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

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THE GOALS OF THE ASA- A PERSONAL VIEW

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A noted endocrinologist was elected secretary of an organization for Roman Catholic scientists, whereupon he immediately disbanded the group. His reason was that there are no Catholic frogs, which is correct, of course. The organization was not intended for frogs, however, but for scientists—persons who need to consider the relationships between their chosen vocation and their religious world-view, whether Catholic, Protestant, or something else.

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The American Scientific Affiliation was organized 25 years ago by a small group of men who were concerned about the challenges to Christian faith that appeared to arise from science. The fellowship has now grown to almost 1400, including about 300 with academic doctorates and 150 doctors of medicine. This growth is clear evidence that scientists can and do express their faith in God.

Meanwhile the climate within science seems to have changed somewhat. Fewer scientists go out of their way to attack the Christian faith. On many campuses there are enough believers to encourage each other in discussion and in witness. Nevertheless, there remain areas of question and even tension for those who seek honestly to relate their science and their faith.

It has been my privilege to serve on the Executive Council of the ASA for five years, part of this time as President. The acquaintances established have been most helpful and stimulating, although I wish it had been possible to meet more of the members personally. In the course of these years it has become apparent that some clarification as to the goals and functions of the organization may be desirable. The comments that follow represent my own personal point of view, rather than an official position of the ASA or its Executive Council. I would appreciate hearing from any member who may have comments or suggestions.

WHAT NEW MEMBERS SAY

We can obtain some image of the ASA by reviewing the application forms of new members, particularly the part where they are asked to outline a personal statement of faith. One wrote of "a growing and developing relationship with God through his Son, Jesus Christ." Another "trusted Jesus Christ as personal Savior and since then have committed my life to Him." "Scripture is the inspired and infallible word of God, and the only rule of faith and conduct." "I accept Jesus Christ as my personal Savior and believe that

God created the world and everything in it, and that He is the supreme ruler of the universe today."

There are indications of a need to relate one's faith to one's vocation. "Until lately my academic life was distinct from my spiritual life; now I would like to intertwine the two." "My personal commitment to Jesus Christ as Savior and Lord of my life impels me to seek the integration of my Christian faith and the discipline that I have made my vocational choice."

The relationship between science and the Bible is described as "compatible," "no conflict," "in harmony although not mutually dependent," or "complementary." "The more deeply I have studied science, the more deeply I have appreciated God's word." "Both science and Scripture are revelations of God; therefore they must be compatible and must complement each other." "I believe there is no incompatibility between science and Scripture, only questions for investigation." "Although the Bible is not a scientific text, I believe it is generally consistent with modern scientific thought."

The possibility of conflict is recognized, however. "Conflicts arise when theologians and scientists read more into the evidence than is justified." "It hurts me to see theologians who know little science attacking science as if it were an enemy—and scientists who know not Christ attacking holy things as if they were superstitions to be overcome. I am, therefore, thrilled that such an organization as the ASA exists." "Apparent discrepancies must be traced either to a faulty explanation on the part of the scientist or faulty exegesis or systematization on the part of the Bible scholar; herein lies the challenge and the responsibility for the Christian engaged in science."

There is some disagreement as to the course of action when conflict arises. "If there is any conflict between the Bible and science, I will choose the biblical view." "I am not sure how to relate science and Scripture except that in areas of conflict I regard Scripture the best choice." "While Scripture sets broad limits and defines basic principles for understanding the Universe and man's place in it, ample scope is left for scientific inquiry to seek to understand and fill in important and interesting data which are not, however, essential to faith or salvation." "As to the relationship between science and Scripture, I believe that there is neither a conflict nor harmony since each uses a different language and frame of reference to describe overlapping events and phenomena."

Finally, we find a desire to share insights and to help others. "Since I became a Christian I have been seriously concerned over the young people who desert the Church feeling that they can't accept both the Bible and science." "I had considerable struggle with questions of faith and reason during undergraduate days." "I was much aided by fellowship and study with other Christians whose problems and opportunities were similar to my own." "My concern is to share the gift of faith in Jesus Christ with fellow scientists and to help those who see a conflict between Christianity and the scientific description of the creation."

A CHRISTIAN MISSION IN AN AGE OF SCIENCE.... With these comments in mind I view our basic job as an attempt to interpret God's message to a culture which has been greatly influenced by scientific methodology and productivity. We share a conviction that the Bible is relevant for people of all times. Furthermore, it will criticize and be in tension with the spirit of every age. Only we must identify the real points of tension and not waste energies on peripheral questions.

We face, then, much the same problem that a missionary does when going to another land. What is the essence of the Gospel? Some of what we have learned in church is really part of Western culture and is not an essential part of Christian belief. We must continually try to distinguish between God's message for all peoples and the trappings which have accumulated from the present age.

This task requires a study of scientific language just as a missionary must learn the language of the country to which he goes. We simply will not communicate if we use scientific terms in a manner that differs from current usage. I have begun to lose patience with those who write of "natural selection" as a figment of the imagination or who fail to realize the multiple meanings of scientific "explanation." Attempts to speak the language of science have sometimes been criticized as representing a spirit of compromise, whereas they should be considered as efforts to present God's message in a comprehensible manner.

What really holds us together is our mutual concern for advancing the Kingdom of God. We sense the need for discussion among ourselves, to sharpen our questions and to probe for new answers. Then we share in a ministry of outreach to influence young people and others who are troubled by conflicts. I am not sure, however, that we have yet found the best balance between these two elements.

THE NEED FOR OPEN DISCUSSION

It is important to recognize that the ASA does have a basic position for which the organization clearly stands. This is seen in the statement of faith in the Scriptures and in Jesus Christ. As I have been reviewing the membership applications it became clear that there is wholehearted support for these doctrines, not mere acquiescence.

Their comments also indicate that the members are persuaded that the God of the Scriptures is Creator and Sustainer of man and all else that is in the universe. The created order is held to be purposeful and good, and God is understood to be free and sovereign. Furthermore, man stands in a unique and special relationship with God.

It is when we come to the interpretation of specific Bible passages or to the meaning of current scientific

data and theories that we begin to find disagreement. The Executive Council has repeatedly been urged to adopt a clear stand on such items as well. But after considerable discussion and prayer the members of the Council have decided against such an approach.

In essence, of course, this does represent a position. Areas of disagreement indicate the need for more information or a new point of view. We need to listen to each other, and the lines of communication must be kept open. We can tolerate unanswered questions in view of the fundamental belief that the God of the Scriptures is also the God of the universe.

Delbert Eggenberger, a former editor of this Journal put it this way (Dec. 1959): "It would be easy to establish a 'party line' in accepted scientific theory and in theology to which any accepted paper must adhere. . . . The Editor, however, believes that the ASA has a purpose, and can thus best fulfill a needed function, of open-minded study that precludes such restrictions."

In a discussion of the Victoria Institute in England, F. F. Bruce pointed out that their constitution "recognized 'the Christian religion as revealed in Holy Scripture' without trying to define the nature of revelation or the exact content of what is revealed . . . .This affords a wide basis for pursuing the researches which form the purpose of our existence, and the Institute would fall short of that purpose if it came to be identified in the public mind, or in actual fact, with one particular view of Biblical revelation or one particular Christian tradition." (JASA, March 1961).

This spirit of openness has two bounds. The scientific data are to be presented fairly, and quotations should reflect the representative opinion of the author cited. Terms and concepts should be used in the sense of current usage within a field.

The other limit has to do with our commitment to the Bible as God's Word. Questions may well be raised about the interpretation of specific passages, but not so as to discredit the Bible. Words used to describe the Bible, such as revelation and inspiration, must not be treated lightly.

IS EVOLUTION THE MAIN PROBLEM?

Some members have been distressed by recent discussions concerning evolution, feeling that the ASA has become "soft" toward evolution and has thus lost its original purpose. This topic is of particular interest and concern to me professionally and I am quite aware of the complex manner in which problems of science, philosophy, and theology become intertwined. I have been gradually coming to the opinion that an anti-evolution platform is not an adequate basis for the existence of the ASA and would like to share some of my thoughts.

As a general point, it should be clear that there are important topics other than evolution, as evidenced by recent articles in this Journal. The problems of race, of population growth, and of ethical issues in science should be discussed carefully by Christians. Significant advances in the neurological and biochemical bases of thought will demand some re-examination of our concept of the nature of man and its meaning for Christian doctrine.

Furthermore, the opinion that evolution is the *cause* of disbelief in God may well obscure the more fundamental nature of the problem. A person who wishes to hide from God will find any convenient excuse for doing so. Even if it were possible by some form of brain-washing to remove the idea of evolution from human minds, it is doubtful that faith in God would increase. The type of atheistic humanism preached by Julian Huxley explains the approach he uses toward evolution; it is not that his knowledge of the scientfic aspects of evolution justifies his denial of God.

Considerable confusion arises from the fact that the word evolution covers a variety of meanings. Much of what is included under this topic in high school biology courses deals with changes in gene frequency, mutations, natural selection, speciation, and other aspects of scientific data and theory that are accepted by most ASA members without serious question. To the best of my knowledge no biologist in our group holds to the absolute fixity of species. We might wish that some other term would be used generally for this type of variation across species lines, but wishing is not likely to change the facts of current usage. A blanket denial of evolution will therefore be interpreted by skeptical scientists as an inability or refusal to understand what biologists are talking about today.

Misunderstanding at this level appears to reflect a common human temptation to phrase questions in an "either-or" form. Some insist that we must accept either scientific explanations or belief in God as Creator. Machen in his *The Christian View of Man* (p. 104) makes this comment which has been very helpful to me:

> God is the First Cause, but the forces of nature and the free actions of personal beings whom God has created are second causes; and it is extremely important, if we would be true to the Bible, that the existence of second causes should not be denied. Thus when it is asked whether when anything happens in the course of nature it is some force of nature or God that Causes that event, the true answer is, "Both." That event is caused by a force operating in the world, and it is caused by God. Only, it is very important to observe that the two causes are not on the same plane.

Evolution in a more general sense deals with the relationships between larger categories, such as classes and phyla. Here we face considerable disagreement among ASA members. Some think that the phrase "after its kind" implies a definite limit to variation (although broader than single species). Others have satisfied themselves that the doctrine of creation does not required such limits. All of these claim full commitment to belief in God as Creator and Sustainer, as revealed in the Bible. The ASA is not officially committed to theistic evolution, instantaneous recent

creation, or any other formulation for interpreting the scientific data. The Council has discussed this question a number of times, and has concluded that the doors of discussion must be kept open on this aspect of the topic. It is only in this way that significant advances can be made on the very real questions (scientific, philosophical, and theological) which still remain to be answered.

Evolution can also refer to a philosophical system or world-view which serves as a self-sufficient unifying "key to the universe" and as a basis for ethical decisions. I find it helpful to refer to this as evolutionism in order to emphasize the strong religious overtones. Teilhard de Chardin has developed a comprehensive world-view which integrates Christianity and evolutionism. On the other hand, the "evolutionary humanism" expounded by Julian Huxley is clearly opposed to faith in the Bible and in Christ. We must point out to pastors and young people that Huxley is preaching his personal religion, not teaching as a scientist.

It is on this topic of evolutionism as religion that the ASA has a responsibility that we have only partly explored. As scientists who are Christians we must become students of theology to learn the full implications of the doctrine of creation. (I have recently profited greatly from reading *A Systematic Theology of the Christian Religion* by J. Oliver Buswell, Jr.) Furthermore, we can stress the point that the scientific aspects of evolution are not a barrier to belief. Some discussion of the scientific aspects may be necessary, however, to clear the roadblocks and permit a more direct consideration of the claims of the Bible concerning Christ. Here is a task on which we can and should be united.

SHARING IN WITNESS

The divergence of opinion on specific aspects of the relationship between science and faith should not obscure the real consensus on fundamental matters of belief. This consensus provides a basis for a concerted effort to find appropriate ways of helping others to find faith in Christ.

Our potential ministry encompasses young people in different age groups—those in high school, in college, and in graduate work. Perhaps we have forgotten the questions we faced at similar times. Approaches which may seem too simple to us now were of considerable value to us then.

Among some church young people there is considerable distrust and fear of science. We have a unique responsibility to help them discover the excitement that can accompany research and to encourage them to consider science as a vocational field.

Our conversation need not be limited to science *per se*. Many of the issues that keep people from faith in Christ have little to do with science. It still surprises some to learn that a scientist is interested in the Bible and is able to discuss it intelligently. Perhaps a larger part of our regional chapter activities should be given to Bible study, meditation, and prayer. Relatively few have had the privilege of sharing in a Bible study which permits free questions and discussion under the simple ground rule that the Bible is held to be trustworthy.

The development of the new high school curricula in science and mathematics has demonstrated the great value of teamwork involving research scientists, high school teachers, and professional educators. Within the ASA there are adequate resources for similar teams of scientists, teachers, theologians, pastors, and specialists in religious education. An important first step would be a decision as to what types of materials should have the highest priority.

The basic dimensions for witness in an organized manner are, of course, speaking and writing. The Visiting Scientist programs supported by the National Science Foundation provide an opportunity for high school students to hear and meet research scientists. With adequate financial support for travel expenses the ASA could make available a similar roster of speakers and topics in the area of science and faith. The Research Scientists Christian Fellowship of England has organized science week-ends for top students, another valuable program we might consider. Those members who travel to other countries on research projects could supplement the work of missionaries through scheduled talks or informal discussions. Perhaps the ASA national office can serve as a clearing house for making contacts between scientists and missionary boards.

It is when ideas are put into writing, however, that a wider ministry over space and time becomes possible. This *Journal* has been a valuable means of communication, but a continuing supply of new papers is essential. Our Publications Board is trying to develop a series of shorter monographs on selected topics. Some members have undoubtedly found that a few of their talks appear to elicit a consistently favorable response. I would encourage them to put the talks into written form and submit them for possible publication.

There is no question but that such efforts require personal sacrifice. They represent a tithe of our time and energies. But we enter into them in the spirit of prayer that God will help us use the remaining time efficiently as we seek for excellence in teaching or research.

"To the non-Christian, the Bible is just another book, to be evaluated as such. The Christian accepts it on faith, but a faith well supported by internal and external evidence—evidence which shows that the Scriptures are inspired by God." Roger J. Voskuyl in *Modern Science and Christian Faith,* Scripture Press, Wheaton, Illinois. Reprinted by permission.

EVIDENCE FOR A LATE PLEISTOCENE CREATION OF MAN

JAMES M. MURK*

Accommodations to the findings of human paleontology which suggest a creation of Adam in terms of hundreds of thousands of years ago are not the best interpretations of the evidence. There is need to reexamine our presuppositions in light of recent efforts to bridge the bio-cultural gap. The uniqueness of man living today is manifested in his capacity for complex symboling illustrated by speech and resulting in true culture which in a measure reflects the imago dei. The existence of tools in standardized traditions does not necessarily prove the presence of this symboling capacity for speech, for which there is no certain evidence until the appearance of the Upper Paleolithic in the Near East. This is therefore the most likely time, and perhaps place, for the advent of man made in the image of God.

I

There is currently a tentative acceptance by many in our circles of the position that Adam may very likely have been created anywhere from several hundred thousand to even perhaps as many as two million years ago. A theological "proof text" that is often quoted is the statement of the orthodox Princetonian Benjamin B. Warfield which was written in 1911,

> The question of the antiquity of man has of itself no theological significance. It is to theology, as such, a matter of entire indifference how long man has existed on earth. 1

Whether theologian Warfield would have agreed to the use to which this statement has been put fifty years later, I cannot say, but the evidence which is accepted to support a very radical antiquity for Adam has some real limitations which have not been seriously confronted by my friends and colleagues.

Anyone who attempts to harmonize or accommodate the Genesis account of creation, including theological assumptions concerning the nature of man, with the evidence from human paleontology and archaeology must be made aware of some conflicting presuppositions coming from both sides of the fence. In some cases, for example, the creationist has accepted, perhaps unwittingly, the assumptions of the thoroughgoing evolutionary position which places his own interpretation of the fossil facts on a very precarious footing. It is my intention to re-examine this issue, illuminating what I believe to be some difficult problems facing theories which recommend the possibility of a several hundred thousand year old Adam, and to suggest a possible alternative interpretation of the archaeological evidence. I will admit that my alternative does not solve all the problems including the most difficult one; namely, what seems to be the immediate appearance of a Neolithic culture after the expulsion of man from the Garden of Eden. What is suggested in this paper, however, may stimulate a more careful examination of all the evidence.

I presuppose a literal acceptance of the Genesis account as historical and not legendary or mythological with the following qualifications: (1) The account of the creation is obviously only a simple outline for the purpose of teaching us the theological truths concerning the origin of the Earth and its creatures including man. God has not revealed to us all that there is to know but only what was necessary for us to know. A corollary of this principle is that the Bible never has to tell us anything that we can find out for ourselves. The important revelations of the Scripture demonstrate things to man that he could not or would not know by himself. Man was commanded, furthermore, to subdue the earth, and part of the fulfillment of this command certainly is to explore and understand what God has created. (2) Some contemporary, conservative interpretations of the Genesis account are limited and

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need re-examination. Perhaps even our hermeneutic principles need some revision.

What are some of the things that the Genesis record reveals to us concerning man?

(1) Man was the last subject in the sequence of creation. (Gen. 1:26-31)
(2) Man was made of the earth like the plants and animals. (Gen. 2:7)
(3) Man was also made, however, "in the image of God." (Gen. 1:26,27)
(4) Man was thus a unique creature with dominion over the creation. (Gen. 1:28)
(5) Man had a capacity for communication and fellowship with His Creator. (Gen. 3:8-11)
(6) Man had a superior rational capacity illustrated by speech and in the naming of the animals, and God placed him in a position of superiority and responsibility on Earth. (Gen. 2:19-20)
(7) Man had a moral capacity, in that he could choose the right or wrong way with reference to the purpose for which he had been created. (Gen. 2:15-17; 3:6-7)
(8) Man had been created for fellowship with God and to be like God in character and rational capacity, the pursual of which purpose on man's part is called obedience.
(9) Man became estranged from his Creator, however, because of disobedience. (Gen. 3:23-24)
(10) God forsook the intimate fellowship of man whose existence became an abnormal one apart from the necessary presence of God. (Gen. 3:24)

II

We do not know for certain what Adam's existence was like after he was expelled from God's presence, but it was a hard life eked out by sweat, and its immediate crudeness is symbolized in the animal skin coverings which were given him by God to hide his nakedness. It is not unlikely that to begin with, at least, Adam and Eve foraged for food where they could and lived in the crude economic way so familiar to many primitive peoples of the past and even to a few in the present. No matter how primitive, preliterate, and non-technical the society of man, however, there is no proof that its individual members are qualitatively inferior to literate and more technologically advanced peoples. Adam after the Fall must have been a creature with at least as much potential as our own. In fact, a common belief in the church has been that Adam, having been a perfect human specimen taught by God and having been exposed to His presence before the Fall, was somewhat superior to ourselves, witnessed to, for example, by the great age to which he lived.

The contemporary anthropological view of man's development, however is contrary to this presupposition. It accepts not only the evolution of man's body but also of his mind—his capacity for culture as well as his morphology. Most anthropologists are committed to the belief that culture has its roots in biology, and that the closing of the bio-cultural gap was an evolutionary development.

Since the Darwin Centennial held at the University of Chicago in 1959, several books and articles have appeared seeking to reconstruct man's cultural development concurrent with his morphological evolution.[2] This obviously presupposes a qualitative development in man's capacity, and this is considered to coincide roughly with the steady increase in the size of the brain throughout most of the Pleistocene. Though it is admitted that quality of intelligence cannot be certainly determined from an endocranial cast; nevertheless, the quantitative rather than qualitative difference between the brains of modern apes and men suggests that the size of the brain has important significance. This is the major progressive morphological change in the hominids of the Pleistocene from *Australopithecus* to Neanderthal and *Homo sapiens* and parallels technological development. No one can exactly explain the connection, but all are aware of the parallel. The development of intelligence, furthermore, is assumed from the archaeological evidence. Henri V. Vallois, Director of the French Institute of Human Paleontology and the Museum of Man in Paris, wrote recently,

> The enormous growth of the brain that is manifest from the time of *Pithecanthropus* is a fact that is well-known and was certainly accompanied by a corresponding development of man's intellectual possibilities.3

A. Irving Hallowell of the University of Pennsylvania also asks some rhetorical questions,

> Are we to assume that the early Pleistocene hominids Coon (1954) has labeled "half-brained men" possessed culture in the same sense as *Homo sapiens*? Is a fully developed human brain structure irrelevant as a prerequisite for a fully developed cultural mode of adaptation? Is a "half brain" as good an instrument as a whole brain for the development and functioning of human speech, music, the graphic and plastic arts, abstract thinking, and religion.4

On the other hand, though we are not sure where to draw the line, it has also been demonstrated from studies of living races that within a certain range brain quantity is not as important as brain quality. Applying this principle to fossil and archaeological evidence, Sherwood L. Washburn, Professor of Anthropology at the University of California, suggests a difference in quality between Classic Neanderthal and *Homo sapiens*, even though the average of the fossil crania of the former slightly exceed the average of the latter. He writes,

> The brain seems to have evolved rapidly, doubling in size between man-ape and man. It then appears to have increased much more slowly; there is no substantial change in gross size during the last 100,000 years. One must remember, however, that size alone is a very crude indicator, and that brains of equal size may vary greatly in function. My belief is that although the brain of *Homo sapiens* is no larger than that of Neanderthal man, the indirect evidence strongly suggests that the first *Homo sapiens* was a much more intelligent creature. 5

G.H.R. von Koenigswald, Professor of Paleontology at the State University of Utrecht and one of the world's foremost authorities on fossil man, agrees with this position in a very recent writing,

> Classic Neanderthal man in Europe is the Man of the Mousterian culture, living in the first part of the Wurm Glaciation under extreme conditions. With the beginning of a warmer

Interstadial he suddenly and completely was replaced by *Homo sapiens*, the Mousterian by the Aurignacian. In the latter, the far wider diversity of tools, the first use of personal adornments and the beginning of art reveal a more intelligent type. That the structure of his brain was superior, has been demonstrated recently by Bonin (1963). 6

We are thus faced with the following propositions: (1) The growth of the hominid brain during the Pleistocene most probably indicates increasing intelligence; (2) When a certain point of growth has been reached, however, quality is more important than quantity where the functioning of mind is concerned. Now some anthropologists and biologists with a Christian frame of reference have taken the second principle and extended it to include most, if not all, the fossil hominids of the Pleistocene—*Australopithecus* 'average cranial capacity, 576 cc.), *Pithecanthropus* (av. 871 cc.), *Sinanthropus* (av. 1046 cc.), Ngangong (av. 1100 cc.), and Pre-Neanderthals (av. 1175 cc.)[7] This is in contradiction to the evidence, which as we have indicated suggests increasing intelligence.

Is it reasonable, furthermore, to believe that Adam's descendants, creatures with at least our potential, existed for hundreds of thousands of years with little appreciable improvement in cultural materials? Considering some technologically static societies, such as the Australian aborigine, which have developed little in the last 35,000 years, it may not be entirely unreasonable to believe that Adam's descendants lived for hundreds of thousands of years with exceedingly slow improvements, but it is very difficult to conceive. The late dean of American anthropologists Alfred L. Kroeber had to stretch his imagination to cover this idea even while holding to evolutionary presuppositions. He wrote in his classic work *Anthropology* concerning the Lower Paleolithic cultures,

And what do we know to have happened in this time? Essentially just one thing: the improvements from roughed Chellean core flints to evener, symmetrical Acheulian ones. That is, the technological tradition remained basically unchanged: it stood still except for some degree of refinement of finish. That is surely a tremendous lot of cultural stationariness to have lasted so long, in comparison with the changability that characterized later prehistory and all history. No doubt development was indeed exceeding slow at the beginning; all the evidence points that way. Yet if we accept the most recently alleged chronology, with the Pre-Crag tools as preglacial, then our 75,000 years of Chellean-Acheulian nondevelopment are stretched into 400,000 which certainly is an added strain on the credibility we have to extort from our imagination. Even wholly beyond our experience to conceive. Perhaps once we get beyond comparable historical experience, we are lost anyhow, as critical minds, and we might as well trust to faith in an authority that claims a lot as in one that claims less. 8

Note that Kroeber was using a very conservative, low estimate of the age and length of the Lower Paleolithic. Most today would begin the Chellean or Abbevillian somewhere between 200,000 and 500,000 years ago and the pebble tool industries of Africa between 500,000 and nearly 2 million years ago. It is very difficult to believe that so little accumulation of culture, so gradual a culture change, would have taken place during the Lower and Middle Paleolithic if these were truly Adam's descendants considering the high estate we usually suppose for even a fallen Adam. To propose a theory that these toolmakers were less intelligent hominid creatures and not men made in the image of God may be a more reasonable solution.

III

Whereas the assumption concerning man's intellectual evolution tends to be ignored by some Christian scientists, there is an important presupposition which is accepted when it ought to be questioned; namely, that the presence of tools made in standardized traditions is an indication of the existence of true man. In an article prepared for *Christianity Today*, Donald R. Wilson of Calvin College wrote sympathetically,

A basic characteristic of man is his ability for conceptual thought. Theologically, this may be considered an aspect of the 'image of God.' Anthropologically, this ability may be logically deduced by evidence of such cultural practices as tool-making. Men's ability to conceptualize also gives the psychological base for his use of language. It is largely for these reasons that the Australopithecines, represented to us by *Zinjanthropus* and more popularly known by the non-endearing terms of South African Ape-Men or Man Apes, have recently been considered to be men. 9

This position has also been taken by James O. Buswell III in his article "A Creationist Interpretation of Prehistoric Man" in Mixter (ed.), *Evolution and Christian Thought Today*.[10]

Support for this assumption comes from the recognition that systematic tool-making doubtless presupposes conceptual thinking and the capacity for extrinsic symbolic representation, particularly language.[11] Culture as we know it has a linguistic base; in fact, we cannot conceive of the existence of culture without the presence of language. Language and culture are the evidence of man's uniqueness, that he differs in kind and not in degree from the animals.[12] This unique human capacity is one of the clear indications of man's singular place in the creation of God, and may be empirical evidence reflecting something of the *imago dei.*

It is true that we do not know for certain what remains of the image of God in man, but the ways in which he is essentially different from the rest of the animal creation may give us some clues, if not concerning the "image" itself, at least these may be rudiments of the unique capacity which made it possible.

Man has, first of all, a far broader repertoire of behavior patterns than any other species. This flexibility is due to his dependence upon conditioning and learning rather than upon instincts. His period of growth and immaturity extends for a much longer time than any other life on earth. Habits of behavior including thoughts, actions and feelings, plus the external props or artefacts which enable man to adjust to his external environment are called his *culture*. This is entirely an extragenetic or suprabiological phenomenon.

This prolonged process of learning is made profitable and is sustained by a unique kind of communication which we call human speech. There is nothing comparable to it or that even aproaches it among all the systems of animal communication. Charles Hockett of

Cornell University suggests that of thirteen "design features" in animal-human communication systems at least three, and maybe four, are unique to man. They are (1) Displacement—the ability "to talk about things that are remote in space or time (or both)."; (2) Productivity—"the capacity to say things that have never been said or heard before and yet to be understood by other speakers of the language . . . one can coin new utterances by putting together pieces familiar from old utterances, assembling them by patterns of arrangement also familiar in old utterances."; (3) Duality of patterning—the use of a limited number of meaningless units of sound put together in many different combinations to form different words or morphemes; and usually (4) Traditional transmission—the extragenetic transmission of the communication system from generation to generation. (To what extent other mammals may do this is not known in detail but is thought to be possible in a rudimentary way.)[13]

These distinctions of Professor Hockett are much more than a refinement of a position taken by Leslie A. White, Professor of Anthropology at the University of Michigan, over twenty years ago. White believed that his conclusions about man's ability to create symbols demonstrated a fundamental difference in kind and not in degree between man and other biological life. We must doubtless conclude from Hockett's analysis that there is still a virtual difference in kind, but the obvious attempt is made to provide a continuity suggesting merely a difference in degree. I believe, nevertheless, that White's conclusions are still valid.

> There is a fundamental difference between the mind of man and the mind of non-man. This difference is one of kind, not one of degree. And the gap between the two types is of the greatest importance—at least to the science of comparative behavior. Man uses symbols; no other creature does. An organism has the ability to symbol or it does not; there are no intermediate stages . . . All culture (civilization) depends upon the symbol. It was the exercise of the symbolic faculty that brought culture into existence and it is the use of symbols that makes the perpetuation of culture possible. Without the symbol there would be no culture and man would be merely an animal, not a human being. Articulate speech is the most important form of symbolic expression. Remove speech from culture and what would remain? 14

White has been justifiably challenged on his inadequately defined use of the term *symbol*. I believe that his idea is more exactly expressed by the linguist Joseph Greenberg in a recent article on the evolution of language.

> The rules by which novel utterances are understood or constructed involve an analysis into classes of words and smaller meaningful units, rules of combination and rules of semantic interpretation. This analysis is what is called grammar. The ability to carry out grammatical analysis would then seem to be one of the things that distinguishes man from other animals. It involves what for want of a more suitable term might be called "multiple abstraction". 15

The ability to use and to respond to symbols certainly is characteristic of the higher animals. Even a bee instinctively does a complicated, symbolic dance to instruct the hive concerning a source of nectar. Hockett also points out that two of the "design features" included in some animal communication are *arbitrariness* and *semanticity*.[16] Both are phases of symbolic behavior. So we observe that contemporary man's capacity is more than just the creation and the use of symbols. It is an ability to employ multiple abstractions; or, as the linguist Roger W. Wescott has phrased it, it is a capacity for "symbolic layering," which refers to the phoneme-morpheme hierarchy or dichotomy.[17] George L. Trager would go a step beyond Hockett's *duality of patterning* and call it *trinity of patterning*—arbitrary sounds combined in arbitrary shapes given arbitrary meanings.[18]

It is in this area of extrinsic symbolic representation on the complex level or what we call articulate speech, that I would begin a definition of true man. We might add to this his complete reliance upon learning and his moral capacity, but these are also related to his ability for complex symboling. Is there any evidence in the archeological record, however, to indicate the presence of this capacity? Most anthropologists, believe that tools made in standardized traditions are evidence for beings who were truly human. It is thus that Kenneth P. Oakley of the British Museum summarized it in a classic article on the definition of man calling him the Tool-Maker.[19]

A standardized tool must, first of all, be a symbol conceived in the brain. The whole group must participate through time, furthermore, for there to be tool traditions; and therefore some kind of external symbolic communication is necessary. Does this external communication have to be human language as we know it? Most anthropologists have seemed to take this for granted, and thus it almost has the status of an assumption. In one of the most recent books to appear on human evolution, Bertram S. Kraus, Professor of Physical Anthropology at the University of Pittsburgh, suggests a position on the subject very representative of this contemporary thinking.

> It seems most likely that Man could not have produced, sustained, and augmented culture without the ability to transmit his experiences and knowledge to his offspring other than by example. This means speech . . . *Sinanthropus* (surely) and *Pithecanthropus* (probably) produced culture and were presumably nonpathological individuals and functionally well-adapted to their environments . . . The ability of the brain to permit speech and culture evidently was achieved long before its volume reached the status found in modern Man. 20.

This is indicative that it is difficult for us to separate the idea of conceptual thinking and communication from language, at least what would be necessary for making stone tools. Words become symbols for things and for images of things. In the latter case they are symbols for symbols, because images or pictures are also symbols. Would it not be possible therefore for symbolic or conceptual thought to be carried on in the mind by means of images? This is almost never the case with man, of course, because words give him much greater facility. We can imagine in pictures, but we will invariably find ourselves falling back on the use of our language. Is imagination, however, dependent upon language? Could not conceptual thought based upon images rather than upon word symbols be carried on in the minds of very intelligent

animals who did not yet have the capacity for the complexity of human language? Do the core and flake tool traditions of the Lower and Middle Paleolithic demand more than this? Simple tool-making and many other kinds of symbolic activity may very well have been possible for creatures far more capable than the living anthropoid apes but without our uniqueness.

The matter of communication is more difficult to explain because we have no adequate precedents in the biological world; however, there is probably a minimum of traditional transmission of behavior patterns by means of imitation on the part of some of the mammals, particularly the anthropoid apes as we shall illustrate later.

Although most physical anthropologists at the present time tend to believe that language was coincident with the appearance of material artefacts in regular traditions, there is some wavering on this point due to recent studies of primate behavior in their natural habitat and the discovery of stone tools on the living site of the Australopithecine *Zinjanthropus*. In fact, as a result of this there seems to be some confusion again as to the definition of man. Oakley actually denies the capacity for speech to the Australopithecines, but by his own definition, if they were tool-makers, they were indubitably human.[21]

Tool-using is, of course, to be differentiated from tool-making. Highly intelligent animals may use material objects at random from time to time. Baboons have been observed crushing scorpions with pebbles, and chimpanzees and gorillas have been observed using sticks and stones as simple tools.[22] The making of tools, however, has been considered the exclusive activity of large brained hominids who had crossed the human threshold. (The following minimum cranial capacities have been recommended; 700 c.c., Franz Weidenreich; 750 c.c., Sir Arthur Keith; 800 c.c., Henri Vallois; but recently, 600 c.c., L.S.B. Leakey.)[23] Chimpanzees, however, have been reported making tools in captivity in the presence of a visible reward. (Sultan by Kohler). Oakley has written,

> Chimpanzees are the only reported animals that make tools . . . In the chimpanzee the mental range seems to be limited to present situations, with little conception of past or future. The power of conceptual thought is basic to tool-making but is only "incipient" in apes. 24

An even stronger interpretation is expressed by the biologists G.A. Harrison and J.S. Weiner of Oxford and London Universities.

> We know from the archaeological record that the first hominids also made the first and crudest of stone tools—the simply shaped pebble tools of the Oldowan industry. That they were effectively used as cutting-tools seems very probable from the South African evidence. The step from using casually picked up sharp stones and giving them something of a shape seems little different in principle from the observed actions of some chimpanzees in putting together sticks or piling up boxes to reach a desired object. In actions of this sort chimpanzees evince the rudiments of a type of mental response which we call 'conceptual'—'the capacity to respond to the present environment in one way and think of responding in another'—the conceptualizing ability of the chimpanzee is well displayed in the human domestic environment where the animal can learn to convey and receive a fair number of messages by the use of symbols and gestures. 25

The first scientific report on the behavior of chimpanzees in the wild was made by British researcher Jane Goodall in 1963. A summary description of her findings states,

> The author established that wild chimpanzees share with humans the ability to modify natural objects and turn them to useful ends—a talent long believed to set mankind apart from all other creatures. 26

Miss Goodall reported seeing certain of these animals break off twigs or shred leaves from their stems and use them to probe termite hills for their tasty occupants. She wrote that she saw them carry such implements for as far as half a mile, going from one termite hill to another. Her conclusions are very enlightening.

> For a long time there has been discussion in scientific circles as to whether any primates in the wild ever modify natural objects to make tools. My chimpanzees have settled the argument once and for all: The answer is that at least some chimpanzees do . . . In so doing . . . the chimpanzee has reached the first crude beginnings of tool-making . . . It is unlikely that this practice of fishing for termites is an inborn behavior pattern. 27

She concluded that this was very likely a social tradition passed on from ape to ape by observation and imitation.

Dr. L.S.B. Leakey of the Coryndon Museum in Nairobi, Kenya has accepted this as evidence that the small brained Australopithecines very likely also had the capacity to make simple tools. Pebble tools had been known from Lower Pleistocene levels in South Africa but had never actually been found *in situ* with fossils of the man-apes. In 1959 Dr. Leakey discovered for the first time stone tools on a living site with remains of a large Australopithecine, the now famous *Zinjanthropus boisei*. There were 9 Oldoway choppers, 1 hammer stone, 5 natural stones, and 176 flakes.[28] Many have been willing to concede that this is evidence enough. Washburn noted soon after the discovery that it used to be assumed that

> . . . tools constituted evidence of the existence of large brained, fully bipedal men. Now tools have been found in association with much more primitive creatures, the not-fully bipedal, small-brained near-men, or man-apes. Prior to these finds the prevailing view held that man evolved nearly to his present structural state and then discovered tools and the new ways of life that they made possible. Now it appears that man-apes—creatures able to run but not yet walk on two legs, and with brains no larger than those of apes now living—had already learned to make and use tools. 29

Recent identification of another discovery in the same area by Dr. Leakey as a possible new candidate for the genus *Homo (Homo habilis)* has cast some doubt again on assertions that the Australopithecines were tool-makers. Perhaps *Zinjanthropus* was a victim or an intruder on a *Homo habilis* living site.[30] It seems to me, however, that there is little to be gained here if our major objection to *Zinjanthropus* as a tool-maker had been his small cranial capacity (most recent measurement, 525 c.c.) within the range of the living apes. Mean estimates for the cranial capacity of *Homo habilis* are only in the neighborhood of 675 c.c. Personally I find no difficulty in believing that either of these creatures could have been capable of making

crude tools without having to admit them to the circle of fully developed man. Even Hockett and Ascher assert that tool-making surely preceded the advent of true language.

> The development of openness (pre-language), with the various consequences already mentioned, either accompanied or paved the way for some radical developments in tool habits. We imagine that tool manufacture—as over against the using and carrying of tools—received its single greatest impetus from this source. If carrying a weapon selects for foresight, shaping a rough weapon into a better one indicates even greater foresight. The manufacturing of a generalized tool—one designed to be carried around for a variety of possible uses—and the development of tools specialized for use in the making of other tools, certainly followed the inception of prelanguage. 31

This presents a little different picture from a few years ago. We may now have small-brained hominids and perhaps earlier proto-hominids which are not only tool-users but also tool-makers, without the presence of true language. If even a chimpanzee, without the rudiments of true language, is a simple tool-using and sometimes tool-creating animal is it inconceivable that more intelligent primates may have created more complex tools without language? This idea had the support of anthropologist and archaeologist Robert Braidwood of the Oriental Institute of the University of Chicago in a discussion with some of us in a seminar a few years ago. He agreed that he could conceive of intelligent tool-making hominids who were not men in the complete sense.

If the consideration is granted that crude tool-making is possible for intelligent animals without language, when does language appear? This is critical to our definition of true man. Hockett and Ascher place the general time of the "Human Revolution" at about one million years ago.

> . . . as soon as the hominids had achieved upright posture, bipedal gait, the use of hands for manipulating, for carrying and for manufacturing generalized tools, *and language*, they had become men. . . We are convinced that all the crucial developments of which we have spoken had been achieved by about one million years ago; that is, by the beginning of the Pleistocene. 32 (italics mine)

Sherwood Washburn would tentatively place it, however perhaps 500,000 years later in the Middle Pleistocene.

> One is tempted to think that language may have appeared together with the fine tools, fire and complex hunting of the large-brained men of the Middle Pleistocene, but there is no direct proof of this. 33

Most men in the field would agree with either one or the other of the above estimates. There are a few, however, who hold to a much more recent origin for human language, a suggestion which we shall discuss below.[34]

Whenever and wherever language was introduced most linguists and anthropologists are agreed that it happened only once. Henry Lee Smith, Jr. wrote in his comment on Hockett and Ascher's article,

> Again as a linguist I am in full accord with the inference that the emergence of true language needed to happen only once, however "sudden" or not so sudden the steps in the development may have been. 35

Trager has taken a similar position.

> Language is not, in my opinion, an evolutionary development. It is an invention—the first cultural invention. All the rest of culture followed automatically . . . the nature or basic structure of language must have been, from the start, what it is today . . . How the first language was invented (and I agree this must have happened only "once" . . .) is not known, and is perhaps unknowable. 36

Hockett and Ascher also have concluded that it must have all happened during one particular period of time and in one particular place. They say that the similarities of systems of phonology extant in the societies of men today "preclude the independent invention of duality of patterning, and of modern articulatory motions, in two or more parts of the world. The crucial developments must have taken place once, and then spread . . . The human revolution, completed before the diaspora, established a state of affairs in which further change and adaptation could be effected, within broad limits, by tradition rather than genetics. That is why human racial diversity is so slight, and it is why the languages and cultures of all communities, no matter how diverse, are elaborations of a single inherited 'common denominator.'[37] But when *did* language enter the picture and when did this "diaspora" take place? Can we tell from the fossils?

Speech is not a physiological function with one special center in the brain. All attempts to locate anatomical evidence for speech from fossil remains have been futile. Vallois concludes,

> . . . the essential thing in speech is unquestionably not so much a fixed cortical form as the existence of a whole system of psychomotor correlations, which examination of casts, as complete as they are, will never enable us to reveal. 38

Another recent summary of research states,

> . . . it is not possible to diagnose the ability to speak from a particular enlargement or marking of the endocranial cast. It is, therefore, impossible to tell in this way whether any of the fossil hominids were endowed with speech. Nor can this be inferred from the presence or absence of genial tubercles in the mandible. 39

J. N. Spuhler, Professor of Physical Anthropology at the University of Michigan, indicates the reasons for this.

> Human speech is an overlaid physiological function. It uses a set of body parts of quite diverse primary action. Consider the muscles used in speaking. Most of our coordinated muscular movement involves corrections and adjustments from proprioceptors. But the laryngeal muscles lack proprioceptors, and feedback control of speech comes by way of the ear and the 8th cranial nerve. When we talk, the voice box, tongue, and lips must work together smoothly and precisely. The 10th nerve controls the adjustment of the vocal cords and the 5th nerve the movement of the lips. Both of these involve bronchial muscle while the 12th nerve moves the tongue with somatomotor muscle. The neurological basis of speech is not clear, but it is clear that the only place where the motor organs and steering apparatus of speech are wired together is in the cerebral cortex. 40

Earl W. Count has noted how far research has progressed in this area.

> The neurological sciences have been developing profound insights into the architecture of phasis; they permit one to say that man speaks because his brain has elaborated cybernetic systems beyond what his ape cousins have done. But

after a century of Darwin we are still as much in the dark as we have ever been as to what actually has brought these systems together. 41

Language is therefore something that must be learned. As far as we can tell "human genes carry only the capacity to learn the language and 'probably also a strong drive toward such acquisition."[42] If children were never taught, furthermore, they would be devoid of language and hence of most of that which we consider human behavior. As a well-known introductory text in anthropology puts it, "Left solely to their own instinctive devices the children of men would remain undeveloped brutes, which is something less than brats."[43]

I am thus suggesting the following propositions: (1) Language, the basis for culture as we know it, is a unique human capacity which is very likely one evidence for the *imago dei* in man; (2) The acquisition of language is perhaps not necessary for a certain level of tool-making and the beginning of traditional behavior; (3) There is evidence that language had a single and perhaps sudden origin; (4) Language is not instinctive but must be learned.

IV

Now the only alternative to the acceptance of a gradual linguistic and cultural development on the part of man's ancestors is its introduction from a source external to man; namely, something like the account in the Genesis record. This would satisfy the requirements of both a single origin and also of its being learned behavior. Though the term *disciple* which means *learner* is not specifically used of Adam, it is used to describe one of man's relationships to God.

Is there any evidence, however, from the fossil and archaeological record to suggest when this might have occurred? We have already rejected the initial appearance of stone tools, which may be in the neighborhood of two million years ago, as the time of our beginning for Adam, for reasons cited above. Then how about a time just before the Neolithic? As noted in the introduction, characteristics of the Neolithic seem to appear in the Genesis account soon after the Fall. (Genesis 4) The earliest archaeological record substantiating a Neolithic culture is about 9,000 B.C. in the village site of Zawi Chemi Shanidar reported by Ralph Solecki.[44] Man morphologically like ourselves *(Homo sapiens)* furthermore, lived on the same site, according to C^{14} dating, from about 33,100 B.C. to 26,700 B.C. About 10,000 B.C. or 15,000 years later, which is the time of the final retreat of the last glacier, similar men returned to the site, and evidence for the Neolithic appears about 1,000 years later.[45]

Among other evidences we must also take into account the beautiful cave paintings of Western Europe which are dated from 15,000 to 30,000 years ago.[46] Certainly these artistic creations and the advanced stone and bone cultures of the Solutrean and Magdalenian suggest creatures with capacities equal to contemporary man.

Is there any time then in the sequence from the earliest pebble tools of a million or more years ago and the beginning of the Neolithic when there is some kind of marked difference in the archaeological record, a hiatus, or a discontinuity?

There is one possible time which stands out more than any other in the prehistory of this long period. It has even been given a special name by prehistorians. This is the cultural efflorescence known as the Upper Paleolithic. There are three things which suggest to me that this might be the time of the advent of "man made in the image of God." (1) Appearing for the first time are graphic and plastic arts—adornments, ornaments, carvings, drawings, and paintings. (2) There is a great increase in the assortment and varieties of tools and in materials from which they are made and a considerable improvement in tool technique. (3) This is all coincident with the first appearance of *Homo sapiens*. The culture of the Upper Paleolithic therefore was the production of men morphologically like ourselves, and these are the same kind of men that produced the Neolithic revolution. I am not suggesting at all that Adam had to have our exact anatomy; however, it does seem to me to be a significant coincidence considering the other evidence.

Prehistorians are well aware of the distinct cultural developments in the Upper Paleolithic in contrast to the older Lower and Middle Paleolithic periods. The French prehistorian Francois Bordes, for example, has written,

. . . we may safely consider the resulting cultures of the Upper Paleolithic as the first great civilization, with its peak or climax in the Magdalenian. For it was indeed a civilization, with everything that word implies in terms of a cultural superstructure: rites, legends, songs (all, unhappily, forever lost), and art, even if based on magic or religion (medieval and Greek art was, after all, nothing else). All of which indicates a relatively dense population, rather well-off materially and capable of providing a certain amount of leisure time to think and create. 47

How does evidence from the Upper Paleolithic differ, however, from the preceding periods of the Old Stone Age which might imply the advent at this time of true language and hence true culture and true men? We have noted above that the significant capacity underlying human language and true culture is man's ability for complex symboling called "multiple abstraction" or "symbolic layering." I would like to suggest that both the artistic expression and the new stone tool products and techniques show evidence for this capacity. Incidentally it is hardly necessary to prove that men of the Upper Paleolithic had language, because there is hardly anyone who questions it. More significant will be the attempt to contrast the Upper Paleolithic record with what preceded it in order to demonstrate that the presence of true language made a significant difference. This is very difficult to do because we have no way of knowing what would be possible for creatures having a much higher intelligence than living anthropoid apes, yet without language.

The art and ornament of the Upper Paleolithic without any doubt expresses this ability for complex symboling. There is, first of all, the article or painting which in itself is a symbol of the real thing, a projection of the image in the mind. Secondly, there is the meaning that must have been ascribed to the painting, carving or sculpture. Usually a religious or magical meaning is suggested; for example, small figurines of women with exaggerated sexual parts may be linked to fertility rites or preoccupation with reproduction. There must at least, however, have been an aesthetic meaning. Much art work, furthermore, was deep in caves which were not living sites. Some animals drawn on the cave walls show red gashes on their bodies or projectile points piercing the flesh, or there are hunting clubs drawn beside the animals. In later paintings there is the use of pigments creating complexes of color comparable to what an artist might produce today. Though most of the cave art is realistic, there are also a few symbolic stick figures representing men. Thus we have symbols of symbols, like a word is a symbol of an image or an idea. Finally there are numbers of undecipherable markings which have been variously described as possible clan symbols or magical signs. Drawing is always the first step in communication by writing, and writing assumes language. I think we have to say that art as a symboling system assumes language as well.

More significant than the presence of art in the Upper Paleolithic is its complete absence in previous periods and even in Mousterian (Neanderthal) sites which are contemporary in other parts of the world with the early Upper Paleolithic cultures for perhaps as many as 10,000 years.

The Mousterian or Levalloisio-Mousterian tool types are almost always identified with Neanderthals and are found in Europe, the Near East and Africa until at least about 35,000 B.C. The early Upper Paleolithic culture identified with *Homo sapiens* appears first in Palestine less than 50,000 years ago. From here it seems to have spread appearing in southwestern Europe about 35,000 B.C. where it suddenly replaces the Mousterian artefacts. But in Palestine and Syria the Upper Paleolithic and Mousterian parallel each other for some time, and, in fact, are found side by side or interspersed. Leakey writes,

> It must be noted that in Palestine, at Mugareh-el-Wadi, Layer 'F' yielded both a 'Lower Aurignacian' culture and an Upper Levalloisio-Mousterian culture in the same horizon, while Turville-Petre found a similar state of affairs at Mugareh-el-Emireh. On the other hand, Neuville found a fine level of 'Lower Aurignacian' with Emireh points at Jebel Kapseh without any association with Upper Levalloisio-Mousterian, and the same is true of Rust's results in Syria. 48

This last statement is an indication of what is eventually found all over; namely, the Upper Paleolithic cultures of *Homo sapiens* replace the Mousterian of Neanderthal.

Any conclusions which we might draw from the supposed origin of *Homo sapiens* and the Upper Paleolithic in the land of Palestine would be purely conjectural, but is it simply a coincidence that this is the one place on the earth designated by God in the Scriptures as "My land?" L.S.B. Leakey says again,

> But whereas we can only guess that the possible origin of the Chatelperronian of South-west Europe (the oldest Upper Paleolithic culture in Europe sometimes known as Lower Aurignacian) was in Palestine, we have ample proof that the Aurignacian came from that country. If the distribution of the Aurignacian is plotted on a map, it is seen to extend from Palestine and Syria to the west coast of France. 49

In a detailed article on Upper Pleistocene stratigraphy in the Near East F. Clark Howell of the University of Chicago points out that nowhere else in Eurasia or Africa do we find the Upper Paleolithic blade and burin cultures so early. He indicates, first of all, that the distinctive intercalated occupation levels of Mousterian and Upper Paleolithic cultures at particular sites "would suggest temporary encampment of a passing group of blade-tool using hunters rather than an autochthonous development of the earlier peoples." Also "Upper Paleolithic blade-tool industries are always found in Europe in association with anatomically modern people; so it is easy to make the further assumption that in the Levant such migrant peoples were truly *Homo sapiens.*" So exactly what contact, if any, there was between Europe and South-west Asia cannot be certainly ascertained, but the tool working technique is very similar though the cultures are not identical.[50]

Whereas there seems to be an abrupt change in Europe,[51] in Palestine there is an obvious mixture of blade and burin tools typical of the Upper Paleolithic combined with the older core-flake techniques characteristic of the Levalloisio-Mousterian.[52] Evolutionary presuppositions would suggest the conclusion that the more gradual cultural change in the Levant paralleled a possible biological evolution from Neanderthaloid to *Homo sapiens,* and there are many who favor this kind of origin for modern man.[53] There is one possible flaw, however, in trying to establish an industrial sequence from Mousterian to Upper Paleolithic, and it suggests another possible interpretation. Out of the seven stages (0 through 6) proposed by Howell for the Upper Paleolithic in the Near East, four of the middle stages (1 through 4) show a decreasing influence of the Levalloisio-Mousterian techniques, but in the oldest "fully distinctive Upper Paleolithic industry" (Stage O) there is no trace whatsoever of Mousterian influence even though the two levels where it is found (15 and 13 at Yabrud) are both above and beneath Mousterian cultures.[54] Could this not suggest a later mixing of two separate industries as the result of the mixing of the two separate peoples, Neanderthal and *Homo sapiens*? The fossils found in the Skhul cave on Mt. Carmel have been interpreted in just such a way in the past, and the most recent dating of this site in Palestine places these hybrid remains right in the midst of the overlap of Mousterian and Upper Paleolithic cultures in the Near East. (Possibly 37,000 to 35,000 B.C.)[55]

Now we read in Genesis that Adam was secluded in a "Garden" prepared by God. What was the purpose of a special place? Besides its being a place of testing, was Adam possibly being protected from contact with some outside influence, perhaps non-human hominids? If our point of view is correct, after his expulsion from the Garden, Adam and his descendants *(Homo sapiens)* would probably have had some kind of contact with Neanderthals. In fact, not only might there have been interbreeding of the wild Neanderthals and the domestic Adamites, but the Adamites may have even begun to build and rapidly improve upon the stone tool techniques of their predecessors. This may all seem very fanciful, but, based on our assumptions, the circumstantial evidence can point in this direction. It also gives us another reason for the Flood which wiped out all but a pure strain of "man made in the image of God." The occurrence of the Flood, furthermore, would explain one of the great mysteries of human paleontology—the sudden disappearance of the Neanderthals.

A fertile biological union of true man and pre-Adamite hominids, however, would seem to argue for genetic relationship and thus a theistic evolutionary position. This is hardly a more powerful argument, however, than others that already exist, such as comparative anatomy, blood precipitation tests of living primates or recent discoveries of close similarities in primate DNA. The stock argument could still apply; namely, that God used a similar pattern in His creation of true man, making hybridization possible. Whatever answer we give, however, all we really seek to preserve is all that Genesis reveals; namely, that God intervened in a unique way in the creation of a unique creature with a unique purpose in His overall plan for the Earth and the universe.

The tool industries of *Homo sapiens* in the Upper Paleolithic also suggest the capacity for symbol layering as opposed to the earlier Paleolithic traditions. The core and flake tools of the Lower and Middle Paleolithic were simple enough to be conceived merely as pictures in the mind and not verbal ideas. (This may be true of some of the Upper Paleolithic tools as well, but the whole tool assemblage and development of this period seems to be different.) Manufacturing techniques were passed on by imitation without language from generation to generation as some less technical patterns of behavior are even learned by the more intelligent mammals to this day.

This was certainly possible in the case of the pebble tool industries. Early hominids, perhaps Australopithecines, learned by imitation to break a pebble in half or in three parts to get a crude cutting edge. Since they were to a large extent bipedal in locomotion, their hands were free to carry these tools and even weapons, such as the smooth rounded stones found in the earliest Lower Pleistocene tool deposits, in their constant quest for food.

The core and flake traditions that followed simply built upon the experience of the pebble tool industry. The first addition to the earlier technique was a systematic shaping of the core by breaking off many flakes instead of two or three. The early Chellean or Abbevillian and later Acheulian hand-ax traditions, for example, differ only in the size of the flakes removed and whether or not a hammer, stone or wood or bone baton is used to remove them.[56] A second addition or perhaps only a refinement of what was an obvious idea from the start was the use of flakes removed from the core and their eventual retouching to achieve a keener edge. This was the idea behind everything from the crude Clactonian to the more refined Mousterian traditions.

The one tool technique preceding the Upper Paleolithic which seems to have taken a good deal of foresight is the Levalloisian, which may have appeared as early as 150,000 years ago. Here a core or nucleus of stone is prepared by careful flaking around its edges, a striking platform is made, and then a flake is removed that is just the right shape and needs little retouching. Here we do have an incipient symbol layering combining both the ideas of a prepared core and flaking. It may not be as complicated as it seems, however, since the one idea follows rather neatly on the other after the natural use of flakes is begun. Though it is perhaps beyond proving at the present time, it does not seem improbable that even this slightly more complicated process could have been conceived with images in the mind and passed on by imitation.

Finally the numbers and varieties of tools of the Lower and Middle Paleolithic are simplicity itself—hammerstones, hand axes or choppers, knives or cutters (including the triangular point) and planes, scrapers, scratchers or gravers. All of these can be suggested by the anatomy of the hominid itself—hand, fist, teeth and nails.

There are a few early examples of "blades and burins" in the Middle Paleolithic which seem to present a foretaste of the Upper Paleolithic to come. This would not be unusual since an occasional sliver of flint could be struck producing a blade-type flake; however, the highly developed technique and efficient industry of blade and burin culture marks the appearance of the Upper Paleolithic which is always identified with *Homo sapiens.* We are not denying the possibility that Adam's descendants may have even picked up the idea of stone-working from non-human hominids just as we have learned principles of aerodynamics from birds. In fact, there are several commands given to man in the Word instructing him to observe and learn from the lesser creatures. (Proverbs 6:6; Job 12:7-11) *Homo sapiens* soon demonstrates his greater intelligence or conceptualizing powers, however, in going way beyond what had remained stagnant for tens of thousands of years.

The Upper Paleolithic, for example, saw a great diversification and multiplication of specialized stone tools

and a rich development of bone and antler tools.[57] In contrast the Neanderthal, who immediately preceded and sometimes paralleled *Homo sapiens,* has been characterized as "uninventive." Oakley summarizes this point.

> As regards material equipment, the Neanderthalers showed little more inventiveness than the Early Paleolithic peoples. They do not appear to have mastered the craft of working bone, although they broke the long bones of animals for use as tools, and selected dense bones, such as the phalanges of bison, for service as chopping blocks or anvils. 58

Oakley then contrasts the work of *Homo sapiens.*

> Compared with all predecessors, the possessors of the new tradition were remarkably inventive. They made a wide range of specialized tools and weapons, and in environment where wood was scarce they mastered the working of bone and other animal substances. Some had a developed aesthetic sense and displayed artistic skill scarcely excelled in any later period; they decorated their bodies and buried their dead with ceremony. 59

The tool technique of the Upper Paleolithic is superficially related to the "discoidal nucleus" technique of the Levalloisio-Mousterian tradition. It involved the systematic flaking of a better prepared nucleus to produce a continuous series of a single kind of blade-flake which then became the basis for many different kinds of tools. Many similar flakes taken from a single nucleus of flint, in other words, could be conceived in over twenty different ways and in many different associations. It seems as if this might be what we could expect to find erected on the tool tradition of the Middle Paleolithic by conceptualizing creatures who now had the added capacity to think in words and thus to build in layers of symbols. This increased the intellectual ability to see relationships, such as bone with stone and hafting with holding. The hand ax disappears and the use of wood and bone handles becomes commonplace.

Upper Paleolithic tools were much more economical of flint and very efficient. A. Leroi-Gourhan, Director of the Museum of Natural History in Paris, has worked out what he calls man's "first economic statistic." From a single pound of flint an Abbevillan hand-ax would provide only about two inches of cutting surface. An Acheulian hand-ax might provide eight inches. The Mousterian knapper, furthermore, could get up to forty inches of cutting edge by careful flaking. The blade technique of the Magdalenian period of the Upper Paleolithic, however, could have produced from ten to forty *feet* of cutting edge from the same pound of flint. He calls this technique *lamination.*[60] It is a further development of the older Levalloisian skill, but whereas the latter technique usually produced only a single flake and a specific kind of tool, the new laminating technique produced a dozen or more similar slivers or blades of flint which were then reworked into over twenty different kinds of tools. It would seem that considerably more imagination and foresight was needed in the latter case than in the former. I suggest that a capacity for "multiple abstraction" also necessary for the presence of language is in evidence.

All of this seems to point to the conclusion that *Homo sapiens* had mental powers considerably superior to his predecessors. Leroi-Gourhan summarizes, for example,

> In sum, the coming of modern man to various regions of France matched the development of a civilization with roots in the Mousterian past but with an intellect much more like our own. 61

If this points to the acquisition of language, where did *Homo sapiens* learn to speak? Was language really an evolutionary development or was it a radically different quantum step?

We know that God created man for fellowship with Himself. (I Corinthians 1:9) Would not this involve the granting of the capacity for "multiple abstraction" and even the teaching of a language? If left to himself would man have been able to make the "brilliantly successful 'mutation' "[62] necessary for true language? Certainly his communication with God by means of words was a normal and necessary part of Adam's environment by which he was being conditioned in the likeness of God. With Adam's rebellion and subsequent expulsion from the presence of God there came an unnatural environment in which neither Adam nor any of his descendants were able to function properly and so fulfill the purpose for which they were created. Only as a man is reconciled to God through God's provision in Christ is the presence of God once again available to him for normal growth. Once again the communication of God is by means of words—concepts in languages. And it is by these words that we are born again (I Peter 1:23), cleansed (John 15:3), and that we grow to spiritual maturity (Acts 20:32). It is still true that "as a man thinketh in his heart, so is he." (Proverbs 23:7) This helps to explain the necessity of the Word of God, or the communication of God, to man today and its primary place in the lives of the members of His new creation, descendants of Adam who are once again on the road to the fulfillment of the purpose for which they were created.

V

There is one major objection to excluding Neanderthal from the category of "man made in the image of God" and that is the evidence which points to a possible glimmering of religious life; for example, a few burial sites. Burial of the dead with attendant ceremony became very common in the Upper Paleolithic, but is found on occasion also in the preceding period. Is not the religious sense which this suggests evidence for the image of God in man? Anthropologists define religion as belief in something beyond the natural and the activities connected with such belief. Thus the religious sense biologically explained simply includes a concern for that which exists beyond one's sense experience—the area of the unknown. All that is needed to have a sense of the unknown is imagination, and we have already concluded that very intelligent hominids were capable of conceptualizing on a rather high level even without language. Or are we even correct in assuming that animals have no sense

of the supernatural? We must also note that having a religious sense does not denote a moral capacity; in fact, religion and ethics are treated separately in the anthropological literature because they do not always coincide. Whereas Genesis would indicate that man's moral sense is a part of his uniqueness, a consciousness of the unknown or even of the supernatural may not necessarily be. Another answer is possible, however; namely, that Neanderthal was taught by *Homo sapiens*. In speaking of the faint glimmerings of art among the Neanderthals, Leroi-Gourhan concludes,

> That was the final flash of the Paleanthropian civilization; doubtless the last Paleanthropes were influenced by the art and skills of groups of *Homo sapiens* who were not too far away. 63

A final question which may be asked by those familiar with the fossil evidence will be, "How about Swanscombe, Fontechevade and Kanjera?" These have been recommended as pre-sapiens sapiens forms dated earlier than 100,000 years ago; viz., Vallois, Montagu, and Howells. The most careful recent evaluations of the first two fossils have judged them to fall within the range of Early Neanderthals placing them in a very precarious position as evidence.[64] Because of the circumstances surrounding the discovery of the Kanjeran remains, furthermore, their age is also highly speculative. One authority describes the ambiguity.

> . . . they are probably of Upper Pleistocene date. But they could be only 40,000 to 30,000 years old. Or they could be of an earlier date, or possibly intrusive. No one really knows. 65

The following are believed to be the earliest *Homo sapiens* fossils extant: (1) Florisbad man from South Africa with a disputed C^{14} dating of perhaps between 30,000 B.C. and 39,000 B.C.[66] and (2) A skull from the Niah Caves in Borneo with a C^{14} date of about 38,000 B.C.[67] *Homo sapiens* tool cultures are dated earlier than this up to possibly 50,000 B.C. in the Near East. The first appearance of *Homo sapiens* culture in Europe is about 35,000 B.C., and this is the earliest estimate recommended by some for the Western Hemisphere. Stone tools found *in situ* in deposits at Tule Springs, Nevada and the Sandia Cave in New Mexico are dated in excess of 21,000 B.C. and burned bones of dwarf mammoths suggesting a huge barbecue recorded a date in excess of 25,000 B.C.[68] It is likely that the diaspora which moved man into Europe, Africa and East Asia also brought him to the New World via the Bering Strait during the Gottweig Interstadial of the Wurm-Wisconsin glaciation or somewhere between 40,000 B.C. and 29,000 B.C.[69]

I would recommend therefore placing the advent of Adam somewhere in the neighborhood of 45,000 B.C. to 50,000 B.C. or shortly thereafter. This, however, is really no better an answer to the Neolithic problem of Genesis 4 which was mentioned above. Given this dating for the creation of true man, there are three possible solutions to the latter discrepancy: (1) Genesis 4 is not really a picture of the Neolithic;[70] (2) The civilization of Genesis 4 was irretrievably destroyed in the catastrophe of the Flood possibly about 40,000 B.C. or earlier, and attempts to reconstruct such a civilization were frustrated by God. (Genesis 11); (3) The Adam of the Garden of Eden was created about 10,000 B.C., there being an existing race of pre-Adamite *Homo sapiens* as well as other hominids.[71]

One final bit of evidence to support the theory that language did not appear until the time of *Homo sapiens* about 50,000 years ago comes from tentative conclusions in glottochronology, a very uncertain area of research in historical linguistics. In an earlier article contrasting animal and human "language", Charles Hockett concluded,

> These successive evolutionary changes, leading to genuine language presumably did not begin more than 10 to 15 million years ago, since our nearest non-human cousins do not show the consequences; they may have begun much earlier. They were concluded at least 50,000 years ago, and may have been completed much earlier. This second date is based on a rough estimate of the time which would have been required for all the languages of the world today to have differentiated from a single parent language, on the assumption that they are all related. I do not recommend this assumption, which is highly dubious; but it affords us our only way of directly estimating a *terminus ad quem*. Indirect inferences, based on archeological reconstructions of paleolithic life, would suggest a much earlier terminal date. Quite possibly *Pithecanthropus*, if not *Australopithecus*, shared with *Homo* the power of speech. 72

(Our difference of opinion here is perhaps a good example of how different pre-suppositions govern our interpretation of the evidence.) The linguist Roger W. Wescott, however, disagrees somewhat with Hockett's skepticism. In his comment on Hockett and Ascher's paper he wrote,

> My own very tentative inclination, based partly on Swadesh's finding that all known languages converge on a monogenetic vanishing point about 40,000 years ago (1960), is rather to believe that language in the full sense does not antedate Neanderthal man. If asked what kind of vocal repertory the Australopithecines had, I would guess that it was simply an expanded version of the general hominoid repertory; and if asked the same question about the Pithecanthropines, that it was still a phatic (or paralinguistic) system enriched by phonesthemes or functionally equivalent imitative referentials; but that the phoneme-morpheme dichotomy was an invention of Upper Paleolithic Europe. 73

We eagerly await more research in this area.

VI

In conclusion let us note that if this theory is correct we will need a new vocabularly to fit our new categories. Perhaps we should reserve the terms *language, culture* and *man* for the period of the Upper Paleolithic to the present. Early hominoids and the living anthropoid apes would have what might be termed *pseudo-culture*. They are tool-users, and at times toolmakers, but theirs are random acts that usually do not persist because of poor memories and a lack of imagination, although Yerkes cites the example of how teaching one chimpanzee the technique of drinking from a water fountain began a persistent pattern of behavior which was passed on by imitation from one generation to another.

The hominid animals—*Australopithecus, Homo habilis, Homo erectus, Pithecanthropus* and *Sinanthropus,* and *Homo neanderthalensis*—have what we might call *proto-culture.*[74] Here activities become more complex and standardized. There is the power for conceptual thought but in terms of pictures carried around in the mind. Behavior learned by imitation persists intact for thousands of years, but a certain limit of development is reached, and there is little appreciable improvement. Lacking language they find it difficult to store more than just so much traditional behavior, and after a certain saturation point is reached, new generations find it virtually impossible to build much on the accumulations of past generations. Lacking the ability for multiple abstraction, only simple associations of ideas are possible for them.

The hominid creature created in the image of God, whom we believe to be *Homo sapiens,* however, has *culture* because he has *language* and the capacity for a great variety and rich interplay of symbols. He has the potential for persistent improvement since each generation can build on the traditions of the past. Not until he adds writing to his achievements, however, and can more efficiently store these traditions, is more of this potential realized. With the development of electronic cybernetic systems to aid him in his accumulation and analysis of knowledge, furthermore, man may be aproaching the day when his tremendous learning capacity will be fully exploited.[75]

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Charles D. Hockett, "The Origin of Speech," *Scientific American,* 203 (September 1960), 89-96.

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16. Hockett "The Origin of Speech," p. 90.

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74. This is the term used by both Oakley and Hallowell to describe tools prior to language. Julian Huxley has used the term "proto-men" to distinguish early hominids including *Homo erectus* (Java and Peking fossils) from "man in the proper sense of the word" or *Homo sapiens* who represents the "fully human phase." Quoted in Hallowell, "The Structural and Functional Dimension . . .", p. 224. See also J. Huxley, *Evolution in Action* (New York: Harper and Brothers, 1953).

75. The implications of Genesis 11:6 are that man has an almost unlimited capacity to learn. "And the Lord said, Behold they are one people, and they have all one language; and this is only the beginning of what they will do; *and nothing that they propose to do will now be impossible for them.*" (RSV)

EXPERIMENTAL WORK BEARING ON THE ORIGIN OF LIFE

WALTER R. HEARN*

Experimental work bearing on the origin of life continues to appear in scientific journals and two major symposia have now been published. In this paper three different reviews of the subject are discussed to indicate not only the current status but also the varying attitudes of investigators toward accomplishments in the field. The influence of the space program and the lively conflict over exobiology are pointed out.

The subject of the origin of life has been reviewed by the present author several times in recent years,[1,2] but has not been discussed at an Annual Convention of the ASA since the symposium at the 1957 Convention at Gordon College.[3] For those who wish an introduction to the subject, these published reviews, particularly the chapter in the monograph *Evolution and Christian Thought Today*[1] (or some of the semi-technical references cited therein) should serve the purpose fairly well.

For those with some technical background who wish to examine the scope of investigation in this field, the standard reference work is Volume 1 of the International Union of Biochemistry Symposium Series, proceedings of the first international symposium on the subject, held in Moscow in August, 1957. The English-French-German edition (with most of the papers in English) was published in 1959, a 700-page book edited by A. I. Oparin and other Soviet scientists and entitled *The Origin of Life on the Earth.*[4] Major areas of concentration in this field are indicated by the titles of the sessions of this historic symposium:

(1) Primary formation of primitive organic compounds on the earth.
(2) The transformation of primary organic compounds on the earth.
(3) The origin of proteins, nucleoproteins, and enzymes.
(4) The origin of structure and metabolism.
(5) The evolution of metabolism.

In each of these areas competing theories still flourish, stimulating a wide variety of experimental approaches. It is clear by now that the problem of the origin of life is as vast as the problem of the evolution of living forms, and that no single experimental success, no matter how impressive nor how dramatically publicized, can settle all the many questions yet unanswered in this field.

As a sequel to the 1957 Moscow symposium, a meeting was held in October, 1963, in Wakulla Springs, Florida, on the origin of prebiological systems. The papers have only recently appeared in print[20] but a brief report with some indication of the content of each paper was promptly published in *Science.*[5] In general the papers fall into the above categories, but several new developments are apparent. For one thing the field has matured sufficiently for workers in it to see the need for clarification of terminology; the geneticist T. Dobzhansky, for example, who served as interpreter for A. I. Oparin's paper, at one point took great exception to use of the term "natural selection" for prebiotic phenomena in addition to its use in the traditional Darwinian sense. Another feature distinguishing the 1963 symposium from its 1957 predecessor was acknowledgment of the importance of space technology for scientific investigation of the origin of

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life. Indeed, the 1963 conference was sponsored jointly by the Institute for Space Biosciences of Florida State University and by the National Aeronautics and Space Administration (NASA), which maintains at its Ames Research Center in Mountain View, California, a large Exobiology Division. We will return to space technology and extraterrestrial life in a moment.

Investigators on the origin of life differ not only in their theoretical preferences and experimental approaches but also in their evaluations of the status of the field as a whole. To indicate these attitudes as well as accomplishments in the field, attention will be called primarily to three review articles by leading investigators, published in 1962, 1963, and 1964 and revealing attitudes which might be called pessimistic, realistic, and optimistic, respectively.

1962: Horowitz and Miller

The 1962 review, by N. H. Horowitz of Cal Tech and Stanley L. Miller of the Oceanographic Institute at La Jolla, is entitled "Current Theories on the Origin of Life." It is in English but published in a tri-lingual annual called *Fortschritte der Chemie organischer Naturstoffe* (Progress in the Chemistry of Organic Natural Products).[6] Stanley Miller, you may recall, was the graduate student of Nobel-laureate Harold Urey whose 1953 paper, "A Production of Amino Acids Under Possible Primitive Earth Conditions",[7] in a sense triggered off the modern phase of research on the origin of life. It is rather surprising, therefore, to encounter the decidedly cautious and negative tone in this recent review article by Horowitz and Miller. The article never describes an accomplishment in the field without emphasizing the tremendous gaps remaining in our knowledge, and criticizes essentially all major competing theories, seldom setting forth an alternative.

In discussing minimum criteria for living matter, these authors conclude that an organism, to be called living, must be capable of both replication and mutation; the underlying pessimism of their review may stem from choosing a definition of living matter somewhat more encompassing than the working definitions used by others in the field. That is, having posed a larger problem, they see the solution to it as relatively more remote. A model DNA-RNA-protein system fulfills their minimum requirements for a living system and is simple in comparison to a whole cell, but they consider it still too complex and too efficient to have originated spontaneously by random chemical reactions; this system must itself be the product of a long evolution. The original, primitive genetic system may have been so different from the highly evolved system that they would bear little resemblance, but we have no experimental evidence to settle this point. There is much speculation that the first living organism consisted of a polynucleotide which produced or was associated with a polymerase, but the authors point out that even this hypothesis is not as simple as it appears. For one thing, degradative reactions have to be assumed which would result in a low, steady-state concentration of biologically significant polymers. At the present time we have no way of judging whether the origin of life was an extremely improbable event or the inevitable outcome of the evolution of organic compounds on the primitive earth.

Instead of presenting enthusiastic arguments for the reducing character of the primitive atmosphere, these authors say it would probably not be necessary to accept the hypothesis of a reducing atmosphere if organic compounds could be synthesized under oxidizing conditions; apparently they cannot. However, under reducing conditions, with essentially any kind of energy source, organic compounds *are* produced. A table of present energy sources averaged over the earth is presented to make the point that electric discharges from lightning and corona effects amount to about four calories per square centimeter per year, essentially the amount of ultraviolet radiation in sunlight at 1500 Angstroms (there is much more UV energy at longer wavelengths: 75 cal/cm^2/yr at 2000 Å, and 570 cal/cm^2/yr at 2500 Å). For formation of free radicals from methane, water, ammonia, etc., wavelengths below 2000 Å are needed; larger organic molecules formed in photochemical reactions in the upper atmosphere would absorb at longer wavelengths and thus might not reach the oceans before being decomposed by absorption of ultraviolet light. It is not surprising that the types of organic compounds formed in experiments with electric discharges are identical to those formed when short-wave UV light is used as the energy source, since the same reactive aldehydes and hydrogen cyanide are formed from free radicals in either case. Cosmic ray energy is negligible at present and although 4 x 10^9 years ago radioactive disintegration was more important, most of that form of energy was expended on the interior of the rocks and not available for reactions in the oceans and atmosphere. The energy from volcanoes was relatively insignificant and localized.

Horowitz and Miller are critical of Sidney Fox's argument that thermal reactions were important on the primitive earth; they discount John Oro's syntheses of adenine and other biologically important compounds from ammonium cyanide solutions on the basis that his concentration of ammonium cyanide (1.5 *M*) would have been impossible in the primitive ocean. Other problems, such as the origin of optical activity in biological systems, are discussed in the same pessimistic vein. In a final section on space research, however, these authors show considerable optimism over the possibility of finding out whether life exists on other planets. A fundamental question which might be answered by space exploration is whether a form of living matter is possible which is not based on nucleic acids and proteins; the implications of this question were discussed in 1960 by Joshua Lederberg.[8] But even if life is *not* found on the moon or Venus or Mars, the possibility of examining the organic compounds on their surfaces or in their atmospheres may

yield invaluable evidence bearing on the origin of life on the earth, according to these authors.

Exobiology: A Digression into Outer Space

It may be appropriate to digress here for a brief look at our actual plans for detecting life on Mars and Venus as described in a 1963 NASA pamphlet on "The Search For Extraterrestrial Life."[9] It is generally assumed that though they now differ, in their earliest stages the atmospheres of all the planets were the same as that postulated for the primitive earth; hot gases of hydrogen and hydrogen compounds such as methane, water vapor, and ammonia, with the possibility of some carbon dioxide. The composition of this atmosphere gradually changed. The gravitational attraction of the earth was not sufficient to hold the lighter gas molecules so they escaped into space. The moon, with feeble gravitational attraction, was unable to hold any atmosphere at all. Jupiter and Saturn, much larger than earth, retained atmospheres of hydrogen and hydrogen compounds. Mercury, close to the sun, is probably too hot for any form of life. Jupiter, Saturn, and other planets far from the sun are probably too cold.

Spacecraft have now been sent past the moon and actually landed on the moon. Mariner 2, launched from Cape Canaveral on August 27, 1963, flew past Venus on December 14, 1963, taking readings and transmitting data which may have significance in the search for extraterrestrial life. Mariner's measurements showed temperatures on the surface of Venus on the order of 800 degrees Farenheit, too hot for life as known on Earth; however, temperatures at the top of the Venus cloud level are about —40°F. Could there be some form of life in the atmosphere between these levels?

Mars and earth both orbit the sun in the same direction but not at the same speed or distance. The mean distance of earth from the sun is 90 million miles; the mean distance of Mars from the sun is 141 million miles. Earth makes one revolution about the sun each 365½ days; Mars takes 687 earth days for the same trip. The distance between Mars and the earth varies from 62 million miles down to 34 million miles when their orbits are in favorable opposition. After a failure by Mariner 3, the Mariner 4 spacecraft was launched toward Mars by NASA aboard an Atlas-Agena rocket on November 28, 1964. If all goes well, this 574-pound planetary flyby will provide information for later attempts to detect life on Mars: as it sails within 10,000 miles of the planet it will transmit to earth high quality television pictures along with measurements of magnetic field strength, infrared spectra, and other data. A subsequent Mariner was originally scheduled to land a life-detecting instrument package on the Martian surface by parachute in 1966 or 1967, but these plans have been changed radically and postponed until at least 1969. What sort of instruments might such a package contain?

Eight devices now under development for detecting evidence of extraterrestrial life are described in the NASA pamphlet. One device measures optical rotatory dispersion in the ultraviolet region: if a sample of Martion soil obsorbs at 2600 Å without optical activity, the baso adenine from pre-biological syntheses may be assumed to be present, but if a large optical rotation is associated with that wavelength, the adenine will be assumed to be linked to an optically active sugar in the nucleic acid molecule and life on Mars will be inferred from the signal transmitted to earth.

Another type of ultraviolet spectrometer is being developed to search for the absorption at 2200 Å characteristic of the peptide bond of proteins. A device called a "multivator" is being developed by Dr. Lederberg at the Stanford Medical Center: it is essentially a set of incubation chambers into which soil samples can be blown for the detection of enzymatic activity. Breakdown of various substrates to easily detected radioactive or fluorescent products will indicate the presence of bacteria in the soil samples.

Another scheme of Dr. Lederberg's is a microscope with fixed-focus lens, an illuminator, a soil collection system, and a vidicon camera to take an actual look at any organisms present; it is believed that a microscope able to cover an object field of 100 microns with resolution of 0.5 micron, a one-watt illumination source, and a vidicon camera with a 200-line scan to match the resolution of the lens system can be combined in a package which will weigh less than three pounds, have a volume of less than 500 cubic inches, and be capable of standing both the trip and the sterilization necessary to prevent contamination by Mars by microorganisms from the earth. Another device is essentially a colorimeter with a monochromator set to measure an intense absorption peak known as the "J-band" of a solution of cyanine dye, a band which shifts when the dye is complexed with protein; if the J-band detector radios back to earth a spectral shift when Martian dust is introduced into the dye solution, the presence of proteins will be inferred, possibly from viruses, bacteria, fungi, algae, spores, or pollen.

A device nicknamed "Gulliver" has been tested several times already on earth; it consists of a chamber containing a universal culture broth made radioactive and three small cannons which shoot "sticky strings" out 50 feet and then reel them back into the culture chamber. If bacteria are present on any of the strings they begin to grow and multiply and produce radioactive gas which is detected by a miniature Geiger counter near the culture chamber; in this case as in some of the others the signal will be sent by transistorized radio to the "bus" or orbiting space capsule from which the package was dropped to the surface of Mars, and the "bus" will transmit to earth with its heavier radio equipment. Another type of "bug detector" being designed by Professor Wolf Vishniac has been nicknamed the "Wolf Trap"; it uses a vacuum chamber to suck atmospheric dust into a culture me-

dium where changes in turbidity and pH can be measured with time.

Finally, an attempt is being made to miniaturize a mass spectrometer so that the range of molecular fragments vaporizing off a sample of Martian dust near the ion source can be scanned quickly; if amino acids, peptides, or proteins similar to those of living things on earth are present on Mars they should give mass spectra similar to those of samples tested on earth. The Chief of Exobiology Programs for NASA says that this device may even be able to detect a form of life *as we do not know it on earth* if complex life-related substances unlike our familiar earth-bound organic compounds are discovered.

Since the moon has no appreciable atmosphere, its surface may be a museum of cosmic dust captured by its gravitational field and left undisturbed by atmospheric or biological alteration. In a 1958 paper with perhaps the shortest and most fascinating title in all scientific literature—"Moondust"[10]—Dr. Lederberg and Dean B. Cowie argued that the record of cosmic history contained in the dust on the moon should be as valuable for understanding the biochemical origins of life as the fossil-bearing sediments of the earth's crust have been in understanding life's subsequent evolution. Lederberg and Cowie expressed concern lest future scientific investigation of the moon and of other celestial bodies be ruined by contamination from interplanetary missiles from earth. A committee has now been set up by the International Council of Scientific Unions under the chairmanship of M. Florkin of Belgium to study this problem.

The reciprocal problem posed by the future possibility of round-trip space flight has also been discussed by Lederberg.[8] The dramatic hazard of introducing a disease-producing organism from another planet can no longer be relegated to science fiction. Although it can be argued that earthly disease-producing organisms have generally had to evolve very elaborate adaptations to resist attack by human defense mechanisms, it can also be argued that an infective organism to which our *defenses* have not been adapted through previous contact might prove to be beyond our powers to cope. The risk of pandemic disease, while extremely unlikely, is also immense. Exobiology is no more fantastic than the realization of space travel itself, according to Professor Lederberg.

In contrast, George Gaylord Simpson in a 1964 article entitled "The Nonprevalence of Humanoids"[11] ridicules the whole field of exobiology, arguing that this new "science" has yet to demonstrate that its subject matter even exists! Simpson concludes that (1) there are certainly no humanoids elsewhere in our solar system; (2) there is probably no extraterrestrial life in our solar system; although some form of life may occur on Mars; (3) because of the vast number of stars in the universe, the highly improbable development of life undoubtedly has occurred in other planetary systems, but even so it is extremely unlikely that we shall ever learn of its existence; and (4) it is nearly impossible that life anywhere in the universe includes humanoids and even less possible that we could ever communicate with them in a meaningful way even if they did exist. According to Simpson, spending money to discover extraterrestrial life is a gamble at the most adverse odds in history which even if successful can teach us only little about life. His article ends on a pleading note:

> But we already have life, known, real, and present right here in ourselves and all around us. We are only beginning to understand it. We can learn more from it than from any number of hypothetical Martian microbes. We can, indeed, learn more about possible extra-terrestrial life by studying the systematics and evolution of earthly organisms. Knowledge from enlarged programs in those fields is not a gamble because profit is sure. My plea then is simply this: that we invest just a bit more of our money and manpower, say one-tenth of that now being gambled on the expanding space program for this sure profit.

Simpson's chilling blast in February, 1964, drew a series of critical replies published in *Science* in May.[12] Also that May, the AIBS bulletin now called *BioScience* carried a report[13] of a Space Biology Workshop convened in January, 1964 by AIBS and supported by NASA at the Space Sciences Center of the University of Rochester. According to the report by Wolf Vishniac and Richard Lewontin of the Rochester Center, thirty of the nation's prominent biologists unanimously agreed that "The search for extraterrestrial life is the single most important question to be answered by the space age." In June, 1964 a *BioScience* editorial "On Exobiology"[14] reported these conflicting opinions about space biology programs and described hardware difficulties which caused the 1964 Mars life-detection shoot to be postponed until the next "window" or favorable launch opportunity in 1966. Furthermore, a reevaluation of the Mars spectrum has now led to the conclusion that the atmosphere on that planet may be as low as ten millibars, an order of magnitude lower than the previously accepted value; the lower pressure would make parachuting an instrument capsule from a "bus" impossible and adding retro-rockets to the capsule might reduce the payload to the marginal point. NASA has revealed that a 1966 life-detection mission is out; Congress, tired of perennial increases in NASA appropriations, has left a total funding of $7,000,000 for exobiology, possibly inadequate to prepare even for a 1969 mission. After 1969 there will be "windows" to Mars in 1971 and 1973, but after 1973 oppositions between Mars and earth become unfavorable for a decade.[13]

1963: J. Oro

This would mark the end of our digression into outer space except for the fact that the second review paper to be considered, John Oro's realistic "Studies in Experimental Organic Cosmochemistry,"[15] appears in a symposium with an extraterrestrial theme: "Life-like Forms in Meteorites and the Problems of Environmental Control on the Morphology of Fossil and Recent Protobionts." This June, 1963 issue of the *Annals of the New York Academy of Sciences* contains papers presented at a conference called in April, 1962, pri-

marily to deal with the claims of Bartholomew Nagy of Fordham University and his NYU colleagues that "organized elements" they found in the Orgueil carbonaceous chondrite were clear-cut evidence of extraterrestrial life. The published symposium carefully arranged with three papers by Nagy at the end for obvious climactic effect, must now be a source of embarrassment to its overzealous organizers; Frank Fitch and Edward Anders of the University of Chicago, who argued against Nagy's claims at the conference, have since convinced most people that some of the "organized elements" on the century-old meteorite were biogenic all right—but earthly contaminants—and the rest merely mineral grains.[16] A spiny type of "hystrichospherid" on the Orgueil meteorite was identified by several investigators as ragweed pollen! Judging by the condensed report appended to the published symposium, the final discussion chaired by Harold Urey must have been a riot—or nearly so.

The rationale for including Oro's down-to-earth paper on organic cosmochemistry in this bizarre symposium was probably to show that the small percentage of organic matter (7 per cent in an Orgueil sample) in the nineteen known carbonaceous chondrites might be of prebiological if not biological origin. Oro's 1963 review stands on its own, however, as a balanced and thorough review (with 182 references) of experimental work relating to prebiological syntheses of organic compounds of biological significance. Amino acids, hydroxy acids, monosaccharides, purines, pyrimidines, polypeptides, and polynucleotides have now all been produced experimentally in model systems simulating reasonable primitive atmospheres. Oro points out that his own "cometary" model, Urey's "primitive planetary atmosphere" used by Miller, and Sidney Fox's "volcanic atmosphere" model should be considered as complementary rather than alternative approaches to study of the prebiological formation of organic compounds on earth.

The implications of Oro's choice of a cometary model are quite interesting, since the composition of present comets is considered to reflect approximately the composition of the primordial solar nebula and protoplanets. The spectra of comets show fluorescence emission bands corresponding to the molecules or radicals CN, CH, CH_2, C_2, C_3, NH, NH_2, and OH, to the radical ions CH^+, OH^+, CO^+, N_2^+, and $CO_2=$, and to the atoms of Fe, Ni, Cr, and other elements; Oro's simplified experimental model contains HCN, NH_3 and H_2O—and this mixture produces adenine and its biological precursor 4-aminoimidazole-5-carboxamide!

Possibly because we take inorganic chemistry as freshmen, organic chemistry in our junior year, and biochemistry only in graduate school, it may be hard for us to think of organic and biochemical compounds as being fundamental components of the universe. Yet, with the exception of the noble gases the four most abundant elements in the universe are hydrogen, oxygen, carbon, and nitrogen, precisely the four major elements of organic compounds and of living matter. Indeed, Oro reminds us that the composition of living matter is a better sample of the universe than is our earth! The assumption that the earth was formed from a gravitationally undifferentiated protoplanet implies that organic chemistry was already going on at the very beginning of the primitive earth.

Before turning to the final review article on the origin of life, we might call attention to several other papers of interest in the "meteorite-microbe" symposium. Sidney Fox[17] of Florida State University as usual reviewed his own work on proteinoids of thermal origin, with impressive photographs to illustrate their precellular "morphogenicity" and hints of their catalytic activity. Along a different line was the report of "Bacteria from Paleozoic Salt Deposits"[18] by Heinz Dombrowski of the Department of Balneology of Justus-Liebig University in Giessen, Germany: for the first time it has been possible to isolate and cultivate bacteria from Permian, Middle-Devonian, Silurian, and even Precambrian salt deposits, creatures having lain dormant for from 180 million years (Permian) to 650 million years (Precambrian). Bacteria from the Precambrian and Silurian salts showed fewer biochemical abilities than the "younger" Permian organisms. Ages of most of the deposits were established from characteristic fossil pollen grains and found to be in accord with geological features. Careful precautions to avoid contamination were taken and apparently these astounding findings have not been challenged by other investigators.

1964: Calvin and Calvin

The 1964 review of the origin of life categorized earlier as optimistic was written by Nobel-laureate Melvin Calvin of the University of California at Berkeley and his wife Genevieve. It is entitled "Atom to Adam," a lecture given by Dr. Calvin before the American Philosophical Society in November, 1963; it appeared in the June, 1964 issue of *American Scientist*.[19] Calvin's minimum criteria for living matter are slightly different from Horowitz and Miller's; they are (1) transfer and transformation of energy and (2) transformation and communication of information. The major argument of the paper is as follows: the problems of prebiological synthesis of biological monomers and polymers are essentially solved; furthermore, the structural information in three-dimensional polypeptide and polynucleotide molecules required by the two criteria for living matter is contained ultimately in their monomeric sequences. This argument is supported by reference to the reversible destruction of secondary, tertiary, and quaternary structure of various enzymes, and to the reversible uncoiling or "melting" of DNA. Calvin postulates that even visible structures such as collagen fibrils may be the direct resultant of primary structure, and stops just short of saying the same thing about cellular units such as ribosomes and mitochondria.

A review of the DNA-RNA-protein system for "molecular communication" leads Calvin to consideration of environmental control of genetic expression. How

do different cells of an organism know they have different functions when they all have the same kind of DNA? What tells the individual cells which parts of their DNA to read? At this point Calvin speculates on what might be accomplished if our present knowledge of manipulating genetic information in bacteria (such as introducing new genes by transduction, or controlling expression of existing genes by simple molecules as in enzyme induction) can be extended to the human level. For example, the ten billion brain cells with which a human being is born might be increased to 100 billion by controlling the growth of various developing cells in the embryonic brain, maybe even allowing us to keep ahead of electronic computers in the future! More practical, no doubt, is control of virus disease, cancer, and the adaptability of man; we may someday have the power to intensify certain human traits, delete others, and perhaps even develop new ones. The chemical control of men's minds is approaching already. Calvin's optimistic spirit is maintained right up to the staggering question: "Who is going to change men, and how many of them, and in what way?" He concludes his review of the origin and development of life with these statements:

The distance from Atom to Adam covers billions of years. But following the laws of the behavior of matter, the process has been orderly, even in its infinite complexity. But during these years, the laws of nature have functioned in a laboratory in which each atom has its destiny, but within which no encompassing comprehension of the whole could sway the course of experiment.

Today, the world is quite as awesome to contemplate as it must have been in its beginnings, for today man is here and he has a little knowledge! With each thread of new truth, the responsibility to weigh the consequence of its application becomes more critical. The rate of evolution can change tremendously with man's new knowledge, and the responsibility to control the rate and the direction of change must depend on wisdom. As it has to this day, time will record our success—or our failure.

In the above quotation which leaves the realm of science and enters the realm of philosophy to speak of destiny, awe, responsibility, wisdom, success, and failure—I personally see a primary reason for us as evangelical Christians to pay serious and respectful attention to Experimental Work Bearing on the Origin of Life, the title of this paper. It is clear to me as a biochemist that this field will continue to develop, with or without adequate NASA support. It is clear to me as a Christian that its development will continue to bring scientists face to face with the perennial theological questions to which we claim the Gospel of Jesus Christ provides necessary and sufficient answers. If we show respect for the work in this field and for the workers in it we shall in turn command respect for the testimony which we bear. Having followed Professor Calvin's scientific arguments I am not obliged to agree with his philosophical position. In fact, I do not agree with him philosophically, for I believe that God, the Creator, *does* possess an "encompassing comprehension of the whole" and indeed has "swayed the course of experiment" at every turn. When scientists, even Nobel prize-winners, seek wisdom, shall we not be ready to tell them of its Source? *"For the fear of the Lord is the beginning of wisdom."*

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"If there is any one revelation which can best be appreciated by a scientist, it is the revelation of the cosmological significance of the Lord Jesus Christ. The cosmic significance of Christ is not limited to His being the Logos of God in creation, but He is the Redeemer of creation and will deliver a renewed creation to the Father. He is the Redeemer of man, but not less of the full handiwork of God. So the Christian's slogan is *pro regi,* for the King, in science and in all human culture." Roger J. Voskuyl in *Modern Science and Christian Faith,* Scripture Press, Wheaton, Illinois. Reprinted by permission.

THE NEED FOR A BETTER UNDERSTANDING OF CURRENT PSYCHOLOGY: A REPLY TO DR. FINCH

MICHAEL MECHERIKOFF AND
C. EUGENE WALKER*

The authors express general disagreement with the point of view presented in a recent JASA article regarding the bankruptcy of modern psychology in failing to fully comprehend the nature of man. Modern psychology as a natural science must be dedicated to the empirical investigation of behavior. Rather than constituting a "procrustean bed," the scientific method is a powerful tool for deciding issues and testing hypotheses. While the possibility of other approaches to knowledge is not denied, it is felt that the scientific method has proved fruitful where philosophical methods have not, and is thus rightly considered definitive for the field of psychology. The authors do not consider behavioristic psychology and Christianity incompatible.

In the December, 1964, issue of this journal, under the title "The Need for a New Approach in Psychology," appears an article by Dr. John Finch characterizing the "merely scientific" approach to an understanding of man as bankrupt because "it refused to cope with the very man-ness of man, his spirit."[1] The issue is viewed as a choice which psychology must make: "it is the difference between a logical positivistic aproach to understanding data and the existential approach."[2]

It is our intention to show that Dr. Finch's proposal represents an inadequate conception both of the power and flexibility in the scientific method and of the scientific status of contemporary psychology.

SCIENTIFIC METHOD

To be sure, Dr. Finch does not say that the scientific method is to be repudiated. In fact he attempts to deny that this is at the root of his proposal. His compromise reads as follows: "Recognize the limitations of the scientific method, derive from it all the information possible, but under no circumstances limit the subject of knowledge to its methodology."[3] On the surface this sounds like an acceptable and reasonable strategy, since it seems clear that there are aspects of human experience traditionally thought of as psychological which we wish to discuss, but which apparently cannot be operationally defined or publicly observed. However, it is important to note that psychology *as a natural science* cannot (nor does it attempt to) comprehend the full stature of man.

An analogy with other sciences may clarify this point. There are questions concerning the physical world which are not amenable to the methods of physics; e.g., What is the purpose of the material universe? The failure of physics to deal with questions of this sort certainly does not indicate the bankruptcy of scientific method nor the need for a groping after existential relationships with truth within physical theory. Biologists, whose application of scientific methodology was at one time also viewed with considerable dismay, do not seem to feel intellectually impoverished by being restricted to propositions which are confirmed with reference to observable characteristics of physical objects.[4]

Let us emphasize that the criticism being leveled at scientific psychology (restricting ourselves to a verifiability criterion of truth) in principle is not restricted to psychology alone. All other natural sciences may also be so criticized. Is it or is it not true that God in some real sense supports and is immanent in His creation? This proposition cannot be tested by the methods of science. If we as Christians believe it to be true, then perhaps we should propose an expansion of physics beyond the limitations of natural science. At the point where a question arises which is not empirically answerable, the Existential Scientist may disregard the rules and limitations and answer the question on the basis of his personal relationship to the truth. This is the point at which the cornerstone

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and foundation of science is demolished, and scientific progress stops.

In the historical development of the established sciences as sciences there came a separation of questions which could be approached in terms of empirical methodology and questions which, by their nature, remained in the area of philosophical analysis and speculation. What seems to distinguish science from non-science, then, is this very separation of questions into those which are subject to empirical investigation and those which are not.[5] Since the rise of scientific psychology during the latter half of the last century this process has also been operating in the various fields of psychological inquiry.[6]

Why should psychology be singled out as the discipline that must not sell its soul to science? Whatever else may be said about them, human beings act and interact in observable ways (as do other living organisms) and may therefore be described in scientific terms. Man did not need to be "objectified" by any special philosophical viewpoint—he is *already* "part of the material phenomena."[7] His actions seem in many respects to be orderly and predictable, and it is the task of psychologists to investigate this observable orderliness in behavior. It is difficult work, and basic variables and satisfactory conceptual schemes have yet to emerge clearly. But to say that psychology as a science has proved itself bankrupt is decidedly premature and unjust. It is certainly tedious and time consuming to try to deal, for example, with anxiety experimentally as a behavioral variable with functional relationships to other variables, but at least the goal is to have a concept of anxiety which is understood in precise terms. To observe that "anxiety is the moment (or series of moments) when man is thrust inward upon his own nudity, when his history confronts nullity, when the question as to his own significance balances between life and death"[8] is poetic but useless in practice.

The chief difficulty with beginning the study of man under the assumption that scientific methodology is inadequate is that no generally accepted alternative criterion for truth is (at least as yet) available. Scientific method, in restricting itself to certain kinds of propositions, furnishes us with a criterion which works well in practice. To try to extend science beyond its self-imposed limitations into "non-materialistic science"[9] would have the devastating effect of making its criterion for truth inapplicable, without furnishing a suitable replacement. Science in general and psychology in particular would again be plagued by the basic problem in philosophical speculation, that what is "true" depends on who believes it. If there are things to be said about mental life and spiritual relationships that are beyond the vocabulary and grammar of natural science, they should be clearly recognized as philosophical or theological statements. No useful purpose is served, and a great deal of harm is done, by robbing natural science of its basic, distinctive methodology.

Let us illustrate the difficulty we run into by citing two passages in Dr. Finch's paper. The closest Dr. Finch comes to providing us with a criterion for truth comes following a quotation of Jaspers distinguishing the philosophical mind from the scientific mind in terms of personal faith. Dr. Finch then says, "the so-called scientist who adheres to logical positivism . . . limits himself, shall I say, by a lack of faith to certain philosophical presuppositions. This limitation tends to put faith in a methodology above a faithful confrontation by the everchanging facts."[10] A "faithful confrontation by the everchanging facts," then, is our new criterion. The details of how such a criterion is carried into practice are omitted. An important point which Dr. Finch misses in this discussion is that scientific methodology *is* precisely a strategy useful when one is confronted by facts—a strategy for digging them out and making sense of them—a strategy *worthy* of faith! In any case, before abandoning scientific methods of confronting facts, we would like to see a more complete explication of the specific procedures of existential research.

The second illustration involves a comparison of the Freudian conception of anxiety with Dr. Finch's conception as to validity. Freud (as summarized by Dr. Finch) believed that "When the instinctual drives are thwarted, anxiety results. When the libidinal flow is blocked, the damming up of such a flow causes anxiety."[11] Here we have a proposition containing terms which are not operationally defined, and which are not connected to specific operations through other variables. Our judgment is that the proposition *as it stands* is not useful. Dr. Finch agrees (but for other reasons), and he suggests that if Freud had not been blinded by rationalistic and physiological assumptions, he might "even have noted that anxiety is the creative directive to every being to be one's self, relentlessly."[12] In Dr. Finch's definition, however, we also have a proposition unconnected to specific procedures for testing its validity or applying it in practice. Although Dr. Finch treats his proposition as if it were the most obvious observation in the world, his relentless self-actualization directive as a specification of the term "anxiety" does not seem to us any more intrinsically acceptable, useful, or true than Freud's libidinal hydraulic system. Again, if we are to detect existential truth, we would like to know exactly how to go about it.

It is somewhat difficult to follow Dr. Finch's discussion of the inadequacy of the scientific method, since most of his paper is devoted to a rebuttal of rationalistic philosophy rather than of scientific methodology. Descartes and Hegel, to whom he devotes special attention, were both philosophers, and not by any stretch of the imagination scientific psychologists or empirical scientists of any sort. Even to say that contemporary philosophy of science (including logical positivism) is closely tied to either Descartes or Hegel would be a dubious assertion. Evidently what Dr. Finch would have us believe is that the scientific

method is a rationalistic system, and that by destroying a couple of other such systems, science will by analogy be shown to be similarly destructible.

It is certainly true that much of the early growth of science took place in a rationalistic intellectual atmosphere, and that scientists as late as the end of the last century held simple concepts of physical mechanism and causality. In a footnote Dr. Finch mentions that around the turn of the century, as a result of the development of relativity theory and quantum theory, scientists were beginning to question the simplicity of their concept of physical reality. Unfortunately Dr. Finch chose to level his critique at pre-nineteenth century philosophy rather than to evaluate the developments in scientific conceptualization in the twentieth century. The scientists he mentions, including Eddington and Einstein, did *not* give up scientific methodology in changing their conceptions of the world. The scientific method was not only flexible enough to accommodate the changed conceptions, but itself made these changes necessary. These scientists did not embrace existential philosophy to find answers to difficult physical questions.

Scientific method is not a static set of restrictive rules presented to the world by Descartes or Hegel or Comte, to be blindly followed by the Freuds and the Watsons, but is rather an approach for understanding the physical world which itself developed and changed and is changing, and which itself needs to be studied and understood.[13] The most intensive analysis of the methods of science was made since the 1920's (a period of history Dr. Finch neglects completely) as a result of the philosophical movement called logical positivism or scientific empiricism (a movement, incidentally, which differed from the early positivism of Comte in several basic, important ways).[14]

This is not the place to attempt to summarize contemporary philosophy of science.[15,16,17] It is a highly technical subject, and there are differences of viewpoint. With respect to the practicing scientist, however, it should be noted that for the most part the usefulness of logical positivism as a philosophy of science has been *descriptive of* rather than *prescriptive for* his scientific work. Scientific methodology has taken root in our civilization not because it is or is not underpinned by any particular philosophical (metaphysical or epistemological) viewpoint, but because it has turned out to be a profitable strategy for understanding, explaining, predicting, and controlling phenomena in this universe. Past philosophical attempts to construct a complete rationalism or a complete empiricism have been beside the point as far as scientific endeavor is concerned. Modern science is *both* empirical and rational, consisting of an elaborate interaction between observational data and logical symbolic systems.[18]

CONTEMPORARY PSYCHOLOGY

The presentation of contemporary psychology by Dr. Finch is accomplished by citing the positions of two men: Watson and Freud. In neither case is justice done to the position of the man, and in neither case does the position of the man represent contemporary psychology. Freud's major work was done around the turn of the century, and Watson's between 1913 and 1930. Psychology as a science has progressed considerably since then, just as other sciences have progressed, both in observational and in theoretical sophistication.

It is important to recognize that Watson was the *first* behaviorist, reacting vigorously against the problem of trying to infer sensory experience in animals, and against an established psychology which lacked objectivity due to the exclusive use of introspection in studying conscious experience. Recent behaviorists are considerably less inclined to reject mental processes, consciousness, and other topics abhorrent to Watson, provided that these inferred processes are anchored to observations. This is in no way different from the treatment of inferred or theoretical entities or processes in other sciences. A psychology of muscle twitches is no longer the goal of behaviorists, and in fact behaviorism scarcely exists today as a separate viewpoint. Behavioristic methodology has been absorbed into psychology as a whole.[19]

Without warning Dr. Finch suddenly begins talking about anxiety and dammed up libido. Eventually Freud's name is mentioned, but the impression is left that Freud and Watson held virtually identical positions. Nothing could be less true. About the only proposition they held in common was that psychology was to be viewed as natural science, and even at this point they had radically divergent ideas about the nature, scope, and methodology of psychology. Although Freud profoundly influenced psychological thinking, his system and his goals do not represent modern psychology today[20] and further discussion of him here is pointless.

One more point concerning the history of psychology bears mentioning. In saying that "the dimension of the spirit burst through the methods of scientific naturalism to create a new discipline in phenomenology"[21] Dr. Finch gives the impression that this event took place as a result of the recognized failure of the scientific method. In actual fact, phenomenological approaches were being proposed long before behaviorism appeared, and can be traced back to the earliest days of scientific psychology nearly a century ago.[22] Certainly Gestalt psychology and even Tolman's behaviorism have a flavor of phenomenology. But these were scientific approaches, basing ultimately their inferences of perceptual or cognitive states on observable consequences. This kind of phenomenology does not burst through scientific methodology—it uses and profits by it.[22] But if we are talking about mental life that in principle is beyond the inferential procedures of natural science, then we are again back to the problem of stating an acceptable criterion for truth. We are not saying that such a criterion does not exist, or that it may not be found: we are saying that until we can distinguish between the meaningful

and the meaningless, the true and the false, in phenomenological propositions, we cannot see the value of such an approach and see no reason for extending the definition of *science* to include it.

Having suggested that phenomenology has already taken psychology beyond the limitations of science, Dr. Finch raises the question of whether a Christian understanding of man may create a new approach (beyond phenomenology) to psychotherapy. This is the first time the word *psychotherapy* has appeared, and it is near the end of the article. One wonders, from the nature of his previous discussion, if psychotherapy rather than psychology is what Dr. Finch had in mind all the while. Perhaps what he is really suggesting might be more clearly stated as follows: "Psychotherapy needs to be viewed as an inevitable mixture of the aplication of the principles of scientific psychology *and* existential philosophy." This may be so, although we see no *a priori* reason why it *should be* so, since the interaction between a patient and his therapist is behavior and should therefore be amenable to scientific analysis, including an analysis of inferred mental states. We are at present nowhere near this goal. Current psychotherapeutic practice does include a considerable amount of non-scientific theorizing and philosophizing. The practice of medicine was also once in this state. The kind of impact scientific methodology has had in engineering and in medicine is what we look forward to in applied psychology as well.

Contemporary American psychology, even such complex fields as social psychology, clinical psychology, and personality theory, is becoming increasingly objective, precise, and experimental. The results of the researcher and theorizer are becoming directly applicable in the clinic and the classroom, and in countless other settings as well. Already behavioristic principles derived from thousands of hours of laboratory study are being fruitfully applied to psychotherapeutic situations.[23,24] It is far too early to tell what future contributions will be in this area. As stimulus-response analysis becomes more refined and precise, it is conceivable that all psychotherapy *may* eventually be a special case of "behavioral engineering."

The implications of this view of psychology for the Christian cannot be explicated in detail here.[25] However, the authors are of the opinion that there is no intrinsic incompatability between behavioristic psychology and Christianity when both are understood in proper perspective. Fuller discussion of this subject will be taken up in future articles.

CONCLUSION

The "new approach" for which Dr. Finch argues is not a new approach at all. It is rather an old approach that was historically found to be fruitless when psychology was considered the province of philosophy. It was the adoption of the scientific method in psychology some 80 or 90 years ago which resulted in the founding and growth of the field, so that today psychology is prepared to take its place among the other natural sciences. The scientific method, far from being a "procrustean bed," has been the tool which produced the modern science of psychology. Science is essentially a *method* of obtaining and verifying information; psychology as a science must be the application of this *method* to the behavior of living organisms.

By contrast, in proposals to adopt a transcendental understanding of man and the universe, no tools or methods are supplied the reader to use in searching out these new frontiers. No objective criteria for authenticity of statements are supplied. If one wants to say that there are other types of epistemologies or other sources of knowledge, then at this point we begin to discuss philosophy or theology, not psychology. Contemporary psychology is committed to the methods of natural science. Philosophy is not. Most psychologists would prefer that there be no confusion about this point.

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6. Edwin G. Boring, "Psychology," in *What is Science?*, James R. Newman (ed.), Simon & Schuster, Inc., 1955, pp. 291-314. Brief summary of psychological history, showing philosophical trends.
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23. Joseph Wolpe, *Psychotherapy by Reciprocal Inhibition*, Stanford University Press, 1958.
24. H. J. Eyseck (ed.), *Behaviour Therapy and the Neuroses*, Pergamon Press, 1960.
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BOOK REVIEWS

CHRISTIANS IN A TECHNOLOGICAL ERA

by Hugh C. White, Jr., Editor

Seabury Press, New York, 1964, 143 pp. $3.50

The discussions which have been brought together in this volume by Hugh C. White, Jr., express unanimously the concern that the church avoid the tragedy of the apparent irrelevance of Christianity by a positive engagement in real and vigorous dialogue with a generation committed to a "technological mentality."

The editor makes the point that after the debates at the beginning of the century on science and religion, evolution and Biblical authority, and inspiration, the church has been "disengaged from the mainstream of American thought and "occupied with private life, commonly referred to as pastoral care." Margaret Mead suggests that those committed to religious vocations are oblivious to the past two hundred years of history. Paradise finds no example in America of a "first rate theological mind" dedicated to the meaning of technology or "of one theological book of any weight trying to interpret it." Obviously since the essays are by Europeans, the inferencc is that something is being done about it, but not by Americans.

According to Polanyi, Greek philosophical speculation brought about an erosion of traditional beliefs and an extension of the I-it relation of impersonal and objective thought. Analogously the patterns of impersonalism have developed in our time. The Christian message explodes on the scene to restore the I-Thou relationship. Modern science and scientific philosophy cannot analyse the human person without reducing it to a machine. Religion suggests a more comprehensive approach. Comprehensive knowledge requires the awareness of a number of clues which cannot be exhaustively identifed. Beyond the particularities man has the capacity to anticipate the "hidden meaning of things." There is no other way of approaching a hidden meaning than by entrusting ourselves to our intimations "of its yet unseen presence." (p. 38). The act of scientific discovery for Polanyi "offers a paradigm of the pursuit of a hidden meaning guided by an intensely personal foreknowledge of this hidden reality." (p. 44)

For Ladriére the "technician mentality" is a vast enterprise embarked upon a stream. The participants are filled with anxiety concerning the outcome. Does the stream lead to a waterfall of destruction or out into a spacious and beautiful lake? Ladriére finds a "logos" at work in this progression of reason and technology in the world. This "logos" exhausts its meaning in the very expression of itself. Man needs to be delivered by the Christian faith from this nonsense of the technological "logos." Man needs to find his effort linked to the life of the totality, "which is quite simply the very life of God."

These echoes from the European scene may well stimulate American Christians to examine the question of the real relevance of Christian theology to the world of the technician. Our popular religiosity may be covering an essentially schizoid pattern of assumptions. Hopefully, American Christians will listen to science as well as pronounce upon it and technology will give us effective ways to implement our spiritual obligation to proclaim the good news with unction.

Reviewed by James Forrester, President, Gordon College and Gordon Divinity School, Wenham, Mass.

EVOLUTION AFTER DARWIN, VOL. 3, ISSUES IN EVOLUTION

ed. by Sol Tax and Charles Callender, Chicago, Univ. Chicago Press, 1960.

This book of 310 pages continues the theme of the first two volumes published by the same press. One article is called "Creation and Evolution in the Far East" by Ilza Veith. Another is "Current Roman Catholic Thought on Evolution" by J. Franklin Ewing, S. J. There are a few more articles in the volume but the largest part consists of panel discussions on the origin of life, the evolution of life, man as an organism, the evolution of mind, and lastly, social and cultural evolution. Famous names are on these panels, such as Edgar Anderson, Julian Huxley, G. L. Stebbins, Leslie White, Marston Bates, Ralph Gerard, Sir Charles Darwin, Th. Dobzhansky and many others.

A few thoughts from this volume picked at random will provide some idea of the coverage. Julian Huxley makes his usual dogmatic statements about evolution being an incontrovertible fact. He speaks of its being an irreversible process in time in which living forms became more and more complex and then he cites proof of this from the increase in melanism of British moths. This, I submit, is no proof of evolution in the way he first describes it. Stebbins challenged Huxley by showing that reversible evolution has probably occurred. An area always of great interest is that of sex. The classical idea is that the simplest organisms had no sex and that sex, like most other phenomena, has evolved. Stebbins believes that genetic recombination (parasexual recombination) is found in the simplest organisms (such as bacteria) and thus sex of this type was always present. Pelikan brings in Luther's belief that while God did not create anything on the seventh day and that He is said to have "rested", yet He did not cease to preserve and govern the universe on that particular day. Some would say, therefore, that God was really an administrator or executive on the seventh day and that logically, He did not really rest. I leave this conundrum for the experts on religion to mull over.

Irving W. Knobloch

RELIGION AND BIRTH CONTROL

by John Clover Monsma
Doubleday 1963 $3.95

For those who are wrestling with the ethics of birth control in their own family and for those who are concerned about the Christian solution to the threatening population explosion, this book written mostly by a group of protestant physicians will present some sane and realistic viewpoints.

Since the fuller meaning of birth control includes not only "conception" control but also all aspects of obstetrical care and control during pregnancy, as well as abortion, sterilization, artificial insemination and natural childbirth, these five categories are discussed in this book.

It was stated that some people feel that these matters are too private to speak about and many others do not know what their church's stand is in these matters and even the physician who is asked to advise and act on these issues is confused by the uncertain attitude of the public. Matters are confused still more by the militant stand of the Roman church which, generally speaking, is against any form of control or manipulation and finally the lack of uniformity of state laws does not help matters.

But it is important that the Christian physician be clear in his own mind as to his personal attitude toward every aspect of birth control so that he can advise, taking into consideration the patient's religious, socio-economic and medical background in such a fashion that guilt feelings may be prevented.

There was a considerable amount of agreement by the protestant physicians (about 19) as they spoke generally or discussed their assigned topics; each took one of the five categories of birth control. Only one Roman Catholic physician presented the conservative view of his church on "conception" control while the one Jewish physician presented the reformed view which was perhaps the most liberal view presented. The reviewer sensed a lack of concern for any Scriptural authority in this liberal viewpoint. It might have been more fair to the Catholic and Jewish (especially Orothodox) viewpoint to have another physician from each faith present his views; however, several protestant physicians reviewed the Roman Catholic view.

The general points of at least partial agreement among the protestant physicians could be stated as follows: Contraception control is not contrary to the "Natural law"; abortion (therapeutic) is justified only if the mother's life is threatened; sterilization (generally of the woman) may be justified for a number of reasons if it will contribute to the health and happiness of the family; artificial insemination of semen from the husband may be acceptable but there is a serious question about semen from other, even unidentified, males. A section on natural childbirth presented divergent viewpoints.

This short and cryptic summary may anger you enough so that you will read this book to fill in the exceptions and additions which were discussed. The Scriptures and scriptural principles played an important role in the thinking of these physicians. It was pointed out that each case must be judged by the physician separately because of the many variables.

For those interested in this subject as it relates to the population explosion I would refer them to the annual convention of the ASA, 1961, which was devoted mostly to this subject and published in *JASA* 14(1), 1962 (March).

This is not the first book edited or written by John Clover Monsma. One of several, written in similar style, entitled *Evidences of God in an Expanding Universe* (published in 1958, Putnam, summarized in *JASA*, 11 (3), 1959) utilized 40 writers including several ASA members.

Read this book and pass it on to your church library or to some young couple who are concerned. We will hear more of this matter in the near future. Since writing this review the American Medical Association has moved from a studiously neutral position on birth control to the view that "the prescription of child-spacing measures should be made available to all who require them, consistent with their creed and mores".

Marlin B. Kreider, Book Review Editor.

NOTE

PHILADELPHIA—BIOLOGICAL SCIENCES INFORMATION SERVICES (BIOSIS) of Biological Abstracts is the name adopted by Biological Abstracts, Inc. (BA), Philadelphia, to better define the present and future scope of its services to the worlds' biological community, it was announced by the Board of Trustees. Organization of BIOSIS will result in expansion of services currently available from BA.

This modification, which is effective immediately, reflects more accurately the diversified, comprehensive nature of BA's existing programs and future plans to offer more complete information services to biological scientists. Under the new program, *Biological Abstracts*, the world's largest life science abstracting and indexing journal, continues as the major publication of BIOSIS.

In addition to publication of *BA*, with its comprehensive coverage of all subject areas of biology, BIOSIS will concentrate on development of diversified techniques and methods to accommodate both general and specialized requirements of biologists for rapid, efficient communications of the world's biological research.

LETTERS TO THE EDITOR

THE GENESIS FLOOD

I take it from the introductory statement in the March issue of the Journal that additional comments on THE GENESIS FLOOD are expected. The Editor of the Publishing Co. that put out the book sent me a presentation copy when it came off the press, and I read it with mixed feelings.

I recognized it as a reissue of G. M. Price's views, brought up to date, and knew it would be a subject of controversy. At the same time I realized here were two born again believers in the inspired Word of God, (one a scientist) anxious to strengthen the faith of others, by demonstrating how the Bible and Science can be reconciled.

The two reviews in the March issue cover the scientific aspects of the book, and nothing more need be said on this phase of the subject. However, it may help clarify the issue in the minds of many to consider factors not touched upon by them. It should be pointed out that our God has given us three separate and distinct revelations of Himself, all equally inspired. First in order was His *World Book,* "creation" (Ps. 19:1-6), which is that referred to in Rom. 1:19,20. This revelation reveals His *glory*. The second revelation, His *Word Book,* the Scriptures, reveals His *wisdom* (Ps. 19:7-14), how He can be just, yet the justifier of them that believe. The third revelation is His *Living Word,* the Lord Jesus Christ. This revelation reveals His *love*. A trinity God can only be revealed by a trinity view. All three are from a different view point, like a mechanical drawing, or an architect's building plans. The analogy is complete, the front elevation reveals the glory of the architect; the plan view, his wisdom in designing; and the side elevation the depth required to embrace the plan. Notice also the prime movers in the revelations, God the Father in Creation; God the Holy Spirit in the Word Book, and God the Son in the Living Word.

It is apparent the authors are among those who believe the seven days of creation are literal 24 hour days. Here is where they get off the track. The Hebrew word "yom" is used throughout the Old Testament in three ways, 1) a 24 hour period; 2) for the daytime only, as opposed to the night; 3) as an indefinite period of time, just as we do today (e.g., "They did not have automobiles in George Washington's day"). Yom is used in this sense hundreds of times in the Old Testament (about 75 times in Isaiah alone). It is so used in Gen. 1, as easily can be demonstrated.

Gen. 1:1 is included in the first day's work. The word heavens is in the plural in the Hebrew, hence includes the creation of the universe, the millions of galaxies, the sun, moon, stars, and on down to the earth. At some stage in the earth's development, the mountains were formed (Ps. 90:2). They were in existence at the time of the flood, but not when the earth was first formed. Diastrophisms of many sorts must have been common in the early days of creation, and many floods, even greater than Noah's must have occurred. This is the theory advocated by Cuvier, but denied by Lyell, the father of uniformatarianism. The authors of The Genesis Flood refuse to accept either. I feel they are correct in rejecting Lyell views, but their principal objection to Cuvier's view is the time scale, not realizing that Gen. 1:1 provides eons of time for thousands of cataclysmic actions to take place, the last (and only large one since the creation of man) being the Genesis flood. For any who might not appreciate this truth, yet are open minded, I would suggest examination of Carl O. Dunbar's book, HISTORICAL GEOLOGY (especially the hundreds of photographs). Seeing is believing.

The rain was a minor contribution to the flood, according to the record; some great upheaval in the seas must have been the primary cause; a temporary rise of a few hundred feet in the ocean floor at some place would have caused it.

Then again another factor must be considered. The Hebrew word "bara" (create) never means *making something out of nothing*. It means "to make something that did not previously exist." For proof of this read Psalm 102:18, and its fulfillment in 2 Cor. 51:7. The use of this word in Gen. 1:1 covers all life brought into existence under the three commands, "Let the earth (or waters) bring forth." Three different words are employed in the Hebrew for "bring forth", but in the commands are included "after their *kind*" (Hebrew, "min"). Much has been written defining "min" but I have never noticed any reference to the gestation period involved in fulfilling this command, which in no case could be covered in one day, but the commands involved "bring forth *abundantly*", hence a long time must be allowed to meet these commands. Incidentally, the gestation period is almost universally a multiple of seven days, e.g., chicken 21 days, man 280 days.

A third factor is also involved in the Genesis record, the fragmentary nature of the entire book of Genesis. It was not written by Moses, as its author, but merely compiled by him, from records (diaries, genealogies, etc.) written by men from the very beginning, preserved on clay tablets, handed down from generation to generation, and finally taken to Egypt by Jacob, ultimately coming into the hands of Moses, who collated them into the divine record, without altering the wording. The entire story of the flood was written by someone *in* the ark (probably Shem), and it must be read in that light. This affects the question of the universality of the flood, which actually is unimportant, except to the extent that God's purpose of bringing it about was fulfilled. That animal life had to die wherever the flood extended, is

obvious, but this also was incidental. Life in the seas was not affected, or vegetable life on the land. Only taking all these factors into account can solve some of the problems involved in the Genesis flood.

The idea that the Bible and Science cannot be reconciled results when the theologian studies only the Scriptures, while the scientist obtains all his knowledge for searching the physical realm, the *World Book*. Failure to integrate all three revelations always results in divided opinions. Coordinating all three, results in complete harmony.

Roy M. Allen, Sc.D.
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Verona, New Jersey

ASA AND THEISTIC EVOLUTION

January 12, 1965

Dear Editor,

At first I decided not to pursue the questions which I raised in my letter printed in the Sept. '64 edition; but on further contemplation I have concluded that this question gets at the heart of the present issue within A.S.A. over Theistic Evolution, so please permit me to mention what appear to me to be serious weaknesses in Mr. Hearn's reply:

1. Mr. Hearn admits that the New Testament authors believed in a literal Genesis 1 and 2 and that this literal view is presented in the New Testament. If the authors believed in a literal view, but their view did not come out in the inspired record, there would be no problem concerning inerrancy; but the author's mistaken view does find its way into the inerrant record. What does inerrancy mean if it does not mean no errors when properly interpreted and with sound principles of interpretation found in many fine textbooks on the subject. It appears to me that Mr. Hearn is saying that Paul wrote an error in the Bible, but the Bible is inerrant. I might add that one good principle of Hermeneutics is that the Scriptures help interpret the Scriptures. It appears that Mr. Hearn feels that Scripture confuses the Scriptures.

2. Mr. Hearn's example in Matt. 6:26 misses the point. Neither the author nor the hearers thought God literally put seeds in the birds' mouths. This was obvious to all (symbolical or figurative language). This is one characteristic of symbolical language, that is, that it normally is obviously so and its purpose is to reveal truth, not conceal it.

3. Mr. Hearn did not tell what the geneological lists from Genesis 1 to 11 symbolized. There is certainly no indication in the text that it is symbolical. Here it is inconceivable that all those names could only have symbolical meanings, and what do the various ages symbolize?

4. It is inconceivable to me that any sound hermeneutical approach would result in taking say Genesis 11:24 and say, "And Nahor lived nine and twenty years, and begat Terah, . . . Nahor being symbolical but Terah being literal." Yet this is what Mr. Hearn must do somewhere along the geneological line.

5. If we can arbitrarily divide a verse and call half literal and half figurative with no internal indication that half is figurative, can we not do this anywhere in the Bible just as we please? And if so does the Bible really have any authority?

Sincerely,
Frank Cole

FROM THE CONTRIBUTING EDITORS

BIOLOGY

Time Magazine (February 12, 1965) brought some welcome news to biologists in an article entitled "Final Defeat for Comrade Lysenko." It will be recalled that Lysenko dominated Soviet genetics for many years and taught that Lamarckism was preferable to Mendelism. The former idea places emphasis in genetics on the effects of the environment on organisms and the inheritance of the induced environmental effects whereas the latter utilizes the gene theory. At any rate, Lysenko has been relieved of his post as Director of the Institute of Genetics of the Soviet Academy of Science. Under his rule, Lamarck's theories with modifications became official state doctrine and genetics in Russia languished. The lesson here is that it is very unwise for governments to espouse scientific theories and force adherance to them. It is equally unwise for religious bodies to champion scientific theories.

IS CIGARETTE SMOKING IMMORAL? Two students were engaged in a conversation on morality. One was a Christian and the other an atheist. The Christian remarked that—"it is obvious that sex, cigarette smoking, and non-church attendance are evidences of America's spiritual degeneration." The atheist replied that he couldn't see why cigarette smoking was more degrading than coffee drinking. Both practiced in excess are deleterious but why are they immoral? And why, he wanted to know, is a departure from current religious thinking immoral? Did not Calvin, Wesley, Luther and even Christ depart from current thinking? Do we consider them immoral today?

I might comment that students are clearer in their thinking than we give them credit for. We oldsters might learn a lesson here, provided, of course, that you agree with the argument.

MENTAL ALTERNATIVES

It is axiomatic that our childhood training determines to a large extent the way we think in later life. In the constant-conflict area of science and religion, we tend to stick to our earlier notions without always considering alternatives to our ideas. It is essential for the well-being of the ASA that we keep the doors of communication open and that we do not, as members, adopt untenable positions from which we cannot retreat, at least not without "loss of face." For this reason, I am presenting below a short list of alternatives in some of the conflict areas, alternatives which should, it seems to me, always be foremost in our minds.

1. It is possible to believe that the plan of salvation as given in the King James or any other version is true without believing that any of the versions is an exact copy of the original manuscripts.

2. It is possible to believe both in the facts in the versions and the facts of science without believing in either religious or scientific interpretations of the facts.

3. It is possible to believe that plants and animals including man have changed during the course of time without believing in the development of all life from primeval matter.

4. It is possible to believe in the creation of certain forms of life as recorded in the Bible without believing that God created as many species as exist today.

5. It is possible, if one so desires, to be a Christian who believes in sin and salvation and, at the same time, believes that Evolution was God's method of operation.

6. It is possible to believe both in salvation and evolution without being an atheist.

7. It is possible to believe in a local Noachian flood without contradicting the Bible.

8. It is possible to believe in a universal flood without making it account for all of the known facts of stratigraphy.

9. It is possible to be an open-minded, tolerant Christian without denying the main facts as they are presented in the Bible.

—Irving W. Knobloch

A.S.A. CONVENTION

The Annual Convention of the American Scientific Affiliation is to be held August 23-27, 1965 at The King's College, Briarcliff Manor, New York. This meeting will be held jointly with Inter-Varsity Christian Fellowsihp. The first three days will be the A.S.A. part and the last two days for I.V.C.F.

ABSTRACT

PATTERN OF GROWTH OF OUR CONTINENT—DISTRIBUTION OF THE OLDEST ROCK

Isotopic age studies indicate that the age of the earth is about 4.6 b.y., (billion years) the age of the oldest known rock about 3.5 b.y., and the age of terrestrial life greater than 2.6 b.y. Field work and isotopic ages are being used to delineate the major provinces in the igneous and metamorphic rocks which constitute the continental basement. In North America, areas of basement rock of uniform age of metamorphism totalling thousands of square miles are bounded by large areas of different metamorphic age. Similar ages of basement rocks of other continents suggest that periods of mountain building and metamorphism may be intermittent and world-wide.

The provincial boundaries are actually transition zones (some only a few miles wide) consisting mainly of partially re-metamorphosed older rocks. The migration of isotopes during later metamorphism disturbs the material balance upon which the isotopic age calculations are based. In many cases, recrystallized minerals give isotopic ages corresponding to the latest metamorphism, whereas "whole rocks" have remained closed chemical systems permitting the determination of the age of original formation. Several transition zones are described in detail.

•Paper presented by *Leon E. Long* at the annual convention of the A.S.A. in August, 1964, at John Brown University and published in full in *The Science Teacher*, vol. 31, p. 13-16 (1964). Leon E. Long is Assistant Professor of Geology at the University of Texas, Austin, Texas.

"WORTH QUOTING"

When God made the earth, He could have finished it. But He didn't. He left it as a raw material—to tease us, to tantalize us, to set us up thinking and experimenting and risking and adventuring. And therein we find our supreme interest in living.

. . . He gave us the challenge of raw materials, not the satisfaction of perfect, finished things.

He left the music un-sung and the dramas un-played.

He left the poetry undreamed, in order that men and women might not become bored, but engaged in stimulating, exciting, creative activities that keep them thinking, working, experimenting, and experiencing all the joys and durable satisfactions of achievements.

Dr. Allan A. Stockdale, "God Left the Challenge in the Earth" in *The Electric Times*. Reprinted from *His* Dec. 1964, by permission.

NOTE:
Next issue: *HOMO HABILIS: Implications for the Creationist* by James O. Buswell III.

THE AMERICAN SCIENTIFIC AFFILIATION was organized in 1941 to investigate the philosophy of findings of science as they are related to Christianity and the Bible and to disseminate the results of such studies.

FELLOWS have a doctoral degree or its equivalent in experience in a biological, physical, or social science and have been elected from among the members.

MEMBERS have at least a baccalaureate degree in science and are currently active in some field of science (broadly defined to include mathematics, philosophy of science, history, engineering, and medicine). Others with an interest in the objectives of the ASA may become ASSOCIATES.

THE FOLLOWING STATEMENT OF FAITH is accepted by members: The Holy Scriptures are the inspired Word of God, the only unerring guide of faith and conduct. Jesus Christ is the Son of God and through His atonement is the one and only Mediator between God and man.

PUBLICATIONS include the *ASA News* (sent to members four to six times each year) and two symposia: *Modern Science and Christian Faith,* 1950, edited by F. Alton Everest; and *Evolution and Christian Thought Today,* 1960, edited by Russell L. Mixter.

SECTIONS have been organized to hold meetings and provide an interchange of ideas at the regional level. Information may be obtained from the persons listed below or from the national office.

CHICAGO — James Kennedy, North Park College, Chicago 25, Ill.

INDIANA — Donald Porter, Taylor University, Upland, Ind.

NEW ENGLAND — J. M. Osepchuk, Deacon Haynes Road, Concord, Mass.

NEW YORK CITY AREA — Wayne Frair, The King's College, Braircliff Manor, New York

NORTH CENTRAL — Robert Bohon, 1352 Margaret, St. Paul 6, Minn.

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