology has traditionally made in the name of "natural law" or Biblical norm. He dislikes what he calls "legalistic ethics," and contends that "the location of God's will in some given command of fixed content makes God's living presence superfluous . . ." (p. 68). This sort of statement, one thinks, should lead Smith straight to a position like Fletcher's "situation ethics," but oddly enough it doesn't. Smith is astute and honest enough to see that liberal theology has its own shortcomings, and that love cannot, in simplistic fashion, be made the only ethical norm. Nevertheless he struggles in vain to find a principle or set of principles which give him what he is looking for. "What we urgently need is a sound philosophy of human life," he says (p. 82). But in effect he admits that he is still working one out. The problems raised by modern medicine *are* large ones, and any moralist, Christian or otherwise, is self-deceived if he pretends to have

ready-made answers. Nevertheless one wishes that Smith, for all his honesty and tentativeness, had taken a little more seriously the relevance of the Biblical revelation in at least suggesting, if not always stating, solutions to some of our present ethical dilemmas.

Reviewed by Frederick R. Struckmeyer, Department of Philosophy, West Chester State College, West Chester, Pa. 19380.

THE HUMAN QUEST: ***A New Look at Science and Christian Faith*** by Richard H. Bube, Word Books, Waco, Texas. 1971. 262 pp. $5.95.

This concise and provocative study represents a contribution to the continuing dialogue between evangelical Christianity and science. Its author causes in me considerable envy for I aspire to communicate my Christian position and scientific interests with comparable effectiveness. While I may differ from the author's conceptualizations in certain respects, I cannot ignore his premises and conclusions if I am to be engaged in "the human quest" as one in which there is a meaningful even vital, relationship between interpretations of Christianity and of science. Before giving attention to specific strengths and weaknesses in Dr. Bube's opus, it may be helpful to review partly the frame of reference for the continuing dialogue.

There are at least three general reactive approaches to the problems attending the relation between religion in general and evangelical Christianity in particular and science. These approaches stem from a tradition in Western culture, the tradition that religion and science are essentially antagonistic in their efforts to resolve what has become known increasingly as the "ultimate concern" of mankind.

The first of these reactive approaches seems to arise from a combination of vested interests, defensive fear, and naivete. Perhaps it is unkind to ascribe vested interests to some Christians who believe that they are contending for the faith once delivered when it seems obvious that they seek to retain an assumed prestige status as theologians or clergymen. Cultural evolution finds many religious scholars within the Christian church adopting attitudes toward emerging science similar to the negative reactions which characterized the religious leaders towards the revolutionary views proposed by Jesus Himself in New Testament times. By this statement, I am not equating science with the teachings of the divine Son of God! But when one has enjoyed a prestige status as an authority in interpreting the universe, it is extremely difficult to allow that authority to be challenged, and perhaps discredited in part, by those whose claim rests upon a developing empiricism. Galileo, Newton, and their scholarly successors have been rejected because their findings threatened a religious monopoly in interpreting natural and cultural phenomena. Only grudgingly, often with much acrimony, have those possessing religious vested interests yielded some authoritative prestige to those who have amassed evidence which cannot be refuted or ignored.

Closely associated with vested interests is a defensive fear which characterizes some Christians whose spiritual roots lack depth in the abiding spiritual principles which constitute the biblical foundation for a secure life of faith. With spiritual roots clinging precariously to a shallow stratum in the soil of certain questionable cultural traditions, these Christians have failed to develop deep root systems that can provide enduring spiritual viability. These shallow-rooted Christians experience persistent apprehension that the penetrating heat of empirical evidence may result in spiritual desiccation. They thus fail to envision themselves as those depicted in the parable of the sower, as those whose superficiality in root form is the causal factor for their resistance to scientific endeavors, even if these endeavors are by those committed to strengthening evangelical Christianity in the modern world.

Unwarranted naivete is commonly present in the structure of vested interests and defensive fear to aggravate the condition. There is little excuse for Christians in the literate Western world to remain unaware of reasonable scientific theory and accomplishments. Not only do we enjoy the benefits if science in our sociocultural experience, but there are media for communicating scientific information unequaled in history or geography. It is indeed both unfortunate and pathetic that great numbers of evangelical Christians, perhaps the majority, depend upon pseudo-scientists, or those who are basically opposed to science, for their scientific understanding. This seems incredible to the informed Christian scientist, but that it is characteristic may be observed as a contributing factor to the pronounced "generation gap" between evangelical Christian parents and their children who are exposed to contemporary scientific thought, especially at advanced levels in colleges and universities. Possibly Christian scholars are partly at fault for this naivete in that they have failed to first qualify as bona fide scientists, and secondly to write with an appropriate combination of precision and simplicity that will communicate to the layman. In the book under review, Richard Bube is quite successful in presenting the scientific perspective with sincere and implicit intention to admonish vested interests in theological circles that they have no cause for alarm, to reassure those who are marked by defensive fear that scientific findings need not be a threat to one's Christian faith, and to the naive that there are fascinating methods and pertinent knowledge available to the Christian in a cognizance of science.

The second reactive approach to problems assumed to exist between Christianity and science is that held by Christian scholars who display a curious ambivalence towards science which leads to misrepresentation of facts through a process of selectivity. Perhaps it is not fair to say that all of these are not well informed, but even though we concede that some are informed, we must conclude that they display biases which make arguments futile and facts useless. Various scholars (whom I grant are such on the assumption that they are sincere and industrious in their efforts) have produced works based upon considerable selectivity of empirical data to support their presuppositions. Thus, Davidheiser in his *Evolution and Christian Faith,* Morris and Witcomb in their *The Genesis Flood,* Wilder Smith in his *Man's Origin, Man's Destiny,* and similar works of this genre fail to represent bona fide science because of their authors' zeal to defend traditional interpretations (held to be truly "biblical") of natural and cultural phenomena.

I have much respect for the Christian convictions of such scholars but I disapprove of their misrepresentations in manipulating data. That there are innumerable cults which consider themselves to represent

"true Christianity" is due to a similar process of incongruous selectivity of biblical statements. One can "prove" almost anything through the process of selectivity and a priori conclusions governing the organization of data in either "Christianity" or in "science." Obviously no Christian scholar attains infallibity or absolute objectivity in his interpretations of natural phenomena or biblical information, but these limitations cannot justify the ignoring of factual data whch seem to weaken an argument. In sharp contrast, Dr. Bube is explicit in his admission of the scholar's limitations while he displays commendable integrity in his reasoning even though he leaves unanswered some questions inherent in the "human quest." But he does not avoid sticky issues which may seem incompatible with his scheme.

The third category of reactive approaches to problems attending science's relation to Christianity needs only brief mention. This is the dramatic reaction that reflects Western man's tendency to think in terms of unilineal absolutes. This is the "either-or" argument that cannot tolerate both Christianity and science. Since Christianity is assumed to provide exclusively all answers to life and science is assumed to offer some answers to man's concern for the temporal present, the "logical" choice is to reject anything scientific if it seems to be in conflict with Christian interpretations. There are no grounds for a dialogue, the issue is settled a priori. In *The Human Quest,* there is implicit refutation of this approach which unfortunately remains in some Christian circles, although it seems to be less prevalent than a generation ago.

Turning now to matters more specific in *The Human Quest,* we may note that the overall argument rests upon at least two general assumptions, both of which are supported by biblical statements. The first is human limitation in addressing one's attention to the "ultimate concern." A Pauline conclusion comes to mind: "For now we see in a mirror dimly, but then face to face. Now I know in part; then I shall understand fully, even as I have been fully understood" (I Corinthians 13:12 RSV). At the outset of his book, Bube, as a reputable scientist, candidly admits that, when confronting crucial questions, "Science alone cannot supply a fully satisfying and meaningful answer to them" (p. 17). Most serious scientists are in agreement with this conclusion.

The second encompassing assumption is that, despite limitations, the Christian scholar is responsible to seek answers to fundamental questions of meaning by exploring both the biblical statements as variously interpreted, along with emerging scientific findings. In Bube's thinking, to admit to fallibility does not excuse the Christian scholar from engaging in this human quest. This assumption brings to mind the Pauline injunction: "Do you best to present yourself to God as one approved, a workman who has no need to be ashamed, rightly handling the word of truth" (2 Timothy 2:15 RSV).

In his first chapter, Bube notes a vital question confronting the scholar: "Is it really true that science has made religious faith impossible?" (p. 20). A soundly-reasoned answer of "No" is reiterated throughout the remainder of the volume. The author immediately provides a frame of reference for answering this crucial question when he proposes "two general theses relating science and Christian faith." These are:

> Thesis 1. The universe exists moment by moment only because of the creative and preserving power of God. Thesis 2. There are many levels at which a given situation can be described. An exhaustive description on one level does not preclude meaningful description on other levels (p. 26).

The first thesis rests upon the sound argument of the fact of existence. For things to be—the argument of "being" in the universe including the world and man—postulates something which may be referred to philosophically as the "Ultimate." There are biblical bases for such argument as, for example:

> In many and various ways God spoke of old to our fathers by the prophets; but in these last days he has spoken to us by a Son, whom he appointed the heir of all things, through whom also he created the world. He reflects the glory of God and bears the very stamp of his nature, upholding the universe by his word of power (Hebrews 1:1-3 RSV).

The second thesis proposes a multilevel approach to description and analysis of the universe of phenomena. This proposal is long overdue in a Christian interpretation of the universe. Bube is to be commended for the proposal although it is not clear whether he arrived at the notion through his own insight, or whether he is borrowing the idea from other scholars. The idea that phenomena can be understood by establishing various "levels" has a venerable history. The basic notion is found in the writing of both Immanuel Kant and Herbert Spencer (if my memory serves me well, for I did not take time to check these scholars). In my own field of anthropology, A. L. Kroeber set forth a scheme of four levels as early as 1936 in an article, "So-Called Social Science" (included in Kroeber's *The Nature of Culture,* 1952). Kroeber proposed such levels as (1) the inorganic as studied in physics and chemistry, (2) the organic as studied in biochemistry and physiology, (3) the psychic as studied in psychology, and (4) the sociocultural as studied in anthropology and sociology. My own guru in anthropology, E. Adamson Hoebel, includes a modified version of the multilevel scheme in his popular introductory text *Anthropology: The Study of Man* (1966).

Significantly, Spencer, Kroeber, and Hoebel exclude an additional highest level because they reject the "spiritual" or supernatural as legitimate within scientific study. In Bube's scheme, the level categories include (1) the nonmaterial level which is concerned with energy and the study of origins; (2) the material but nonliving level which is concerned with particles, atoms, and molecules as studied in physics and chemistry; (3) the simple life level with the concern for the cell as studied in biology; (4) the living but nonhuman level concerned with plant and animal life as studied in botany and zoology; (5) the human level concerned with man and society as studied in psychology, anthropology, and sociology; and (6) the "ultimate" level concerned with God as studied in theology. Such a scheme has merit and seems quite reasonable to me, especially when Bube, in his explanatory context, cautions against the dangers of reductionism. Of course, Bube is aware that his "ultimate" level is excluded from similar schemes offered by the humanistic devotees of science who will have no part with a "non-empirical" arena. Bube's proposals provide an acceptable basis for answering many questions which humanistic scientists will not entertain—

at least not in their formal writings.

Many years ago, I was enrolled in a geology course at the University of Minnesota. The instructor, George Thiel, the chairman of the department and a significant contributor to his discipline, became involved in geological process during one lecture. In response to class members' questions as to "why," he answered rather lamely: "We in geology do not attempt to answer the "why" in geological process. I recommend that you direct such questions to members in the philosophy department." Pathetically, the problem of "why" remained unresolved subsequent to conference with philosophers committed to naturalistic humanism. In contrast, Bube's inclusion of the supernatural in his "levels" idea—the postulated personal God of evangelical Christianity—removes a formidable impasse.

In the second chapter of *The Human Quest,* a complementary question emerges when the author traces the change in perspective through time from earlier teleological explanations, which rest upon a vital relationship between God, the world, and man, to the contemporary position which divorces science from religion. In this change, science has become the source for objective and rational answers to meaning while religious answers to meaning are considered subjective and irrational. The question introduced at this point, and which persists implicitly throughout the book, is: How inevitable are these involved changes in perspective? A negative answer is crucial to the book's success for the Christian scientist.

It may be observed that Christian scientists do not have a monopoly on whether science permits viable religion as a problem confronting contemporary man. For example, in my own discipline of anthropology, the late Robert Lowie was famous for his contributions to studies in religion and science. Since Lowie seemingly never committed himself to any religion, he cannot be accused of undue bias. In an article, "Religion in Human Life" (published posthumously in the *American Anthropologist,* Vol. 65, 1963), his conclusion is:

> What an average man wants above everything else is security. But does science supply this? The answer is "No." That complete world-view that science explicitly renounces is precisely what the layman craves. In this perilous universe he is forever beset with dangers beyond his control. He wants at all odds to survive, and here science leaves him in the lurch—not everywhere and always, but often enough to make him keenly sensible of its imperfections. . . Science has achieved remarkable results, both practical and theoretical, but it has not made man a superman; so long as the enormous chasm yawns between man's rational control of nature and his biologico-psychological drives, there will still be room for belief in a Providence that grants not mere comfort, but security—not mere probability, but certainty. Religion and science thus perform different functions in the life of man, and it is not necessary that either should interfere with the other. (p. 542)

There are certain assumptions in this statement by Lowie that are at dramatic variance with those held in *The Human Quest,* but the point is clear, nonetheless, that others than Christian scientists feel it necessary to analyze the functional relationship between science and religion in their bearing upon meaning for mankind, even though, as in Lowie's case, they fail to bridge the two.

Chapters three, four, and five find Bube probing the definition of science, of Christian faith, and of the difference between science and religion, or more specifically, Christian faith. Herein occurs what I consider to be a weakness in the book. Bube's definition of religion seems to reflect considerable influence from naturalistic humanists who attempt to define religion as a human phenomenon quite apart from the essential notion of the supernatural. Bube does not so define religion explicitly but his discussion contains many statements which make this definition implicit. As is the case with many words in the English language, etymology does not provide a sound basis for definition of religion. Its effective definition must correlate positively with its traditional and consensual usage among scholars.

While religion relates directly to belief and practice, it does not relate to *any kind* of belief and practice. To be a valid term free from confusion, or a certain vagueness which attends Bube's analysis at this point, it seems to me that religion must relate *always* to the supernatural—in evangelical Christianity, to a personal God. One can involve both science and religion in man's "ultimate concern," but confusion results if religion is defined solely as the "ultimate concern," (Paul Tillich notwithstanding). Hence, I cannot accept at face value such comments as: "Even the man who stoutly maintains that there is no God (no supernatural?) is taking part in a religious activity." (p. 68) In my opinion, it is the prepetuation of an erroneous part truth to say that "To such people material possessions are the items of ultimate concern in their life; in a sense, material possessions play the role of God in their perspective on life." (p. 69) I insist that religion *is not* merely "ultimate concern" unless that ultimate concern is viewed as man's relation through belief and practice to the supernatural realm—to supernatural beings and power which means in Christianity an omnipotent God Who is in essence a spirit. To equate ultimate concern in itself with religion is to substitute the means for the end as Jacques Ellul has so forcefully emphasized in *The Power of the Kingdom.*

Fortunately, in the succeeding argument of subsequent chapters, Bube limits his notion of religion mostly to Christian faith which, by common usage, means a form of religion in which belief in the supernatural is assumed. However, as an anthropologist with interest in cross-cultural implications in any attempt to reconcile the science-and-religion differences, I cannot avoid wondering how Bube's argument would fare among scholars who are not part of Western thought, or those cultures which have been influenced by Christianity. I suspect that some modification in both definition and application would be in order, although I think his argument is basically sound, perhaps even for cross-cultural application if the suggested stricture on religion is observed.

I find no serious grounds on which to challenge the treatment which the author accords to the interactions between science and the Christian faith. I would be guilty of crass hypocrisy if I did not subscribe to Bube's proposed interaction, for my confession includes both to being a Christian and being an anthropologist. In modern thought devoid of the supernatural dimension for the structure of the world, man is indeed "only a complex machine." The author, as I see it, has a secure stance in this conclusion: "Man is a complex machine. But to assert that man is *only* a complex machine is to equate the whole with the sum of its parts and to fail to recognize the necessity for a multilevel description

in order to do full justice to what kind of creature man is." (p. 156) The author effectively utilizes his "multi-level description" concept for a complete picture of reality, and thus to refute physical, psychological, and sociological determinism. (Are there implications for resolving the theological problem of predestination?) I heartly concur in this refutation.

Of course it is to be expected that any consideration of the science-and-Christianity dialogue could not escape some attention to evolution. Despite his inclination toward evolution as a theistic evolutionist, Bube avoids the morass of emotional biases in his fair analysis of this persistent controversy. I may disagree in part with the author, but I readily concede that my presuppositions and conclusions perhaps are more vulnerable to attack by scholars than those of the author. I hope the author will tolerate with patience my adamancy in frowning upon his loose use of the term, religion, when he writes of the danger of evolutionary thinking becoming "a life-directing religious faith," or that "Evolutionism takes its place as one of the world's religions with cults and offshoots of various economic and political kinds." Am I guilty of mere semantic quibbling?

Bube concludes his work with a consideration of the social implications that may stem from some resolution of science and Christianity. The adage, "The proof of the pudding is in the eating," is the thrust of his concluding words:

> The Christian involved in science has additional opportunities. He is in a position to bridge the gap between the Christian community and the scientific community. He is the only one who knows from the inside what it means to trust oneself wholly to God in Christ and at the same time what it means to evaluate properly the potentialities of scientific investigation for an understanding and control of the natural world. If he does not undertake the role of reconciling these two communities, there is no one else able to do it. (p. 251)

The organization, style of writing, lucidity, and minimization of technical jargon in *The Human Quest* make for pleasurable reading. Also the inclusion of "Topics for Discussion" following each chapter adds much to the potential use and application of the book for discussion groups whether in classroom or informal groups who have a stake in the issues included in the book. Congratulations Dick, for leading us along better illuminated pathways in our human quest!

Reviewed by George J. Jennings, Department of Anthropology, Geneva College, Beaver Falls, Pennsylvania.

ECOLOGY CRISIS, by John W. Klotz, St. Louis: Concordia, 1971, 176 pps. $5.95.

This book is so good that I wish I had written it. It is a sensible, reasonably complete book on God's creation and man's pollution (actually the emphasis is more the reverse). It covers the subject in sufficient depth for the college freshman or sophomore, but is written simply enough so that even their parents could understand it. There are numerous references, most to *Science* and *BioScience*, so that *Ecology Crisis* surveys some of the science-oriented literature comprehensible to the few laymen who might actually look up something in a bibliography.

A page and a half glossary (by Andrew J. Buchner) helps some, but not enough. *Decomposer, predator,* and *half-life* are missing, for example, though *roentgen, biodegradable* and *PAN* are not. The index is just adequate.

The organization of the book makes up for these deficiencies. There are two introductory chapters, followed by about fifteen pages each, on upsetting the balance of nature, several kinds of pollution, endangered species, and on what needs to be done.

Another strength of the book is the author's experience—Klotz has evidently been a conservationist since this reviewer joined the population explosion!—with resulting emphasis on conservation (prevention) rather than cures, and on some of the historical background. The author rightly puts down some of the more rabid ecoactivists and those who blame our Judeo-Christian heritage (White, *Science* 155: 1203-7; 1967) for our present troubles. His concept of our relationship to God is one of planetary stewardship.

There are some faults, of course. There are too many quotations. White's attack on Christianity was itself attacked (see Feenstra *et.al*, *Science* 156:737-8, 1967 and Moncrief, *Science* 170:508-12, 1970) but Klotz does not include this in his discussion of White. On page 20, the efficiency of herbivores in utilizing energy is too low by a factor of about 10, according to Odum.

On page 65, a correlation between rainfall in La Porte, Indiana, and steel production in Chicago is cited. This presumed effect of air pollution is controversial—see *Science* 171:847, and 172:987, both 1971. Finally there is insufficient examination of the effect of our prevailing lifestyle on the environment.

I repeat, this is a good book. The paperback is adequately bound. Lord willing I intend to use it as a text in freshman biology next year.

Reviewed by Martin La Bar, Division of Science, Central Wesleyan College, Central, South Carolina.

HUMANISTIC PSYCHOLOGY by John A. Hammes, New York: Grune and Stratton, 1971. 203 pp. $7.95.

Subtitled *A Christian Interpretation*, "the primary purpose of this book is to present the compatibility of scientifically established psychological truth with the truths proposed by a Christian frame of reference." The author is a professor of psychology at the University of Georgia and a Roman Catholic.

He approves of released-time classes for moral and religious instruction, movies, dancing and application of of the Ten Commandments to this age. He is against abortion.

The book is divided into four main parts and subdivided in 16 chapters. Part I considers the basic methods used to study man; Part II the various theories of man's nature; Part III personal adjustment; and Part IV a Christian interpretation of the origin, purpose and destiny of man.

A large part of the book is devoted to tables, figures, suggested readings, name and subject indices, bibliography, and blank pages between sections. These together comprise 67 of the 203 pages. Each of the remaining 136 pages of prose costs nearly 6 cents. It is not worth it.

If the reader can grasp the text, the tables and figures become super-fluous; if he cannot understand the text, they are not helpful. The utility of the subject index is restricted because of its incompleteness,

e.g., theory is discussed in the text but does not appear in the index. While the original sources referred to are listed, it is difficult to check them because the relevant page numbers are not given. Five misspelled words appear in the book.

On the positive side, Hammes is to be commended for his integration of psychology and theology, his extensive knowledge of philosophy and his Christian testimony—all of which come through clearly.

The book however, possesses some negative qualities. Its greatest short-coming is imprecision, something one does not expect in a psychology textbook. Hammes makes a mistake common to many writers, i.e., identifying his view as *the* Christian view (p. 149) instead of *a* Christian view. There are not too many things that all Christians agree upon and certainly sex is not one of them. For instance, Hammes, in speaking of sex writes (p. 109): "sexual enjoyment is for the married, according to Christian philosophy. . ." What about hand holding, nocturnal emissions and masturbation? Hand holding is certainly a legitimate sexual activity; there is little voluntary control over nocturnal emissions; and some Christians consider masturbation an appropriate sexual outlet under certain circumstances for the unmarried (cf. Herbert J. Miles, *Sexual Understanding Before Marriage*. Grand Rapids: Zondervan, 1971, p. 137f.)

Here is another imprecise statement on sex (p. 148) which can be questioned: "Chastity and modesty are ignored, even despised, in contemporary society. . . . College campus sexual behavior . . . has become free of moral censure. The only control governing such behavior today is fear, the fear of possible pregnancy." Despite the new morality, there are probably as many virgins as non-virgins among the young today. At any rate, no one really knows for certain. Furthermore, there are many controls on promiscuity besides possible pregnancy which, with modern birth control methods, may be the weakest inhibitor of all. Other examples of imprecise statements are found concerning public support of immorality in the media (p.110) and approbation by contemporary psychologists of illicit affairs (p. 114). Some of the statements are virtually meaningless, e. g., (p. 109): "To elevate sexual satisfaction to a level higher than other and more primary drives is to unbalance human nature." Just what does that mean? Should a person engage in consummatory responses an equal number of times for each drive to keep them balanced?

The most unsatisfying chapter in the book is the one on determinism and human freedom. This is Hammes position: "Determinism, if correct, makes of divine justice a mockery, and portrays God as fiendish rather than benevolent" (p. 86). For the already convinced, such writing may be edifying; for the disclaimer it is aggravating. Care must be taken not to identify the deterministic view as non-Christian and the free will view as Christian. The history of doctrine certainly does not allow such a view to go unchallenged. Hammes' discussion leaves the reader bristling with questions rather than satisfied with answers.

The psychologist who reads this book may find much of its philosophical content on the periphery of his knowledge and interest. He will also find that Hammes makes some quite incredible statements in the light of contemporary psychological knowledge. For instance he writes (p. 66) "Concept formation, or ideation, is the highest capability of human being. This activity sets him apart from all other animals." Contrast this statement with one from a modern psychology text: "Concepts can be developed by lower animals as well as man" (Harry Harlow, et. al., *Psychology*. San Francisco: Albion, 1971, p. 376).

Hammes implies (pp. 14, 30, 48) that psychologists believe the experimental approach the only valid one in studying human behavior. This is an example of misrepresentation. In addition to the experimental approach, the most powerful psychological method, such techniques as naturalistic observation, test, interviews, and questionnaries are employed by psychologists. (Jerome Kagan and Ernest Havemann, *Psychology: An Introduction*. New York: Harcourt, Brace and Jovanovich, 1872, pp. 21-28).

After decrying cause-effect relationships based on correlation (p. 33), Hammes seemingly accepts it as a basis for inferring that divorce is bad for mental health (p.103). Further, his discussion of cause-effect is not in agreement with, for example, Floyd Ruch and Philip Zimbardo (*Psychology and Life*. New York: Scott, Foresman, 1972, p. 14f.).

For whom is the book intended? "This book has been written for the college student with little or no background in philosophy or theology." At places they may find it pedantic and preachy. It might serve a greater usefulness in a graduate seminar where some of its topics could provide a semester of vigorous debate. For the reader interested in a highly readable coverage of humanism, Frank Goble's *The Third Force* (New York: Grossman, 1970), a study of the psychology of Abrahm Maslow, will prove more helpful than *Humanistic Psychology*.

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THE STRUCTURE OF SCIENTIFIC REVOLUTIONS by T. S. Kuhn, Chicago, 1962

Science has been defined in many different ways. One of the definitions in my dictionary[1] reads: "organized body of the knowledge that has been accumulated on a subject." We usually get the idea that our sciences have 'accumulated' over the ages as a result of objective observation, especially if we read the standard text books. There can be little doubt that this idea is at least partly conditioned by the views of science to which the authors of these books subscribe. A way in which one can check whether such views are tenable is to study the history of the various sciences. This Thomas S. Kuhn has done in his book *The Structure of Scientific Revolutions*[2], and it is certain that he would disagree with the above dictionary definition, as well as the view of the history of science we meet in most textbooks. Kuhn differs from the prevailing view of science in that he believes that a scientist's conceptual framework, or the view he holds on matters pertaining to his field, does indeed play a role in various ways in his work, even in the area of "observation" and "facts". This article is an attempt to look carefully at Kuhn's important book, and to discuss the problematics from which it arises.

Thomas S. Kuhn (1922-) received his formal education at Harvard. His baccalaureate degree was in the area of theoretical physics, but his subsequent work was in the history of science. He has written two books:

"The Copernician Revolution"[3] and the book under review. While at Harvard, Kuhn was influenced by James B. Conant, president of Harvard University, and himself a well-known scientist and author. Kuhn now teaches history of science at Princeton University.

In the first chapter of the book we are discussing, Kuhn pleads for an historical awareness in the sciences ("science" being used in the restricted sense of natural science). For reasons which he will describe more fully later, Kuhn thinks textbooks of science to be misleading in one fundamental way: they do not give a proper view of the history of science. These books give the impression "that the content of science is uniquely exemplified by the observations, laws, and theories described in *their* pages." (p. 1) Referring to scientific theories of previous ages, Kuhn states: "If these . . . are called myths, then myths can be produced by the same sort of reasons that now lead to scientific knowledge. If on the other hand, they are to be called science, then science has included bodies of belief quite incompatible with the ones we hold today." (p. 2)[4] That a scientist has a certain set of beliefs which are never questioned as long as the community works efficiently and makes progress, and that research is "a strenuous and devoted attempt to force nature into conceptual boxes supplied by professional educations" (p. 5) are some of Kuhn's opinions, ones not to be found in current textbooks.

This leads to Kuhn's idea of paradigm. Normal science, as he calls it, does not want change, or challenges of the main theory. Chapters 2 to 5 describe the route to normal science and Kuhn's concept of paradigms. In the preface Kuhn explained that he was struck by the fact that it is doubtful that "practitioners of the natural sciences possess firmer or more permanent answers . . . than their colleagues in social science." (p. x). Why is it then that science gives such a convincing impression of being of one mind. How are controversies over fundamentals avoided so successfully? Kuhn postulates that this is so because in the sciences paradigms play such an important role. Paradigms are "universally recognized scientific achievements that for a time provide model problems and solutions to a community of practitioners." (p. x). Thus a paradigm is a

> conceptual and instrumental framework . . . accepted by the entire scientific community; the resulting mode of scientific practice inevitably evokes 'crises' which cannot be resolved within the framework; . . . science returns to normal only when the community accepts a new conceptual structure which can again govern its search for novel facts and for more refined theories . . . (cover).

The nature of a science before a paradigm emerges is discussed. Once a paradigm does become accepted, it saves much discussion and repetitive research, but it also makes the science unintelligible to the general reader.[5] Accepted paradigms are what distinguish the natural sciences from disciplines such as psychology, sociology and theology.[6]

Chapter 6 is entitled "Anomaly and the Emergence of Scientific Discoveries". Novelty emerges with difficulty, often after repeated anomaly. Normal science is so predictable and regular that anomalous findings stand out very clearly and cause a crisis situation. Chapter 7 describes how crisis can lead to the emergence of scientific theories, while the next chapter discusses the response of the "scientific community" to emerging scientific theories. The arguments that Kuhn uses to back up his opinions are convincing; they show that he is well acquainted with the way the physical sciences operate. He argues that paradigms "are constitutive of science," since they dictate research projects, equipment to be used, and which results are to be considered acceptable: "By shifting emphasis from the cognitive to the normative functions of paradigms some examples enlarge our understanding of the ways in which paradigms give form to the scientific life" (p. 109). The author concludes chapter 9: "I have so far argued only that paradigms are constitutive of science. Now I wish to display a sense in which they are constitutive of nature as well." (p. 109)

Chapter 10 takes the next step: "When paradigms change, the world itself changes with them." ". the familiar demonstrations of a switch in visual *gestalt* proved . . . suggestive. What were ducks before the scientific revolution were rabbits afterwards" (p. 110). The whole way of looking changes, like "scales falling from eyes" or "flashes of intuition" (p. 121). Kuhn suggests that perception changes with scientists' commitment to paradigms, not with the "raw data" or "brute experience". Different paradigms even lead to different laboratory manipulations. A pure observation language[7] will therefore not help scientists of different paradigms to communicate. Only after experience is determined by a paradigm can a pure observation language begin. But, Kuhn somewhat softens the blow, "changes of this sort are never total. Whatever he may then see, the scientist after a revolution is looking at the same world" (p. 128). After discussing a specific example, he suggests that after this paradigm change, scientists "had still to beat nature into line. . . . When it was done, even the percentage composition of well known compounds was different. The data themselves had changed" (p. 134).

Most revolutions "have customarily been viewed not as revolutions but as additions to scientific knowledge" (p. 135). Why are the revolutions so invisible, asks Kuhn in Chapter 11. He feels this is so because textbooks, and other scientific literature record the *outcome* of revolutions. New paradigms necessitate new textbooks. "Textbooks thus begin by truncating the scientist's sense of his discipline's history and then proceed to supply a substitute for what they have eliminated." From just a bit of history, in scattered references, "both students and professionals come to feel like participants in a long standing historical tradition", a tradition "that, in fact, never existed" (p. 137).[8] Depreciation of historical fact is deeply ingrained in the scientific profession. "Fortunately, instead of forgetting these heroes, scientists have been able to forget or revise their works" (p. 138) There is a persistent tendency to make history look linear or cumulative. "But that is not the way a science develops." (p. 139).

How does one paradigm replace another? This is the topic of Chapter 12. Usually new interpretations arise in the mind of one or a few young men, less committed to the old paradigms. There are no absolute criteria for verification (paradigm testing). Kuhn says Popper[9]

> denies the existence of any verification procedures at all. Instead he emphasizes the importance of falsification, i.e., of the test that, because its outcome is negative, necessitates the rejection of an established theory. Clearly, the role thus attributed to falsification is much

> like the one this essay [i.e., Kuhn's] assigns to anomalous experiences . . . I doubt that [falsifying experiences] exist (p. 145).

Proponents of competing paradigms often fail to communicate. Before this communication can occur, "one group or the other must experience the conversion that we have been calling a paradigm shift" (p. 149). Often the shift is not made, but a new generation of scientists, who accept the new paradigm, grows up; indeed one cannot abandon paradigms every day and still be a scientist. "Probably the single most prevalent claim advanced by the proponents of a new paradigm is that they can solve the problems that have led the old one to a crisis" (p. 152). Quantitative precision is often very convincing, also. Decisions for the new paradigms can only be made on faith, for the new paradigms then need supporters who can develop hard-headed arguments. After this is done, the man who continues to resist unduly ceases to be a scientist.

The final chapter is a crucial one. Kuhn compares the natural sciences to the social sciences. Social scientists often ask the question "Why should science move steadily ahead, while art, philosophy, or political theory does not?" Kuhn answers "But science does not, either." Debates on whether social sciences are indeed sciences are fruitless because they are based on a false idea of the sciences, and also because paradigms are not universally agreed upon in the social sciences. Of course, a theologian or philosopher contributes to progress too, but only of his school (paradigm).

> The absence at most times of competing schools that question each other's aims and standards makes the progress of a normal scientific community far easier to see . . . (Once) the reception of a common paradigm has freed the scientific community from the need constantly to re-examine its first principles, the members of that community can concentrate exclusively upon the subtlest and most esoteric of the phenomena that concern it (p. 162-163).

Kuhn works out this key idea in detail. He describes scientific education, as mainly from textbooks, rather than original sources, and continues,

> Of course, it is a narrow and rigid education, probably more so than any other except in orthodox theology. But for normal scientific work, for puzzle solving within the tradition that the textbooks define, the scientist is almost perfectly equipped (p. 165.)

Kuhn could end his book here, but does not. In the final few pages, many new ideas are introduced. I will quote rather extensively to give Kuhn the opportunity to have his final say.

> We may . . . have to relinquish the notion . . . that changes of paradigm carry scientists and those who learn from them closer and closer to the truth.
>
> It is now time to notice that until the last very few pages the term 'truth' had entered this essay only in a quotation . . . Nothing that has been or will be said makes it a process of evolution toward anything. . . . We are all deeply accustomed to seeing science as the one enterprise that draws constantly nearer to some goal set by nature in advance.
>
> But need there be any such goal? Can we not account for both science's existence and its success in terms of evolution from the community's state of knowledge at any given time? Does it really help to imagine that there is some one full, objective, true account of nature and that the proper measure of scientific achievement is the extent to which it brings us closer to that ultimate goal? If we can learn to substitute evolution-from-what-we-do-know for evolution-toward-what-we-wish-to-know, a number of vexing problems may vanish in the process. . . .
>
> I cannot yet specify in any detail the consequences of this alternate view of scientific advance. But it helps to recognize that the conceptual transposition here recommended is very close to the one that the West undertook just a century ago. . . . When Darwin first published his theory of evolution by natural selection in 1859, what most bothered many professionals was neither the notion of species change nor the possible descent of man from apes. . . . All the well-known pre-Darwinian evolutionary theories . . . had taken evolution to be a goal-directed process. The "idea" of men and of the contemporary flora and fauna was thought to have been present from the first creation of life, perhaps in the mind of God. . . . Each new stage of evolutionary development was a more perfect realization of a plan that had been present from the start.
>
> For many men the abolition of that teleological kind of evolution was the most significant and least palatable of Darwin's suggestions. . . . What could 'evolution', 'development', and 'progress' mean in the absence of a specified goal? . . .
>
> The analogy that relates the evolution of organisms to the evolution of scientific ideas can easily be pushed too far. But with respect to the issues of this closing section it is very nearly perfect. The process described . . . as the resolution of revolutions in the selection by conflict . . . of the fittest way to practice future science. The net result of a sequence of such revolutionary selections, separated by periods of normal research, is the wonderfully adapted set of instruments we call modern scientific knowledge. . . . And the entire process may have occured . . . without benefit of a set goal, a permanent fixed scientific truth.

Comparing the book under review to the work of J.B. Conant shows that Kuhn was influenced by him to a considerable extent. Kuhn acknowledges this in the preface; in fact he dedicates his book "To James B. Conant Who Started It." In the book *Science and Common Sense*[10], Conant defines his view of science:

> The dynamic view in contrast to the static regards science as an activity; thus the present state of knowledge is of importance chiefly as a basis for further operations. . . . Thus conceived science is not a quest for certainty; it is rather a quest which is successful only to the degree that it is continuous. . . .
>
> Why not boldly claim, as many scientists have in the past, that the physicists and chemists are trying to find out how the inanimate universe is constructed and how it works? If that is the goal, then clearly there is a terminal point, at least in principle; when the puzzle has been solved . . . the laboratories can be closed . . . (pp. 25-26).

Conant then introduces the term "conceptual schemes", and uses it in many respects like Kuhn's "paradigms". Other similarities are also apparent.

Kuhn's idea of paradigm is criticized sharply in an article by D. Shapere.[11] Some comments and pertinent quotes follow.

> [Kuhn's] view, while original and richly suggestive, has much in common with some recent antipositivistic reactions among philosophers of science—most notably Feyerabend, Hanson, and Toulmin[12]—and . . . it is bound to exert a wide influence among philosophers and historians of science alike. (p. 383).

Shapere suggests that Kuhn's use of 'paradigm' is too global, too all embracing, so that the term loses its meaning; there are guiding factors in science, but it is confusing if the word paradigm is applied to them. Some of Kuhn's views appear too strongly and confidently held to have been extracted from a mere investigation of how things have happened. This is one place at least, where Shapere and Kuhn would probably agree. Shapere correctly sees that the interpretation of historical facts (by Shapere or Kuhn) would

then also be "through" a paradigm. It is somewhat disconcerting to a person of a more positivistic bent, like Shapere, that Kuhn gives no logical, rational method of removing these difficulties. Shapere further mentions that differences are often a matter of degree so that "looking for the guiding elements in scientific activity is not like looking for a unitary entity that either is there or is not" (p. 388). Because adherence to paradigms is indeed often not a black-or-white situation, it would seem to me that Shapere has a valid criticism.

> For Kuhn's term "paradigm", incorporating as it does the view that statements of fact are (to use Hanson's expression) theory-laden, and as a consequence the notion of (in Feyerabend's word) meaning variance from one theory or paradigm to another, calls attention excessively to the differences between theories or paradigms, so that relations that evidently do exist between them are in fact passed over or denied. (p. 391).

Shapere raises some questions on the phenomenon of paradigm change and also objects strongly to Kuhn's relativistic dismissal of "truth". He feels that the idea of progress offers little compensation for the confusing situation which arises when the idea of truth is abandoned. Shapere's conclusion is that an approach such as Kuhn's was the inevitable reaction to the ahistorical views of science. "Until historians of science achieve a more balanced approach to their subject —neither too positivistic nor too relativistic[13]— philosophers must receive such presentation of evidence with extremely critical eyes.[11] (p. 393) In Kuhn's case this would necessitate a more careful use of his tools, specifically the use of the concept "paradigm", Shapere suggests. This is a valuable contribution to the discussion about the idea of "paradigm".

In English speaking countries, where irrationalist thinking[14] is not as prevalent as in continental Europe, books such as Kuhn's are starting to attract attention. However, especially in the sciences, i.e., among scientists, in textbooks, and in history of science books, the positivistic view is still pervasive. Because of this, Kuhn, himself a trained scientist, is like a prophet in his own country, for, after all, "the facts are not to be denied." It would take us beyond the scope of this review to discuss the impact of the Vienna circle, and of logical positivism[15], on scientific thought in general, and on textbooks in particular. Yet it is against this tradition, the tradition ingrained in most of us educated in North America, that Kuhn is reacting. The positivistic approach encountered in textbooks is often a rather simplistic one, many times seemingly oblivious to the present stage of the debate. For this reason it is probably well for us to mention an articulate member of this school of philosophy.

The problems that ideas such as Kuhn's raise, particularly for positivistic strains of philosophy are discussed by Israel Scheffler, in his book, *Science and Subjectivity*.[16] Scheffler feels that the inevitable result of Kuhn's ideas is a complete breakdown of communication in the sciences. For this reason, some measure of obectivity, or control over assertion, is necessary for "common discourse." Unless there is some common language, there can be "no real community of science in any sense approximating that of the standard view, no comparison of theories with respect to their observational content, no reduction of one theory to another, and no cumulative growth of knowledge at least in the standard sense." (p. 17) After making some fundamental distinctions about the process of observation and scientific proof, Scheffler claims that communication in the sciences is still possible, i.e., some measure of objectivity[17] can be retained. This in spite of the fact that observations are affected in no small degree by hypothesis, conceptual scheme, etc. Scheffler's solution to the problem of communication in the sciences is the same as the one suggested by some members of the school of logical positivism,[18] namely, the necessity and possibility of some kind of observational language. I feel, however, that from his point of view, Scheffler has dealt perceptively and capably with some of the problems Kuhn raises.

The reason why *I* chose to review Kuhn's book is that he has diagnosed, correctly in many respects, the thinking which is prevalent in North American research institutions and scientific literature. He has seen that theory and ideas do shape, in several ways the scientific disciplines. The fact that some, like Scheffler, have been able, more or less successfully, to adjust positivistic thinking to objections such as the ones Kuhn raises is probably more exciting for these philosophers than for the average scientist. It can be said that for the latter the history of science is one gradual but glorious unfolding of the spirit of discovery; this spirit of discovery has led and leads to objective facts which enable man to understand and manipulate his world. With Kuhn I think that, on the contrary, scientific theories are often reversed and that differences of opinion between scientists do occur. The ideas which drive an investigator or theoretician are thus more than interesting asides, to be divulged to a doting public if the man happens to win a Nobel prize.

Thus, while Kuhn's idea of paradigm needs clarification, as Shapere suggests, it is also true that it is impossible to do scientific work in a vacuum. A striking illustration of this can be found in Butterfield's book *The Origin of Modern Science*.[19]:

> It is particularly towards the end of the sixteenth century that we can recognize the extraordinary intermediate position which existed . . . In 1589 one writer, Magini, said there was a great demand for a new hypothesis which would supersede the Ptolemaic one and yet not be so absurd as the Copernican . . . People even put forward the view that one should drop all hypotheses and set out simply to assemble a collection of more accurate observations. Tycho Brahe replied to this that it was impossible to sit down just to observe without the guidance of any hypothesis at all. (p. 73)[20]

A question which must be answered, not only by Kuhn, but also by us, is: "What is it *then* that structures reality, that makes it dependable, "investigatible", or "consistent?" Kuhn's answer has been unambiguous: the mind (or paradigm) of the investigator. Thus there is no truth, only progress toward a non-existent goal. The human mind, no matter what paradigm it works under, fashions the laws which hold for creation, fashions them in the scientific community. One could call this Kantian conceptualism.

We must differ with Kuhn's extremely subjectivistic conclusion, no matter how much we approve of his belligerence against the predominant spirit of the scientific community. In fact, this belligerence, as we already mentioned, is the main reason for our extensive discussion of the book.[21] Yet, the formulation of natural laws is not a matter of survival of the fittest, the fittest being the formulation which leads to most progress. Rather, it is the Word which was from the be-

ginning, through which everything was made (John 1:1-14), which originated and upholds reality. It is the business of the scientist to investigate this structure which holds for reality, and he should attempt to formulate laws or theories which reflect this structure. Then formulations, while often in error, and always influenced by the "paradigm" of the investigator, should still be seen as man-made attempts to reflect the creating, upholding, structuring Word.[22]

When we accept that it is this Word which structures reality,[23] it is not surprising that Kuhn, and also Conant, have to back away from their position, to account for the constancy[24] which confronts them as they, or others, investigate reality. Kuhn, for example, states: "But changes . . . are never total. Whatever he may then see, the scientist after a revolution is still looking at the same world." (p. 128) Similarly, Conant says: "we shall assume that under the same set of conditions the phenomena are in all details reproducible. Such assumptions may be regarded as an act of faith . . ." (p. 35.) However, it is not only important to realize, with Francis Bacon, that "Nature, to be commanded, must be obeyed,"[25] but also that the above quotations illustrate a dialectical tension between Freedom and Nature (or Freedom and Determinism, as it is often called) which seems unresolvable. This tension is also observable in the philosophy of thinkers like Scheffler, who, unlike Kuhn and Conant, are closer to the "Nature pole" in this philosophical dilemma.

In the Nature-Freedom motive a dialectical tension exists. Both are present to some degree even though one may predominate. Dooyeweerd rejects the Nature-Freedom motive as one of the apostate ground motives in Western thought, identifying instead with the Christian motive of "Creation-Fall-Redemption, in the communion of the Holy Spirit." This avoids the dialectic tensions which inevitably arise in the other ground motives he has identified.[26] Also in *our* attempts to break away from the dilemma between positivism and a position such as the one defended by Kuhn, the Creating Word, which originated, upholds, and structures all of reality, has a central place as we described.

This respect of the Christian for Jahweh's law should not only be in his scientific work. To do things properly requires this obedience in everything he does. This truth is strikingly brought home in Isaiah 28:23-29.

[1]Dictionary. Concise Oxford Dictionary of Current English. Fowler and Fowler, 1964

[2]Kuhn, T. S. *The Structure of Scientific Revolutions,* Chicago, 1962.

[3]Kuhn, T. S. *The Copernican Revolution, Planetary Astronomy in the Development of Western Thought.* New York, 1957.

[4]See also Frazer, J. G. *The Golden Bough, a Study in Magic and Religion.* New York, 1951. p. 56.

[5]Compare, for example, an article in the *Journal of Biochemistry* to Newton's "Principia" (a "pre-paradigmatic" book).

[6]The striving of phychology, for example, to earn the label "science" is rather interesting and telling in this respect.

[7]Long an objective of the Logical Positivists of the Vienna Circle. For a discussion of this subject see Passmore, J., *Hundred Years of Philosophy,* New York, second edition, 1966, chapter 20.

[8]For a striking discussion of such a situation see the section on relativity in Chapter 1 of Polanyi, M., *Personal Knowledge, Towards a Post-Critical* Philosophy, Chicago, 1958.

[9]Popper, K. R., *The Logic of Scientific Discovery,* New York, 1959.

[10]Conant, J. B., *Science and Common Sense,* New Haven, 1951.

[11]Shapere, D., The Structure of Scientific Revolutions, The Philosophical Review, 73, 383-394, 1964. For a more elaborate discussion of Kuhn's idea of paradigm, one which tends to agree with Kuhn's viewpoint, see M. Masterman in *Criticism and the Growth of Knowledge,* Cambridge, England, 1970. See Footnote 22.

[12]See Feyerabend, P. A. *Explanation, Reduction and Empirecism,* Minnesota Studies, 3, 1962. H. R. Hanson, *Patterns of Discovery,* Cambridge, England, 1958, *The Concept of the Positron, A Philosophical Analysis,* Cambridge, England, 1963. S. Toulmin, *Foresight and Understanding,* London, 1961, New York, 1963. For a concise discussion of these writers, see J. Passmore; *A Hundred Years of Philosophy,* New York, second edition, 1966, pp. 540-541.

[13]If this non-descript "middle-of-the-road" attitude is philosophically tenable!

[14]Especially existentialist thought.

[15]For brief, well-written introductions to this philosophical school see Ayer, A. J., ed. *Logical Positivism,* Glencoe, Ill. 1959; Passmore, J. *A Hundred Years of Philosophy,* London, Second Edition, 1966; Koch, S., *Psychology and Emerging Conceptions of Knowledge as Unitary,* in Wann, T. W., ed. *Behaviorism and Phenomenology,* Chicago, 1964.

[16]Scheffler, I., *Science and Subjectivity,* Indianapolis. 1967.

[17]The term "objectivist" as Scheffler uses it for example, is probably a misnomer. John Van Dyk (*Survey of the History of Philosophy,* mimeograph, Dordt College, 1969) points out that positivism is not an objectivistic but a subjectivistic philosophy because it places the law for creation in man himself, (in his reason, i.e. his subject functions); he is autonomous.

[18]See footnote 15.

[19]Butterfield, H., *The Origins of Modern Science,* New York, 1957.

[20]See also Hansen, N. R. *Patterns of Discovery.* Cambridge, England. 1958.

[21]Kuhn's book does not go into many of the philosophical problems which are inherent in the subject of the growth of scientific knowledge. However, he is well aware of these problems. For a recent discussion see Lakatos, I. and A. Musgrave, editors, *Criticism and the Growth of Knowledge,* Cambridge, England, 1970. This book contains an introduction by Kuhn, and discussions by J. W. N. Watkins, S. E. Toulmin, L. Pearce Williams, K. R. Popper, Margaret Masterman, I. Lakatos, P.K. Feyerabend, and a final statement, again by Kuhn. The paper by Miss Masterman perhaps explains the popularity of Kuhn's book: ". . . this book is at once scientifically perspicuous and philosophically obscure. It is being widely read, and increasingly appreciated by actual research workers in the sciences, so that it must be (to a certain extent) scientifically perspicuous. On the other hand, it is being given widely diverse interpretations by philosophers which gives some reason to think that it is philosophically obscure. The reason for this double reaction, in my view, derives from the fact that Kuhn has really looked at actual science, in several fields, instead of confining his field of reading to that of the history and philosophy of science, i.e., to one field. In so far, therefore, as his material is recognizable and familiar to actual scientists, they find his thinking about it easy to understand. In so far as this same material is strange and unfamiliar to philosophers of science, they find any thinking that is based on it opaque. Kuhn's form of thinking, however, is not in fact opaque, but complex . . . it reflects the complexity of the material."

[22]The importance of this Word which upholds the structure of creation, was stressed in the speeches by J. B. Hulst, J. H. Olthuis, G. Spykman and R. E. Vander Vennen at Dordt College in December, 1970. These speeches are published, and available from Dordt College.

[23]For a pertinent discussion of the law structures see J. Olthuis' article as mentioned in footnote 22.

[24]This "constancy" should be seen as faithfulness of the creator rather than a uniform determinism.

[25]Bacon, Francis, *The New Organon,* Book I III, 1620.

[26]Dooyeweerd, H., *A New Critique of Theoretical Thought,* Volume I, Philadelphia, 1958.

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MORALITY, LAW AND GRACE by J.N.D. Anderson, 128 pp. Paperback. (1972) $1.95.

ARGUING WITH GOD by Hugh Silvester, 128 pp. Paperback. (1971) $1.50.

DESPAIR: *A Moment or a Way of Life?* by C. Stephen Evans, 135 pp. Paperback. 1971).

FROM CHRIST TO CONSTANTINE by M.A. Smith, 208 pp. Paperback. (1971).

QUESTIONS OF SCIENCE AND FAITH by J.N. Hawthorne, 62 pp. Paperback. (1972).
All five books available from Inter-Varsity Press, Box F, Downers Grove, Illinois 60515.

These five new titles from the expanding Inter-Varsity library deserve to be noticed by readers of the *Journal ASA*. The consistent high quality of these endeavors makes it desirable for evangelicals of various vocations to be on the Inter-Varsity Press mailing list.

In *Morality Law and Grace* the prolific Dr. Anderson, Professor of Oriental Laws and Director of the Institute of Advanced Legal Studies in the University of London (*Christianity: The Witness of History* and *Christianity and Comparative Religion*) adds to the material given in the Forwood Lectures on the Philosophy and History of Religion at the University of Liverpool in February 1971. He starts with the age-old dilemma of morality and determinism, sketching the perpectives of physicist, psychologist, philosopher and theologian, and concluding that "there is no reason whatsoever to suppose that ordinary men and women are mistaken in their firm conviction that they have, within limits, a genuine freedom of choice and action." In subsequent chapters he considers morality in the permissive society, and develops in detail the connection between morality and law in general and in connection with tyranny and injustice. Finally he turns his attention to morality and grace, and works out the Biblical position on what is normally referred to as works and faith. Throughout the book the author strives for a balanced position.

Arguing with God is subtitled, "A Christian Examination of the Problem of Evil." Written by an accountant turned Anglican minister, chaplain, and Tutor at Oak Hill Theological College in London, it is one of the most readable expositions of this No. 1 Christian dilemma available. It is written primarily for Christians, and for non-Christians who might be thinking of becoming Christians. He tackles the question of the definition of "good;" moral evil and natural evil; the existence of evil in a world created by a good and all-powerful God; insufficient solutions which deny either the goodness of God, the power of God, or the reality of evil; the "free will defence;" the problem of human freedom; eschatological resolutions of the problem of evil; activity of God that shows He cares; and a challenge to Christians

to take their place in the work of God in a world in need. One of the most penetrating insights is the simple statement that the *first* response of a Christian to experience with suffering in the world is to repent. He has troubles with natural evil, and yet gives the provocative comment that "the world as it is appears to be the only suitable home for man as he is."

Nothing is revealed about the author of *Despair* except that he was born in 1948. The book pretty much follows the lead of Francis Schaeffer in developing the theme of despair as the product of modern existentialism. He discusses Dostoevsky, Nietzsche, Sartre, Marcel, Camus, "Man of La Mancha," "Catch-22," Jaspers and Marx, in an easy and popular style. He argues that each man must come to the moment of despair before he recognizes his ultimate need for Christ, but that this is in no way to be compared with the adoption of despair as a worldview. This is a useful book to give to a friend caught up in existentialism without the Christian dimension.

From Christ to Constantine is living and readable church history, written by a reader in classics and theology at Oxford to show that "many of our present problems have arisen in other forms before, and it is often instructive to see how they were faced by Christians of other ages." Such history is not only a record of unyielding faith in the face of threat, persecution and martyrdom, but it is also the humbling record of heresy, party strife within the church, and personal animosities between Christians. Scattered throughout the book are references to the great failures of the church, to oriental Christianity as the "great might-have-been" of history, and to the disappearance of North African Christianity,

> The North African Christians certainly grasped the basic truth that one did not have to be an intellectual to come to Christ. Yet they often failed to learn that one needed more than martyrs and defiance to commend the faith.

That today's Jesus People might learn this lesson of history! A fact of some interest is the list of occupations that was not tolerated for new converts to Christianity: gladiators, actors, schoolmasters, painters, and sculptors. The schoolmaster is in the list because of his necessity to teach the tales of classical mythology. A 25-page Glossary of terms is included at the end; an author's assessment and overview of the whole period would have been helpful as a conclusion. Church history seems to afford little hope for the church institution to overcome its human limitations and be an effective corporate witness; church history does reveal that persecution is the normal condition for the Christian.

Questions of Science and Faith by J. N. Hawthorne, Professor of Biochemistry at the Medical School, Nottingham, England, is little more than an outline of the principal points of such a discussion. The treatment is so brief and the style so cryptic that high readability is sometimes accompanied by superficiality. The general tenor of the book is positive and encourages consideration of both the Biblical perspective and authentic science. It could serve as a discussion guide for a high school group.

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