JOURNAL OF THE
AMERICAN
SCIENTIFIC
AFFILIATION

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

VOLUME 17 NUMBER 3 SEPTEMBER 1965

The Journal of the American Scientific Affiliation

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The *Journal of the American Scientific Affiliation* is indexed in the CHRISTIAN PERIODICAL INDEX.

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

SEPTEMBER, 1965 PRINTED IN THE UNITED STATES OF AMERICA VOLUME 17, NUMBER 3

ABRAHAM AND THE STARS

ALLAN A. MacRAE*

Since God, who inspired the writers of the Bible, is also the Creator of nature, it is to be expected that the Bible and nature will fit together.

This, of course, does not mean that we can construct a complete science of physics, chemistry, botany, astronomy, or even history, from the study of the Bible. This was not its purpose. The Bible was written to tell us what we need to know about God, about man's sin, about the possibility of reconciliation to God, and about God's plan for man. These are great and vital subjects, and it is difficult to get a true understanding of them into the heart of sinful man. To do so is the purpose of the Bible.

Nevertheless, if the Bible is to fulfill this purpose, it could hardly be expected that its Divine Author would allow it to be in error with regard to other subjects. Even though the full explanation of such matters is no part of its purpose, its incidental references to them could hardly be erroneous. It is the claim of Jesus Christ and His apostles that God's word is entirely true.

This does not mean, of course, that the Bible will use the scientific terminology that is in vogue today. Such terminology changes from time to time. What the word "science" generally meant a century ago, the word "philosophy" means today. What the word "philosophy" generally meant a century ago, the word "science" means today. English words are constantly changing their meanings. Scientific terms are often redefined in order to fit with advancing knowledge and with newly suggested theories. Thus, under the modern scientific system of classification, the word "fish' is used to denote an animal that has certain specific structures. In ancient times the word was used to designate any animal that habitually lives in the water. Modern science has a perfect right so to define the words that it uses as to fit its attempted classification and interpretation, but we are wrong if we insist upon attempting to interpret the Bible as if its words were written with today's usages in mind. We must take words and phrases in the meanings that they possessed at the time when they were written.

A similar situation exists in connection with the use of the word "day." Nowadays it is quite customary, for the figuring of interest, or the arranging of railroad or airplane time-tables, to think of a day as indicating a period of 24 hours. Yet it is comparatively seldom that any of us use the term "day" in common speech in this particular sense. No one, meeting a friend in the late evening, would say, "Isn't this a nice day?" He would be more apt to say, "We had a very pleasant day and the evening is nice too!" In common use a day ordinarily means a period of light between two periods of darkness or a period of activity whether short or long. A radio speaker began a statement with the words: "Al Smith used to say, in his day, that . . ." Here it is clear that the word "day" did not indicate any particular period of 24 hours, but rather a period of activity which ran for several years. Similarly in John 8:56, Jesus said, "Abraham saw my day and was glad." He did not here refer to a period of 24 hours, but to the time of His activity on earth.

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There is also the matter of phenomenal language. We do not believe that the sun goes down and up but that the earth turns; yet no one has any difficulty in understanding what we mean when we speak of sunset and sunrise.

Through the ages it has been the belief of the Christian church that the statements of the Bible, if correctly and carefully interpreted, will not contradict any aspect of God's creation or of God's universe. Sometimes the incompleteness of our knowledge of some phase of science or history may cause us to think that a statement in the Bible is wrong. A little later, when our knowledge has moved forward, we are enabled to see clearly that the Biblical statement revealed a knowledge on the part of the Divine Author beyond what was known to man. The Bible is never out of date, but it is often ahead of date.

This is well illustrated in the divine promise to Abraham regarding the stars.

Today most people know very little about the stars. A century ago the appearance of a comet in the sky would be immediately noticed and would produce wide-spread discussion. If a comet should now appear, most people would know nothing about it, except what they read in the newspapers, or hear on the radio.

The reason for this, of course, is the tremendous increase in the lighting of our streets. During the last fifty years artificial light has become so strong and so extensive in most of our populated areas that very few people ever get more than a tiny glimpse of the stars. It is an entirely different situation from that of a century ago, when everybody saw a great deal of the stars and most people came to know the major constellations almost as if they were friends.

We can be sure that Abraham had this sort of knowledge. There was hardly any artificial lighting in the areas where he spent most of his time. He was often outdoors when the heavens were covered with brilliant stars and must have known a good deal about them. In addition Abraham had come from Ur of the Chaldees and had spent a large part of his life in Haran. Both of these were towns that were dedicated to worship of the moon god. Babylonian astronomy and astrology were widely cultivated. Even though one held an entirely different religion, he could hardly spend years in a Babylonian environment without knowing a good deal about the stars, to say nothing of the many observations that he would naturally make during long evenings in the out-of doors, undisturbed by the artificial light that now keeps most of us from paying much attention to them. In view of all this, it must have been a very great surprise to Abraham when God gave him the particular promise recorded in Genesis 15:5.

In Genesis 12:3 God had already promised Abraham that He would make him a great nation. Having lived in the great nation of Mesopotamia, Abraham would hardly think of a group of a few thousand people as being a great nation. He must certainly have thought that this promise meant much more than that. Yet in Genesis 15, when Abraham was enduring depression and discouragement, the Lord directed him to look at the stars, saying: "Look now toward heaven, and tell (count) the stars, if thou be able to number them." And he said unto him, "So shall thy seed be" (Genesis 15:5).

This must have impressed Abraham as a very strange promise. He could hardly have been ignorant of the fact that all the stars that can be seen with the naked eye from any place in the Near East would total well under 4,000 (and no one in that day would have any reason to think that stars existed that could not be seen with the naked eye). Four thousand might appear like a large number of dots, but it would hardly represent "a great nation."

Abraham may have thought: "Look at the wonderful beauty of the stars. God has promised that I am going to have descendants who will shine like the stars, and will be indeed a heavenly progeny." Yet as he thought it over, he would know that this was a mere rationalization. After all, God had said: "Look toward heaven and count the stars, if thou be able to number them; . . . so shall thy seed be." It was not a difficult task to number the stars that could be seen with the naked eye. More than three thousand years were yet to pass before the telescope would be invented and it would be possible to learn that there are far more stars than the naked eye can see.

In Genesis 17:5 God promised Abraham that he would become "a father of many nations." This must indeed have seemed incongruous to Abraham, after the comparison of his descendants to the number of the stars. Four thousand descendants would not be enough for one great nation, and certainly not enough for many nations.

In chapter 22 God repeated His promise to Abraham, saying, in verse 17: "I will multiply thy seed as the stars of the heaven, and as the sand which is upon the seashore. "Now", Abraham may have said, "here is a real promise! Who can count the sand that is on the seashore? If my descendants are to be as numerous as the sand on the seashore, I shall indeed have a tremendous progeny."

More than three thousand years passed, and then the telescope was invented. Soon men were able to observe great numbers of previously unknown stars. According to the latest estimates, there are about two hundred billion stars in our galaxy alone. Within the present century it has been found that our galaxy is only one of millions of galaxies, each of which also contains great numbers of stars. It is now believed that there are far more stars in the heavens than there are grains of sand upon all the seashores of this earth put together!

At this point a question may reasonably be asked. Are we assuming certain things about Abraham's knowledge

for which we have no proof? Can we be sure that Abraham knew so much about Babylonian astronomy? Can we be sure that Babylonians had counted the stars as early as the time of Abraham? Is it not possible that Abraham actually knew very little about the stars and that from merely glancing at them he received the impression of a tremendous number and therefore considered it a marvelous promise that his descendants would be as numerous as the stars? In answer let us assume that either or both of these objections should be correct. What would it do to the argument that we have advanced?

Actually, it would only make the argument stronger. On the assumption that God gave Abraham a promise that would appear very wonderful to Abraham but which actually would not amount to much, we have a situation in which people a thousand years later might easily have been inclined toward skepticism regarding the whole truth of the Bible.

By the time of the great astronomical researches of Ptolemy it would have been apparent to any careful investigator that the total number of stars visible from any point on this earth would hardly pass beyond four thousand. At the time of Christ any skeptic could easily have declared that, while the statement in Genesis might have been quite natural in a time of ignorance, knowledge had now advanced to the point where any intelligent person could easily see the absurdity of the use in Genesis 15 and 22 of the number of the stars as indicative of a great number of descendants. After all, four thousand is hardly sufficient to describe a great nation, to say nothing of a whole group of nations.

This attitude toward Genesis could easily have been maintained by educated people for at least another thousand years. No one would have any reason to think that there were other stars which were not visible. To make such an assumption, without proof, would be utterly unscientific. Only after the telescope was invented were we able to see that the Bible was right all along.

God who is the Creator of nature is also the Author of the Bible. He knows many facts that science never deamed of in Abraham's day. He knows many facts that science has not yet discovered. If, as was formerly true in this case, a clear statement in the Bible disagrees with a present observation or theory of science, let's just wait until science discovers more facts. Genesis 15:5 is very appropriately followed by the words: "And he believed in the Lord; and He counted it to him for righteousness."

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Note: to be published in *Bulletin of Evangelical Theological Society*. Paper presented at meeting of Evangelical Theological Society, Nyack, New York, December 1964.

ABSTRACT

CROSS, CONSTELLATION, AND CRUCIBLE: LUTHERAN ASTROLOGY AND ALCHEMY IN THE AGE OF THE REFORMATION.

John Warwick Montgomery, Professor and Chairman, Division of Church History and History of Christian Thought, Trinity Evangelical Divinity School, Deerfield, Illinois. *Paper presented at the 19th annual convention of the American Scientific Affiliation, John Brown University, Siloam Springs, Arkansas, August 1964.*

The allegation has frequently been made, from Erasmus to Troeltsch, that Luther and his followers were indifferent to or openly hostile toward scientific development, and that if any contribution was made by the Reformation to the rise of modern science, its source lay in Geneva rather than in Wittenberg. However, this judgment cannot be sustained if one studies in depth the astrological and alchemical work of the German Lutherans in the 16th and 17th centuries: astronomers such as Brahe and Kepler, and hermetics such as Libavius and J. V. Andreae. Here Lutheranism, owing to its cardinal doctrines of Justification and Omnipresence, developed a philosophy of science which infused the physical universe with meaning, and joined in the closest possible manner the external world of nature and the inner world of psychology. Though the great historians of science such as Thorndike have been unaware of it, adherents of the Augsburg Confession, by their theological insights, transformed both the astrology and the alchemy of the Middle Ages by dynamizing the former and existentializing the latter. In point of fact, Lutheran theological Orthodoxy made a powerful contribution to the scientific advance, and this contribution lay not merely in the static relation of astrology to astronomy and alchemy to chemistry, nor exclusively in the archetypical symbolization process described by Jung and Eliade, but in a grounding of both macrocosmic physical nature and microcosmic human nature in ultimate and beneficent meaningfulness.

This paper available from:

1. *Transactions of the Royal Society of Canada*, 4th Series, Vol. I (1963), 251-270.
2. *Ambix, the Journal of the Society for the Study of Alchemy and Early Chemistry* (England), Vol. XI, No. 2 (June, 1963), 65-86.
3. *Revue d'histoire et de Philosophie Religieuses* (Paris & Strasbourg): article forthcoming in French.

Thirty years ago there were serious discrepancies between Genesis and astronomy. Today there is striking agreement which has been brought about by development of the science. Further developments are crtain to com. They will, no doubt, show still more emphatically that the Genesis account is in accord with the universe which was and which is.

Peter W. Stoner, M.S.*

*Quoted by permission from "Modern Science and Christian Faith", Scripture Press, Wheaton, Illinois, edited by F. Alton Everest.

THE DEVELOPMENT OF CIVILIZATION IN ANCIENT MESOPOTAMIA

STANLEY D. WALTERS*

This paper traces the stages of cultural development in ancient Mesopotamia from prehistoric through to "civilization," sketching the characteristics of each phase. Comparison with the early chapters of Genesis shows that the earliest phase of human life represented in the Old Testament is "civilization." The problems raised for the conservative Christian are considered. Emphasis is placed on the area where the "food-producing revolution" occurred, its recency, *and producing revolution" occurred, its recency, and the importance of religion and other non-economic factors.*

INTRODUCTION

Ancient Mesopotamia has always exerted a peculiar fascination for the student of the Bible. The reason for this is that the earliest chapters of the Bible have explicit connections with that area. The Tigris and Euphrates Rivers are named in connection with the garden of Eden (Genesis 2:14); Mt. Ararat may be identified with ancient Urartu, in eastern Asia Minor; well-known Mesopotamian cities are mentioned (Babel, Erech, Nineveh, and others, Genesis 10: 10-12); the land of Shinar, where the tower of Babel was built, is probably the same as ancient Sumer; and, of course, Abraham was originally a citizen of the Sumerian city of Ur.[1]

People do not usually realize how long civilization has been flourishing in the world of the Bible. Talking recently with the family of a faculty colleague which was preparing for a year's residence in Syria, I said, "Well, a year from now you'll be speaking Arabic."

"I suppose so," the wife said, adding, "Tell me, has Arabic remained rather pure compared with that spoken by Abraham?"

I explained that, compared with Abraham, Arabic was a relatively recent linguistic development in the near east, with its flourishing period in the first millennium of our era. Abraham, on the other hand, is dated early in the second millennium BC, and probably spoke Akkadian, and perhaps a north Semitic dialect as well.

This all makes Abraham seem very old indeed: he lived two and a half millennia before the flowering age of Arabic literature. Since he appears so early in the Bible, we must surely be well back toward the beginning of things with him!

But when we get to the city of Ur, we find that in Abraham's day civilization had already been in existence for a long time. Writing, which originated in Sumer, had been in use fifteen-hundred years, and people had been living in well-organized communities for at least the same length of time. Law codes, some with striking similarities to Hebrew legislation, antedated Abraham by several centuries and Moses by a millennium.

Therefore, interest in the Bible and in the question of human origins seems to make a survey of life in ancient Mesopotamia relevant.

It is possible to distinguish three successive stages of human culture there, which may be denoted as food-gathering, food-producing, and civilization. The purpose of this paper is to present and characterize these three stages, and then discuss the relationship between them and the early chapters of the Old Testament.

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IMPORTANT SCHOLARS

The names of three scholars will come up often in the course of the paper, and it is well to identify them at the outset.

Probably the leading archaeologist specializing in prehistory is Robert Braidwood, Research Associate in Old World Prehistory at the University of Chicago. Braidwood has written and researched this area of interest more thoroughly than any other person, and maintains a continuing program of research and excavation in the middle east.

A second name is that of Henri Frankfort, for many years Research Professor of Oriental Archaeology at Chicago, and, at the time of his death in 1954, Professor of the History of Pre-classical Antiquity at the University of London. Finally, I should mention V. Gordon Childe, a classics scholar whom interest in human origins took to the near east, where he excavated at various sites for fifteen years. For many years he was Professor of Prehistoric Archaeology at Edinburgh University.

The geographical designation "Sumer" should also be explained. It denotes the southern portion of the Tigris-Euphrates valley, and the civilization which flourished there before about 2000 BC.

I. THE FOOD-GATHERING STAGE

Where Did Man Originate?

With the question of human origins as such, I shall deal only in passing. It is widely accepted today that *man* in a real, human sense, has been in existence at least since the Pleistocene glacial period, that is, something less than a million years. The upper limit is far from being fixed yet, especially since the discovery of *Zinjanthropus*, with an alleged potassium-argon date of closer to two million years. The lower level, however, is fixed rather well by finds of stone tools in datable geological sequences, which seem to be as old as 500,000 years. The oldest of these are the "pebble tools" of Africa, and it is there that most anthropologists today would tentatively locate the "cradle" of the human race.[1a]

As far as the near east is concerned, scattered Pleistocene finds show that, while man may not have *originated* there, he has probably *been* there for something like 500,000 years. In Palestine itself, for example, a number of skeletons were found in caves on Mt. Carmel, which are dated 75,000 or 100,000 years ago. In northern Iraq stone tools of the Acheulean assemblage have been found. By 10,000 years ago, there were "completely modern Mediterranean-like men who were reasonably successful hunters and food-collectors, but who still lived a savage's life in small mobile bands."[2]

What Was Stone Age Man Like?

Of greater interest to us is the question, What kind of people were these Stone Age or paleolithic persons? Are they in any way like the persons we meet in the early chapters of the Bible?

The answer to this question must be tentative, since it is based on *our interpretation of the known artifacts left by them.* That is, much that they left has not been found; much that they had has not survived, because made of perishable material; our interpretations may be wrong, and, because writing had not yet been invented, we have but small clue to their thoughts, ideals, and aspirations.

Hunter. The obvious deduction from the evidence of stone tools is that paleolithic man was a hunter. None of the bones found in connection with him are of domestic animals, so it is assumed that he hunted wild animals. That he roamed from place to place is assumed because of the absence of any permanent buildings at the open-air sites which have been discovered, and because he is known to have lived in caves. Stone sickles suggest the reaping of wild grains.

Language? A further interpretation is suggested by Braidwood, who has proposed three steps in the history of tool-making. First, *utilization,* in which man used anything that was handy to do the job. Second, *fashioning,* in which a tool was prepared for a specific job. Third, *standardization,* in which tools were made according to "certain set traditions." Now, the existence of various traditions of tool-making indicates to Braidwood that there was present "a notion of the ideal type of tool for a particular job." Both the concept of ideal types and the skill to make them must have been passed on from generation to generation.

Reasoning from this, Braidwood proposed that the notion of an ideal type is really a symbol, and that these early men may have had word-symbols—i.e., language—as well. He acknowledges the conjectural nature of his proposals, but they are indeed suggestive.[3]

Religious Beliefs. Was paleolithic man a religious person? It is thought that he was. This conclusion is drawn from the burial of the dead, and from the Stone Age paintings found in European caves. Frankfort says, "From paleolithic times onwards, man has been aware of being involved, not only with his kindred, but with superhuman powers." He adds that the cave paintings are not only "expressions of a coherent religious conception," but also show that "from the first, man possessed creative imagination."[4]

The same point has been made with wit and incisiveness by G. K. Chesterton, in a book which deserves to be better known among Protestants, *The Everlasting Man.* In a chapter titled "The Man in the Cave," he uses Stone Age cave art to scotch the idea that the cave man was a brute whose "chief occupation in life was knocking his wife about." "People have been interested in everything about the cave man," he says, "except what he did in the cave," and what he did there is one of the few things we really know about him.

"What was found in the cave was not the club, the horrible gory club notched with the number of women

it had knocked on the head." It was paintings of animals which were found there, expressions of "the experimental and adventurous spirit of the artist, the spirit that does not avoid but attempts difficult things." In short, the archaeologist had "dug very deep and found the place where a man had drawn the picture of a reindeer. But he would dig a good deal deeper before he found a place where a reindeer had drawn a picture of a man. That sounds like a truism," adds Chesterton, "but in this connection it is really a very tremendous truth."[5]

Summary

We may summarize by saying that the first great stage of human life, in Mesopotamia as elsewhere in the ancient world, seems to have been both precarious and primitive, but genuinely human. Stone Age persons were nomadic, drawing their livelihood from wild animals and grain, and lacking both metal and pottery. Nevertheless they possessed some manual skills, imagination, and religious belief. This stage of existence lasted for thousands of years, until a sudden and striking change occurred.

II. THE FOOD-PRODUCING STAGE

Whereas many anthropologists today regard Africa as the "cradle" of *human life,* it was in Mesopotamia that *civilization* first appeared. What is meant by "civilization" must be discussed later, but at present it will be enough to say that the precursor of civilization was a middle stage, a relatively sudden change in the whole way of life—from merely collecting food to settled village life and the domestication of grains and animals.

This change—sometimes called the food-producing revolution—has been most clearly delineated by Braidwood, to whose writings the following discussion is indebted.[6]

The earliest evidences for the change appear at the end of the last ice age, about 10,000 years ago, and consist of village sites scattered across what Braidwood calls "the hilly flanks of the fertile crescent." The important feature is that they are *villages* rather than temporary nomadic settlements.

Geographic Area

The "fertile crescent" is by now a rather well-known term to describe the geographic area arching from the head of the Persian Gulf northwest across upper Syria and the headwaters of the Euphrates, and down the Palestinian littoral to the Nile Valley.

It was not *in* this area that the food-producing revolution took place, but rather in the hilly fringe areas, especially on the north. Another way of putting it would be to say that many centuries before people settled in southern Mesopotamia—at the site of Abraham's Ur, for example—farm villages had been flourishing in the north.

This change-over sometimes is identified as the transition from the paleolithic age to the neolithic age, and is dated by Braidwood between 9000 and 7000 BC.

Advances in Knowledge

What did these villagers know that the ice age hunters did not? They had permanent homes, usually with mud walls; pottery had been invented, and a variety of pottery shapes and types developed; there were stone and flint tools, they had domesticated both grain and animals. At one important site, Jarmo, 95% of the animal bones belong to domestic species.[7] Braidwood says, "In no case is there any question but that we have to deal with a well-settled farming and animal-tending community."[8]

Moreover, there is evidence of extra-utilitarian interests. For example, there is decoration on the pottery; there are beads and other bits of jewelry; and there are figurines of animals and humans, probably connected with fertility rites of some kind. The presence of sea shells from the Persian Gulf suggests extensive trading relationships.

Surely the most important of these changes is agriculture. For grain production to be developed, an "extraordinary first step" must be taken, in which "the satisfaction of immediate needs is limited" in order to save seed, store it and later sow it again. In addition to this, knowledge of cross-breeding and selection was discovered, so that wild grasses were improved, and "vastly more nutritious grains" were produced.[9]

A Relatively Rapid Change.

To this brief description two comments may be appended. One has to do with the relative *suddenness* with which the change took place.

Human life had existed in the middle-east—although not in the area later known as Sumer—for perhaps half a million years. During these millennia, the conditions of which must necessarily be described as primitive, man's life seems to have undergone relatively little change.

This is so long a time that our imagination falters. One way of looking at it is to compare the whole length of man's existence to one 24-hour day. The present time is midnight, and Jesus was born five minutes and thirty-six seconds ago. Earliest history began less than fifteen minutes ago. Everything before 11:45 p.m. was in prehistoric time.[10]

Compared with this vast stretch, the changeover—even if it took two or three thousand years—is relatively rapid. Frankfort says that the "peculiar coherence" of the mature Mesopotamian civilization was "the outcome of a sudden and intense change, a crisis, in which its form—undeveloped but potentially a whole—crystallized out, or rather was born."[11]

A second remark concerns the *causes* of this revolutionary change. We do not know *why* or *how* it happened, and the best workers in the field acknowledge this. Of course, they feel that the retreat of the last

great glaciation had something to do with it, but on the whole the question of "why?" is recognized as a philosophical one, which the historian as such does not answer.

III. CIVILIZATION

It is with the third stage of human history in ancient Mesopotamia that "civilization" first appears. This is to say that Stone Age man—either paleolithic or neolithic—cannot really be called civilized. This in turn pre-supposes a definition of "civilization," to which we must now turn.

A Definition

When we say that man during the ice age was not "civilized," we do not mean that his behaviour, as Childe says, does not appeal to our own sense of propriety and good taste.[12] Civilization is not present, he believes, unless there are present at least three elements: writing, cities and wide political organization, and occupational specialization.[13]

The same matter has been dealt with even more carefully by Braidwood, in an important monograph published in 1952. We deal with civilization, he says, if we find a culture with a preponderance of eight elements. These are: fully efficient food production, cities, a formal political state, formal laws, formal projects and works, classes and hierarchies, writing, and monumentality in art.[14]

A Unique Development.

Now, there are many places where the transition from Stone Age culture to a society that may be called civilized has taken place. Examples of *early* transitions are Egypt, the Indus Valley in India, and a little later, China, and the New World. There are even societies which are today making this transition.

But the transition in ancient Mesopotamia is of unique interest, because it was the first time in human history that it had ever happened. The developments in the Nile and Indus Valleys were probably influenced by the achievement in Sumer, but who influenced the Sumerians? Apparently no one: the efflorescence of civilization was spontaneous.

Shortly after 4000 BC, settlements first appear in southern Mesopotamia, the general area of Abraham's Ur. These villages differ from the northern farm villages by their size, by large buildings identified as temples, and by metal tools. This period is called the Proto-Literate by archaeologists, because writing appears in rudimentary forms.

An Illustration

A site which is representative of the Proto-Literate period is Uruk, the Erech mentioned in Genesis, where most of the important elements in "civilization" appear.

1. Efficient food production. Settlement in the south is possible only by virtue of irrigation. This is true today, and reputable scholars believe it was true in the Proto-Literate period as well.

Irrigation is a complex arrangement, both socially and technically. A division of labor must be effected, in which some people maintain the irrigation system, while others raise grain. It is expected that the farmer will share his crops with the irrigation worker. Still others work at craft specialities, making tools and pottery. Regulations governing these various responsibilities must be effected, and sanctions imposed. Probably some kind of enforcement agency is necessary.

This seems simple enough to us, but it presupposes a trust and solidarity among large groups of people which neither of the two earlier stages reveal and it involves both craft specialization and political organization—both important elements in civilization.

2. Monumental architecture. There is at Uruk a monumental temple, erected on a succession of large platforms. The excavator estimated that it took 1500 men, working a ten-hour day, five years to build the temple.[15]

Interestingly enough, according to Childe, the oldest building yet found in the south is a shrine, located at the city of Eridu. This suggests that the social solidarity necessary for successful irrigation was religious in nature, "a feeling of dependence on a . . . personal deity."[16]

3. Writing. Clay tablets with simple pictographs appear. While they are not literary texts, they do represent the invention of writing, and at a date considerably earlier than the oldest Egyptian hieroglyphs. These earliest tablets are thought to have been devices for keeping accounts in connection with the temple, which was the largest economic unit in the city. They are written in Sumerian, which is the oldest known written language.

4. Political organization. In the absence of literary texts from this period, it is not possible to be certain about the type. But Thorkild Jacobsen, long of Chicago and now of Harvard, has advanced the thesis that the city-states of early southern Mesopotamia were regulated by what he calls "primitive democracy." Ultimate authority and sovereignty resided in a general assembly of all citizens. In a crisis—either internal or external—the assembly met to pool its experience and inventiveness, and to act as a unity. Leaders for the occasion were chosen, depending on the type of crisis. For internal situations, a man was chosen to the office of EN, while for military actions the office was called LUGAL. When the crisis passed, the men returned to their regular occupations.

Jacobsen thinks that this city pattern was extended to Sumer as a whole. Eventually, perhaps because the EN or LUGAL were reluctant to relinquish the power given them by the assembly, ways were found to perpetuate it. A "primitive monarchy" developed, but this takes us beyond the proto-literate period.[17]

5. Artistic Activity. Finally, there was a surge of artistic activity. The architecture of the temple represents this, as does its detail and decoration. Cylinder seals appear—intricate carvings done on small cylinders of stone or metal, and used to impress distinctive designs on wet clay. The artistic and technical skill reflected by these seals is unbelievable in such an early period. Sculpture in the round also appears for the first time.

Spiritual Factors

It is necessary to stress here, as I did after discussing the food-producing revolution, the importance of non-economic factors. While Gordon Childe has interpreted it primarily in economic terms, others have seen a broader picture.

For instance, Braidwood, who believes civilization would not have developed on the basis of food-production alone, says,

> The great change between pre-civilization and civilized human life came in those realms of culture other than the technological and economic . . . In this sense there was certainly a change in kind of human life as civilization appeared.

This change in kind he sees in terms of new social institutions, new forms of thought, and a new moral order.[18]

APPLICATION

We must now return to the relevance of all this to the student of the Bible. Can any of these three stages of human life be equated with the culture represented by the early chapters of Genesis?

Aspects of Culture in Genesis

Several important types of human activity may be found in Genesis I-XI.

1. Domestication of both grain and animals. "Now Abel was a keeper of sheep, and Cain a tiller of the ground" (4:2). The same is implied by Adam's giving names to the animals, and the remark that among them "there was not found a helper fit for him" (2:19-20). Similarly, Jabal is "the father of all those who dwell in tents and have cattle" (4:20). Noah also is described as a "tiller of the soil" (9:20) and made wine.

2. Cities. The grandson of Adam, Enoch, "built a city" (4:7). In a later chapter reference is made to burnt brick and mortar, and the building of a ziggurat in Sumer (11:3ff).

3. Metal Work. The man Tubal-cain is described as "the forger of all instruments of bronze and iron" (4:22). Musical instruments—the lyre and the pipe —are mentioned in 4:21.

Thus in these chapters several elements of civilization are attested or implied: domestication of grain and animals, monumental architecture, political organization (implied by the city), and specialization of crafts.

Genesis Reflects "Civilization"

From our survey of the development of civilization in ancient Mesopotamia, it is clear that the domestication of grain and animals cannot be dated before about 7000 BC, while forging implements from metal is a practice attested first about 3500 BC. The reference to working with iron suggests a far lower date, as smelting of iron was not known until the latter part of the second millennium BC, that is, after 1500 BC.

It is therefore a reasonable conclusion that the early chapters of Genesis reflect human society and life as it was known not earlier than the Proto-Literate period of ancient Mesopotamia. Another way of putting it is to say that the early chapters of Genesis reflect *civilization,* which we know to have appeared first in ancient Mesopotamia about 3500 BC.

It is precisely here that the problem for the conservative Christian arises. If Genesis 1-4 are taken as historical accounts, then the stage of culture which we have denoted by the "food-producing revolution" was reached by the second generation of human beings (Cain and Abel), cities by the third generation, and the forging of metal, including iron, by the seventh generation. To put it still more baldly, if Adam was a literal, historical person, the actual father of two men named Cain and Abel, it begins to look as though he would not have lived earlier than about 7000 BC.

On the other hand, the archaeological record shows the existence of human life through thousands of generations before the food-producing revolution and the efflorescence of civilization. Ramm has already pointed out the dilemma, saying, "The evident recency of the data of Genesis 4 seems to involve us with the recency of man in Genesis 3."[19] It is one of the few problems in his excellent book to which he is able to offer no solution.

Searching for an Answer

The most which I can do at this point is to call attention to certain features in this historical and prehistorical survey which deserve special note by the conservative Christian, and to point out lines along which a solution may be sought.

1. While the Old Testament seems to present the origin of human life and civilization as approximately simultaneous, it does present it as occurring in the area of ancient Sumer. Of all the centers where the transition from primitive to civilized life occurred, the first was right here. Moreover, here the transition occurred spontaneously, without influence from other centers. This correlation should not be overlooked.

2. Another is the importance of non-economic factors, including religion, in the development of civilization. I have already noted the presence of temples from the first in Sumer, and the importance of religion in fostering the social solidarity necessary for irrigation and subsequent expansion. In Proto-Literate ruins, says Frankfort, "the temples are the most striking feature."[20] This is significant because Genesis shows

human life originating with God, and possessing moral qualities from the start. And while the Sumerians worshipped a pantheon which we would find difficult to identify with the God of the Old Testament, it is nevertheless most suggestive to realize that in this—up to that time—utterly unique, qualitative development in human life, religion was a major factor.

3. Again, note should be made of the comparative recency of the food-producing revolution, a recency which accords well with a literal creation of man as described in Genesis 1-2.

One way of resolving the tension between the apparent antiquity of man according to archaeology, and his apparent recency according to the Bible, has been to look for some place in the prehistoric sequence where brute became man through the creative act of God, imparting to him the *imago Dei.*

To those who prefer this type of solution, may I respectfully commend the food-producing revolution? In this case, Genesis 1 and 2 are not telling us so much about the primeval origin of human life itself, as about the first great strides in human life, which brought man to the state we call "civilized."

4. One other possible solution to this problem will be regarded as a live option by some, and should be mentioned. It is hinted at by Ramm, when he says,

> Perhaps our problem is interpretative. Maybe our trouble is that we are trying to apply modern methods of historiography to a method of divine revelation which will not yield to such a treatment.[21]

Perhaps the question we have to ask is the question of *genre.* It is the beginning of wisdom in Biblical interpretation to inquire, What *kind* of literature is before us in this passage?

The opening chapters of Genesis have always been regarded as of the historical genre by conservative Christians. There are good reasons for so regarding it, and I am aware of these reasons.

Since the problem of the antiquity of man is so acute when these chapters are regarded as history, it may be that conservative Christians should ask again this fundamental question in Biblical interpretation. Perhaps along this line a solution may be found.

I cannot close this paper without emphasizing our unique dependence on and need for the early chapters of the Bible. The debate over historical correlations must not be allowed to obscure the great moral truths revealed here, namely, that behind the processes of life there stands the creative hand of God, that human life is moral in quality, and marked by spiritual needs which can be met only through a right relationship to God.

The Biblical doctrine of creation, which is adumbrated here, is crucial for the Christian understanding of life. It constitutes the only real reason why a man should become a Christian: the God who calls in Jesus Christ is the Creator, and has designated the conditions of human life. This is the answer to every person who thinks that in submitting to Christ, life will somehow thereafter be truncated, less than full, less than normal. The Biblical doctrine of creation affirms that no man is fully normal who is not in a right relationship with God through Christ.

1. The theory that Ur was in northern Syria has not found general acceptance. See Wisemen, "Ur of the Chaldees," *New Bible Dictionary,* p. 1304f.

1a. Robert J. Braidwood, *Prehistoric Man* (Chicago Natural History Museum, 1961), p. 22; see also Donald R. Wilson, "How Early is Man?" *Christianity Today* VI (1962), 1175-76 (September 14).

2. Robert J. Braidwood, *The Near East and the Foundations for Civilization* (Eugene, Oregon, Oregon State System of Higher Education, 1952), p. 11. A discussion of the Palestinian material may be found in W. F. Albright, *The Archaeology of Palestine* (Baltimore, Penguin Books, 1961), p. 52-57.

3. Braidwood, *Prehistoric Man,* pp. 48ff.

4. Frankfort, *The Birth of Civilization in the Near East* (Doubleday Anchor Books, 1956), p. 27f.

5. G. K. Chesterton, *The Everlasting Man* (Doubleday Image Books, 1955), 26-28, 30.

6. See, most recently, "The Earliest Village Communities of Southwestern Asia Reconsidered," *Atti del VI Congresso Internazionale delle Scienze Preistoriche e Protostoriche* (1962), I, 115-26. Here, Braidwood discusses three phases of the changeover: a) A terminal food-collecting stage, ca. 15,000-9,000 BC; b) Incipient cultivation and domestication, ca. 9,000-7,000 BC; c) Primary effective village-farming communities, ca. 7,000 BC, well-established by 5,000 BC.

7. Childe, *New Light on the Most Ancient East,* 4th edition (New York, Grove Press, n. d., but about 1950), p. 106.

8. Braidwood, *The Near East and the Foundations for Civilization,* p. 16.

9. Frankfort, *The Birth of Civilization in the Near East,* p. 31.

10. Braidwood, *Prehistoric Man,* p. 17.

11. Frankfort, *op. cit.,* p. 3.

12. *Encyclopedia Britannica* (1961) vol. V, p. 742b.

13. *Ibid.,* p. 741b.

14. *The Near East and the Foundations for Civilization,* p. 1f.

15. As reported *ibid.,* p. 39.

16. Childe, *New Light,* p. 114.

17. Thorkild Jacobsen, "Early Political Developments in Mesopotamia," *Zeitschrift fur Assyriologie* 52 (1957) 90f.

18. *The Near East,* p. 42.

19. Bernard Ramm, *The Christian View of Science and Scripture* (Eerdmans, 1956), p. 328.

20. *Op. cit.,* p. 54.

21. Ramm, *op. cit.,* p. 330.

22. In addition to the titles in the footnotes, the following works are important: Braidwood, Robert J., "Asiatic Prehistory and the Origin of Man," *Journal of Near Eastern Studies* 6 (1947), 30-42.

Childe, V. Gordon, *What Happened in History?* (Penguin Books, 15957).

Jacobsen, Thorkild, "Primitive Democracy in Ancient Mesopotamia," *Journal of Near Eastern Studies* 2 (1943) 159-72.

Although Genesis was written thousands of years ago, every reference to astronomy in this first chapter is corroborated by the best of our present scientific information. And yet we note that books of astronomy, written 25 years ago or more, are full of serious errors and anything written more than a few hundred years ago would be suitable only for the entertainment of the reader.

Peter W. Stoner, M.S.*

*Quoted by permission from "Modern Science and Christian Faith", Scripture Press, Wheaton, Illinois, edited by F. Alton Everest.

HOMO HABILIS: Implications For The Creationist

JAMES O. BUSWELL III*

With the discovery of the latest fossil hominid in East Africa, the antiquity of man, as estimated by the discoverer, Dr. Louis S. B. Leakey, jumps from the previously accepted hundreds of thousands of years to over a million and a half. Homo habilis is pre-Australopithecus and pre-Zinjanthropus, but more like Homo sapiens in several respects, and was a tool-maker. So far, the results of the potassium-argon dating of the site look reliable.

Should creationists accept this discovery, repudiate it, or shelve it? What are its implications for the Bible-believer? Conservative theologians of the past as well as of the present tell us that the mere antiquity of man is not theologically relevant. What, then, are the relevant considerations?

This newest find does not meet with uniform acceptance in the world of science as yet. More will have to be known concerning its morphology, its culture, and its dating before a consensus can be achieved.

I. THE PROBLEM OF ANTIQUITY AND CHRONOLOGY

In view of our title it may be instructive at the outset to note how frequently we are asked about the relation of this or that fossil man to Adam, somewhat as though there were even a possibility of gaining some certain understanding of exactly where and when man originated. Elwyn L. Simons, palaeontologist at Yale, wrote that

> In order to report with confidence the exact regions of origin of the human species and of earliest cultural items, we would need 100 times the archaeological and palaeontological evidence that we now have, with absolute dates for all sites. 1

We cannot pinpoint these for you but we can report some ideas and recent developments in the continuing search for early man.

In 1960, Dr. L.S.B. Leakey, famed palaeontologist and discoverer of the Australopithecine "man-ape," *Zinjanthropus boisei*, discovered the greater part of a juvenile mandible, and parts of the skull at a level below that of the *Zinjanthropus* deposit in the now famous Olduvai Gorge, Tanganyika. The skull capacity proved to be larger than the Australopithecine skulls, and anatomical details indicated a much more human-like form. Because of the lack of sufficient material, Leakey simply reported the find as a pre-*Zinjanthropus*, "a very remote and truly primitive ancestor of *Homo*."

Subsequently other discoveries served to corroborate the find of 1960, indicating that this non-Australopithecine lived earlier, contemporary with, as well as later than *Zinjanthropus;* and *Zinjanthropus* had been dated at *1,750,000* years old! Thus a fossil form of significantly human proportions, accompanied by evidence of culture in the form of tools is reported at an antiquity unprecedented, even by evolutionary standards.

If those who take the Bible seriously are not to react in mere denunciation and sarcasm to such an announcement, how are they to accommodate such extreme developments into the frame of reference of orthodox creationism? How are we to interpret such ancient man-like remains in terms of a Christian philosophy of human origins? The only strictly Biblical arguments used in opposition to such reports involve the genealogical material from the Old Testament.

Theologians have been discussing the chronological implications of the Genesis genealogies for a very long time. Opinions as to how they should be interpreted have varied from those who insist that they cannot be used to figure the antiquities of biblical events at all,

1. "Some Fallacies in the Study of Hominid Phylogeny" *Science* 6 Sept., 1963, pp. 879-889.

*James O. Buswell, III, is Associate Editor of the Journal of the American Scientific Affiliation. Presented at the 19th annual convention of the American Scientific Affiliation, John Brown University, Siloam Springs, Arkansas, August 27, 1964.

**Wilson's article should be read, or re-read as a preliminary to the present one. He treats the genealogies as well as the potassium-argon method of dating in slightly more detail, providing a valuable supplement to the content and point of view of the present article.

prior to the times of Abraham, to those who are just as convinced that they can, and indeed do, constitute "biblical chronology."

From some of the most orthodox, conservative scholars, however, have come repeatedly, statements of the former position to the effect that the genealogies were not intended for chronological or time-measuring devices in the language and culture in which they were originally given. Donald R. Wilson, *(Christianity Today,* September 14, 1962) in connection with the reports of Leakey's *Zinjanthropus* finds, has ably discussed the contribution of William Henry Green and the conclusion of B. B. Warfield on the question of the genealogies. Green pointed out that "the notion of basing a chronological computation upon these genealogies is a fundamental mistake. It is putting them to a purpose that they were not designed to subserve, and to which from the method of their construction they are not adapted."[2]

More recently, Professor Samuel Schultz, chairman of the Division of Bible and Philosophy of Wheaton College, has expressed the opinion that "Genealogical records in the Scriptures were not designed to be used as time tables . . . No statement is made anywhere in Scripture that affords us a conclusive and reasonable basis to calculate the time that elapsed prior to Abraham."[3]

Thus the attempts at such reconstructions of ancient chronology from the genealogies by those who have interpreted them in literalistic, modern genealogical terms would seem to have been spurious. In 1871 Charles Hodge noted that

> The extreme uncertainty attending all attempts to determine the chronology of the Bible is sufficiently evinced by the fact that one hundred and eighty different calculations have been made by Jewish and Christian authors, of the length of the period between Adam and Christ.4

At the same time, Hodge reported that the longest of these was 6984 years, and the shortest 3483.

As applied to the question of the antiquity of man, the same conservative scholarship has fearlessly followed the implications of its conclusions on the genealogies. Thus Charles Hodge, although thinking in terms of merely "eight or ten thousand years," admitted that,

> The Scriptures do not teach us how long men have existed on the earth. Their tables of genealogy were intended to prove that Christ was the son of David and of the Seed of Abraham, and not how many years had elapsed between the creation and the advent.5

Later, regarding the pertinent periods of Biblical record, Green concluded that the Mosaic records do not fix and were not intended to fix the precise date either of the Flood or of the Creation of the World.[5]

B. B. Warfield in his 1911 study of "The Antiquity and the Unity of the Human Race" gave much latitude for the times of ancient man. He wrote that,

> . . . for aught we know instead of twenty generations and some two thousand years measuring the interval between the creation and the birth of Abraham, two hundred generations and something like twenty thousand years, or even two thousand generations and something like two hundred thousand years may have intervened. In a word, the scriptural data leave us wholly without guidance in estimating time which elapsed between the creation of the world and the deluge, and between the deluge and the call of Abraham. So far as the Scripture assertions are concerned, we may suppose any length of time to have intervened between these events which may otherwise appear reasonable.7

As Wilson suggests, we may suppose that such opinions were written, not to reconcile evidence of fossil man with the Biblical record, but rather in an attempt to achieve a correct understanding of what the Bible teaches. Certainly Hodge, Green, and Warfield were not particularly exercised over current evidences of ancient man. Each felt he could accommodate any current scientific evidence within the framework of his philosophy of scriptural interpretation. And it is their philosophy of scriptural interpretation which remains today, characteristic of evangelical orthodoxy, and is no more jeopardized by the scientific evidence of our day than it was in theirs.

It has been felt necessary to preface this report in this way because of the fact that, despite wide knowledge of this point of view in Christian circles, the only serious objections to the acceptance of reports of fossil man are, almost without exception, based primarily upon an assumption that their antiquity alone is enough to deny Creation and jeopardize the entire system of Christian orthodoxy. Such assumptions, we submit, stem from a misunderstanding of either the function of the genealogies, or the nature of prehistory, or both. We are told, for example, by Whitcomb and Morris, that "To stretch the genealogy of Genesis 2 to cover a period of over 100,000 years is to do violence to the chronological framework of all subsequent Bible history and prophecy."[8] Using the number of years since the dawn of recorded history as a criterion for the number of years of man's sojourn before that time, on some principle of balance or symmetry, we are told that "The incongruity of insisting upon 100,000 years between Noah and Abraham while granting that the entire history of redemption from Abraham to the eternal state may be only four or five thousand years, becomes obvious."[9] The incongruity *is* obvious, but only from the point of view of a premise based upon a specified criterion which has no intrinsic biblical or historical basis. Furthermore, who knows how far off "the eternal state" may be? On the same premise, the harnessing of power for the technological advance of civilization should have progressed at a uniform rate throughout the ages. Instead, however, we have the late explosion of technological advance which allowed one historian to observe that George Washington would have been more at home in the court of Hammurabi than he would be in any world capital today. No principles of congruity can be applied in the one case any more than in the other.

Another form of objection by creationists to the reports of ancient fossil men is the belief that the further back in time man is pushed, the stronger are

the implications of an evolutionary origin. So far, there is no continuous sequence of fossil remains, nor intermediate forms connecting with the scattered representatives of early non-human primates to warrant such a belief. The position of human derivation from pre-human forms, as far as the fossil data is concerned, is dependent upon evolutionary presuppositions, be they theistic or naturalistic.

II. DESCRIPTION

One of the more fascinating things about the most recently published finds in East Africa is precisely contrary to the usual evolutionary presupposition, particularly in view of its alleged age. That is the fact, referred to above, that they indicate a more "man-like" form than their *Zinjanthropus* and other Australopithecine contemporaries. The juvenile mandible and parts of the skull found in 1960, which are catalogued as Olduvai Hominid No. 7, are supplemented and their interpretation corroborated by a re-examination of several other finds at or near the same locations. They are: some teeth and cranial fragments (Olduvai Hominid No. 6), some teeth and jaw fragments (Olduvai Hominid No. 4, the oldest hominid remains so far discovered at the famous Olduvai Gorge), some hand and foot bones and a clavicle (Olduvai Hominid No. 8), and two important finds in 1963. These were Olduvai Hominid No. 13, a good part of a cranium, a mandible, and other fragments and small parts from a "late adolescent" indicated from the eruption of teeth. Leakey pointed out that "This specimen exhibits all the special morphological characters" which could be seen in the 1960 find. The other discovery in 1963 was a badly crushed specimen whose importance was that the fore-part of the skull and brow ridge area was recovered.

The characteristics which show these finds in such marked contrast with the Australopithecines as reported by Leakey, et. al.,[10] are (a) a cranial capacity of 675 to 680 c.c. as compared with the largest Australopithecine cranial capacity of under 600 c.c.; (b) smaller jaws, within the range of *Homo sapiens;* (c) incisors generally larger than both Australopithecines and *Homo sapiens;* (d) curvature of the skull vault within the range of variation of *Homo sapiens,* and unlike the Australopithecines; (e) gross skull size. Even the juvenile which could expect about a 5% increase in brain growth, according to Leakey, has skull parts "far larger than those of the *Zinjanthropus* adult" and "almost identical in size" to the corresponding parts of *Pithecanthropus;* (f) The clavicle resembles very closely that of modern man; (g) hand bones are more robust, but resemble those of modern man; and (h) foot bones resemble modern man in several respects with "well marked longitudinal and transverse arches."

The most important index of "human" status available in a prehistoric site is the archaeological indication of culture. The cultural remains in this case constitute the main reason for the name which was suggested by South African palaeontologist Raymond Dart, and given to the type—*Homo habilis.* The specific name is taken from the Latin, meaning "able, handy, mentally skillful, vigorous." Some of the cultural indications were stone tools of a small, crude core variety with 4 or 5 flakes broken off. Their conformation in comparison with later primitive tools indicates that they were probably used for skinning, for cutting meat, or other similar uses. They were probably used in what is referred to as "precision grip" (thumb and fingers) rather than in a "power grip."

With the cultural and anatomical data combined, came an important reappraisal of *Zinjanthropus boiesi.* Dr. Leakey describes it as follows:

> When the skull of *Australopithecus (Zinjanthropus) boisei* was found on a living floor at F.L.K. #I, no remains of any other type of hominid were known from the early part of the Olduvai sequence. It seemed reasonable, therefore, to assume that this skull represented the makers of the Oldowan culture. The subsequent discovery of remains of *Homo habilis* in association with the Oldowan culture at three other sites has considerably altered the position. While it is possible that *Zinjanthropus* and *Homo habilis* both made stone tools, it is probable that the latter was the more advanced toolmaker and that the *Zinjanthropus* skull represents an intruder (or a victim) on a *Homo habilis* living site.
>
> The recent discovery of a rough circle of loosely piled stones on the living floor at site D.K.#I, in the lower part of Bed I, is noteworthy. This site is geologically contemporary with M.K. #I, less than one mile distant, where remains of *Homo habilis* have been found. It seems that the early hominids of this period were capable of making rough shelters or windbreaks, and it is likely that *Homo habilis* may have been responsible.11

In addition to the reassignment of the cultural remains, an important reinterpretation of *Zinjanthropus* in relation to its significance in human phylogeny has been anounced by Leakey. In 1959 at the University of Chicago celebration of the centennial of the publication of Darwin's *Origin of Species,* Leakey claimed that,

> *Zinjanthropus,* in spite of being classified in the subfamily Australopithecinae, already exhibits specializations which foreshadow *Homo,* and therefore it seems reasonable to accept the genus *Zinjanthropus* as being in the direct evolutionary line leading to *Homo.* 12

He also suggested that,

> . . . this genus may well be directly ancestral to modern man, while the other two genera in the same subfamily may be regarded as divergent branches of the same general stock, which exhibit specializations in directions away from *Homo* and which eventually became extinct. 13

By July, 1961, however, at a symposium on African Ecology and Human Evolution, Leakey was already suggesting a change, namely, that *Zinjanthropus,* as an Australopithecine, was "a hominid which is headed for extinction" while the juvenile, not yet called *Homo habilis* "seems to be much more closely related to the stock which eventually gave rise to *Homo.*"[14]

Thus changes in man's family tree are seen to be quite frankly dependent upon an open-minded scientific attitude that is not afraid to admit a previous erroneous position. In this case, it is to Leakey's credit that he, himself, corrected his earlier, premature differentiation of *Zinjanthropus* from the Australopithecines. In the

cases of the Piltdown hoax, and of the reinterpretation of the anatomical reconstruction and posture of Neanderthal, it was necessary for men of a later generation to correct the errors of their predecessors.

III. CRITICISM

Correspondence with other creationist anthropologists in direct solicitation for opinion about *Homo habilis* for this paper have brought forth references to Leakey himself in terms of "amazing," "fantastic," and "basic skepticism." But all anthropologists have heard expression of this kind in conversations on the subject.

More important, however, the responses indicate a general lack of alarm at the increased antiquity. Claude Stipe of Bethel College writes, "If there is evidence for *Homo* before Java and Peking *(Pithecanthropus)*, this would not be surprising to me." Another experienced anthropologist writes, "The possibility that God may have specially created man looking like *Homo habilis* who later evolved into modern man does not trouble me."

Another element in the responses involves the question, What is man? Ralph G. Ellenberger of Nyack Missionary College writes that this find "certainly makes it necessary to make Adam much more ancient if *Homo habilis* is truly demonstrated to be a tool-maker . . . Is it possible that any non-man was capable of the level of abstraction and conceptualization necessary for tool-making? At the present, I feel that tool-making is indeed a human art; and that if *habilis* was a tool-maker, then by definition, he must have been human. This seems reasonable unless we develop some theory of a pre-man tool-maker."

Another anthropologist, with slightly broadened criteria, writes, "Within my personal frame of reference, men are culture-building beings with algebraic mentality and eternal souls, and what they look like doesn't matter very much."

The type of reservations which must be held at this time are well stated by Stipe: "It seems to me that at this stage, one cannot draw any very important conclusions. It is necessary to determine more accurately the dating, if possible, and to have a more complete examination by a number of experts." Ellenberger expands the second point with a sound prediction: "Obviously any sensible person must make *some* reservation of judgment at this time, pending some genuine printed crossfire between Leakey and . . . his opponents. So far the discovery is pretty recent to raise much controversy in the journals, though I would assume considerable controversy is forthcoming."

Already the status of *habilis* is disputed. Dr. Bernard Campbell of Cambridge University is reported in the press to hold that it should be classed with the latest and largest Australopithecine form, *Telanthropus capensis*. Leakey, however, counters by the suggestion that *Telanthropus* is nothing but a late example of *Homo habilis*.

Dr. J. T. Robinson of the Transvaal Museum of Pretoria (currently teaching at the University of Wisconsin),[15] probably the foremost living authority on the South African Australopithecines, holds that *Zinjanthropus* is quite esurely a specimen of the older genus of Australopithecines, *Paranthropus*, while *Homo habilis* constitutes a transition from the later genus, *Australopithecus* (which it closely resembles in many features) to the still later *Homo erectus*, "full-fledged" man in common parlance. (See fig. 1) Dr. Leakey, in comparing *habilis* rather consistently with only the *Zinjanthropus* representative of Australopithecines would seem to have ignored the rather marked distinctions between the two genera, *Australopithecus* and *Paranthropus*. Robinson's interpretation has not as yet been published, so that its acceptance by others in the field remains to be seen.

Reaction to the geological dating was not long in coming either. Those which have been expressed to date are mostly concerned with critical appraisals of the potassium-argon method by which the *Zinjanthropus* date of 1,750,000 years was established. So far no dates have been reported on specific *habilis* sites, but their obvious geological relationship to *Zinjanthropus* allows the interpretation of the antiquity of the one to serve for the other.

First, Leakey, with J. F. Evernden and G. H. Curtis, two University of California geologists, published the date of 1,750,000 for Bed I.[16] This was the report that was then published by the *National Geographic Magazine*.[17]

Family: Pongidae { Gorilla; Chimpanzee; Orangutan; Gibbon

Family: Hominidae
- *Subfamily:* Australopithecinae
  - *genus:* Paranthropus (including Zinjanthropus*)
  - *genus:* Australopithecus
- *Subfamily:* Homininae
  - *genus:* Homo
    - *species:* habilis*
    - *species:* erectus (Pithecanthropus, Sinanthropus)
    - *species:* neanderthalensis
    - *species:* sapiens

FIGURE 1

* after Robinson

Many anthropologists were skeptical. Some believed Leakey was too eager and the dates too early. Others doubted the applicability of the postassium-argon method to finds less than two million years old.

Published reactions came in the form of one by G.H.R. VonKoenigswald, W. Gentner, and H. J. Lippolt.[18] Their arguments were largely reflected in a criticism of the age determination by William L. Straus, Jr. (a

physical anthropologist) and Charles B. Hunt (geographer-geologist) both of Johns Hopkins.[19]

Both of these articles specified that they were not critical of the *precision* of the determinations of the potassium-argon ratios in the minerals at Olduvai Gorge, the error in precision being less than 10%. Rather they criticized the accuracy in the measurements due to the nature of the sample itself. Different materials had been tested in some of the seven sites in the layers of tuff chosen for analysis. Also there seemed to be an unconformity between the Basalt layer dates and the upper and lower portions of Bed I. Straus and Hunt concluded: "Because some of the dates are inconsistent some must be inaccurate." They decided that until accurate measurements are learned, "the indicated ages must be taken *cum grano salis.*"[20]

In June, 1962, Evernden and Curtis gave a clarification of their method, answering the criticisms of Von-Koenigswald *et al* at a conference at Woods Hole, Massachusetts, published the following year (1963) by the National Academy of Science. They explained satisfactorily the absence of any basement contamination; asserted the lack of retention of pre-eruption argon in any appreciable amounts in tuffs and flows, particularly at Olduvai, on the basis of the concordance of the data on the seven tuffs dated; and, with other clarifications concluded:

> Therefore, we feel that there are no grounds for rejecting the Bed I dates and that they must be accepted as valid estimates of the age of *Zinjanthropus.* 21

Discussion revealed that there was no evidence of digging in, as in burials, or of slumping.

Finally, Richard L. Hay of the University of California reported more significant corrections and re-appraisals of methodology as well as results by Curtis and Evernden themselves, including modification of dating procedures which resulted in the correction of one Basalt date previously out of line, and the re-assignment of one specimen from Bed I to Bed II which cleared up another slight unconformity.[22]

Altogether, the potassium-argon evidence looks reliable. We note that there have not been any published objections to the general order of magnitude of these finds. Yet there will have to be many more samples of the *habilis* and *Zinjanthropus* beds at Olduvai Gorge before anything like a textbook account of human prehistory in that part of the world can be written. Meanwhile, as Ellenberger suggests, it will not be until more interpretations of the present and increasing data have been exposed to sufficient "printed crossfire" that a concensus can be achieved.

IV. CONCLUSION

1. *Homo Habilis* is certainly a "man", taxonomically speaking, and is certainly older than any previously discovered "man." The archaeological remains do not yet spell out an unequivocally human culture complex, although for many, the mere existence of tools is sufficient to indicate the fully human status of their makers. Cultural indications are the only reasonable archaeological clue to the human state, and we believe would be indicative of a fully human spiritual nature as well. We believe that tools, (or the conceptual thought necessary to design and make them with any pattern or tradition), language, and all other cultural behavior (as opposed to mere genetically determined behavior), as well as man's spiritual nature, his soul, are co-terminous and have their theological definition in the image of God in man.

2. Orthodox Creationists need not withdraw from full acceptance of the latest evidence alleged to be the earliest known representatives of mankind, by reason of their antiquity alone. Nothing in Scripture would theologically preclude the assigning of the most ancient men as progeny of the Biblical Adam.

REFERENCES

1. Simons, 1963, pp. 879-889.
2. Green, 1890, p. 297.
3. Schultz, quoted in Buswell III, 1956, p. 18.
4. Hodge, 1871, Vol. II, p. 41.
5. Ibid.
6. Green, op. cit., p. 303.
7. Warfield, B. B., 1911, p. 247. (Quoted in Buswell, Jr., 1962, Vol. I, p. 325).
8. Whitcomb and Morris, 1961, p. 484.
9. Ibid.
10. Leakey, Tobias, and Napier, 1964, p. 8; and Leakey, 1963, p. 456.
11. Leakey, Tobias, and Napier, 1964, p. 9.
12. Leakey, 1960, p. 26.
13. Ibid., p. 28.
14. Leakey, 1963, p. 456.
15. This paragraph summarized from lectures by Dr. Robinson and Dr. Leakey at the University of Chicago, May 11, 1964, and April 8, 1964, respectively.
16. VonKoenigswald, Gentner and Lippolt, 1961.
17. Leakey, 1961.
18. VonKoenigswald, Gentner and Lippolt, 1961.
19. Straus and Hunt, 1962.
20. Ibid, p. 295.
21. Evernden and Curtis, 1963, p. 126.
22. Hay, 1963.

BIBLIOGRAPHY

Buswell, J. Oliver, Jr., 1962 *A Systematic Theology of the Christian Religion.* Two volumes. Grand Rapids: Zondervan.

Buswell, James O. III, 1956 "The Creation of Man", *Christian Life,* Vol. 18, No. 1, (May) pp. 14-18.

Carr, Donald R., and J. Laurence Kulp, 1957 "Potassium-Argon Method of Geochronometry", *Bulletin of the Geological Society of America,* Vol. 68 (June) pp. 763-784.

Evernden, J. F., and G. H. Curtis, 1963 "Dating of the 'Early Man' of Olduvai Gorge," *Nuclear Geophysics:* Proceedings of a Conference, Woods Hole, Mass., June 7-9, 1962. Washington, D.C.: National Academy of Sciences. National Research Council, Publication 1075, 1963, pp. 122-128.

Green, William Henry, 1890 "Primeval Chronology," *Bibliotheca Sacra,* Vol. XLVII, pp. 285-303.

Hay, Richard L., 1963 "Stratigraphy of Beds I through IV, Olduvai Gorge, Tankanyika," *Science,* Vol. 139, (1 March), pp. 829-833.

Hodge, Charles, 1871 *Systematic Theology.* New York: Scribner and Armstrong.

Howell, F. C., and F. Bourliere, (eds.), 1963 *African Ecology and Human Evolution.* Chicago: Aldine.

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EXPLANATION IN THE PHYSICAL SCIENCES

FREDERICK H. GILES, JR.*

By noting a series of answers to a simple question regarding a common physical event, some of the properties of explanation in the Physical Sciences are illustrated. The importance of the empirical, the logical, and the psychological aspects of scientific theories are noted: the ultimate acceptance of a particular explanatory framework appears to depend upon all three of these aspects.

A one-hour discussion of "Explanation in the Physical Sciences" is a task fraught with difficulties. The subject is as broad as science itself, and the literature is extensive. It is nearly impossible for a professional philosopher of science to keep abreast of the field—it is impossible for the non-professional.

The subject is deep and formidable. In a blurb advertising a recent publication dealing with scientific explanation, the following quote appears: "It is not, I think, anything other than another graphic characterization of the existing state of affairs to say that no one today knows what a scientific explanation is . . . It is at this moment very much a mute question what general conditions an account of a fact must satisfy if it is to constitute 'scientific explanation.' "[1]

Therefore, with a recognition of many limitations in understanding and insight, as well as in the necessary bounds of time and space, we will proceed into the subject much as an infant explores the ocean. We will wade in, splash around a bit, have fun, and then get out; with some on the inside, much more dripping off on the outside, perhaps a bit chilled, but with some feel for the subject none-the-less.

What is an explanation? Perhaps the most ready answer is "an explanation answers the question 'why?' ". Unfortunately, however, the word "why" carries a variety of meanings. In his book, The Structure of Science, Professor Ernest Nagel takes 10 different questions, and uses the word "why" in 10 different ways.[2] In a comparable sort of study, Aristotle discusses four causes which lend four distinct meanings to the question "why?".[3] As an outline for this discussion, turn Doctor Nagel's scheme inside out and consider 10 answers to a single question.

A ball released from a man's hand is observed to drop. To the question "why did the object fall?" the following answers are possible:

1. The ball wanted to fall.
2. That's the way "Nature" is, or "Providence" (God) has so ordained.
3. The man let go of it.
4. All objects, left to themselves, fall.
5. The ball is heavier than air.
6. Free objects accelerate downward at 32/ft./sec.^{2}.
7. There is a gravitational force pulling the ball to the earth.
8. The ball is in the gravitational field of the earth.
9. Objects tend to a state of lowest potential energy.
10. Masses move along geodesics in space-time.

Here then are ten "explanations"; ten answers to a simple question concerning a very common observation, and the possibilities are still not exhausted.

Each answer makes a connection between the event to be explained and some broader, or more general, or more fundamental, or more immediate context.

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The event is related to some thought structure: a presumably mutually understood reference framework. A suitable explanation will fit the event smoothly into the framework, and the acceptability of the explanation will be determined by the smoothness of the fit. The appropriate framework will depend upon the context of the question, as well as upon the experience and sophistication of the question and the questioned. Hopefully, a sequential consideration of the above answers will give some feel for the type of refference frames which arise, how they arise, and the extent to which these frames may form a backdrop for explanation in the physical sciences.

1. The ball wanted to fall. This type of answer does not currently arise in the physical sciences. It seems to reflect an "animistic" view of things: a living breathing earth, on which objects are endowed with volitional capabilities. Today we presume that inanimate objects do not desire, and that the projection of this anthropormorphic activity on to such objects is naive and unnecessary. An answer of this sort may, however, be quite appropriate in some biographical or psychological context; for example, the falling object may be a human being who has dropped from a roof.

2. That's the way "Nature" is; or, "Providence" (God) has so ordained; or, that's as "Chance" would have it. Scientists sometimes use this sort of statement, but it would not be considered a "scientific explanation." It is beyond the province of the scientist to ask why "Nature" is as it is, yet the answer does presume that there exists some very broad, inclusive framework called Nature, God, Providence, even sometimes Evolution or Chance, in which all our experience occurs.

Such frames are much broader than "physical science". To use them as the immediate basis for scientific explanation is not considered fair. They purport to subsume all of experience: the events observed, as well as the explanations of the events. They are so inclusive that unique and testable deductions cannot be made from them: an event fits into such a framework simply because it occurred. Any explanation fits the event into the framework simply because the explainer wants it to.

These all-inclusive frames of reference may however become the final, fiat, court-of-appeal when honest ignorance disallows the use of a more immediate context. Unfortunately, resort is most often made to this sort of explanation only under conditions of exasperation, frustration, or laziness, and the situation is frequently further aggravated by the view that such appeals are unassailable.

3. The man let go of it. This reply is in direct contrast to the answer discussed in the immediately preceding paragraphs: whereas the former answer involved a frame of reference that was too broad, this explanation associates the observed event with no framework at all. The reference is only to a preceding event.

Now there are times when this type of reply may be exactly what is desired. A mother, upon hearing a crash in the next room, might well ask, "Junior, why did the vase fall?" She is not interested in being told that free objects move along geodesics in space-time. Similarly, the falling of an apple would be "explained" by an orchard man in terms of "high winds" or "weak stems", but this would not satisfy Isaac Newton. Because it does not refer back to a framework, but only to a preceding event which, though perhaps more controllable, is really no broader a foundation for explanation than is the event in question, this sort of explanation would probably not be graced with the adjective "scientific".

Before going further, two notes must be injected.

First, answer number 3 assumes there is some sort of link between the event to be explained and the one explaining it. Whether there is a real or necessary connection between the events is a matter for later, deeper, and much more thought. Saying that one event "causes" a subsequent one is perhaps inaccurate, or even wrong, but the usage is certainly handy and common. For this discussion therefore, the "handy and common" has been chosen.

Secondly, the reply "The man let go of it" assumes one's knowledge that it is natural for unheld objects to fall. By "natural" one means that this is what an object does when it is left alone: a falling object is merely "doing what comes naturally". This assumption arises from observation, and it soon leads to the following generalization.

4. All objects left to themselves, fall. This answer arises from experience, and explains the event in question by putting it into a particular class of observed regularities. The answer exhibits the leap of faith which our minds make so naturally, and which undergirds modern science. Note the implicit assumption. In the past, objects when left to themselves, fell. This statement is then made to be more than a historical report: it is the foundation for predicting, for expecting, for "explaining" future similar events.

For this reason, it becomes one of the jobs of the scientist to catalog observed regularities. The statements of these regularities are the beginnings of scientific "laws", and an event is explained when it is properly related to such a statement. It is a "law" that when objects are left to themselves, they fall.

Using a mutually familiar regularity as an explanatory framework is often sufficient to quiet a questioner, but it is recognizably very incomplete. Like folders in a file cabinet, or like pigeon holes in a desk, rudimentary laws of this sort collect our immediate observations into handy regions, but as experience extends the number of folders, a more sophisticated and inclusive filing system becomes essential. More about this later.

5. The ball is heavier than air. Whenever a regularity has been uncovered, everyone is properly pleased. Now, suppose one uses previous experience and the generalization expressed in answer number 4 to predict what will happen when he releases, not a ball, but a helium-filled balloon. Instead of falling down, the balloon falls up! Such experiences make it obvious that one must have some sort of warning "footnote" addended to the law that "all objects, when left to themselves, fall." Other footnotes will also come to mind: for example, a cork will fall down in air, but it will fall up if it is released under water.

Unfortunately, footnotes of this sort are unpredictable. They are found only by extended experiment and observation. They are the result of trial and error, and they normally come as a shock. The danger of further observations upsetting an empirical rule must always be recognized. It thus becomes the job of a scientist not only to catalog regularities, but also to catalog any known exceptions. Answer 5 derives from the existence of a known footnote, and presupposes a previous knowledge of the rule which was the basis of answer number 4.

6. The object has a downward acceleration of 32 ft./sec.^{2}. Though still essentially only a description of an observed regularity, this reply has that expected scientific "ring" to it. Two features have been introduced: the first is the use of a technical term requiring a precise definition, and the second is a quantitative element indicating a measurement has accompanied the observation. Both of these qualities are usually present or implied in the statement of a "law". The first feature assures ungarbled communication and transfer of information, while the second feature leaves the law open to unequivocal tests for exceptions or necessary extensions in its applicability.

The two features go hand in hand. In the Physical Sciences at least, it is difficult to imagine a definition which doesn't allow or imply a means of measuring the quantity or quality defined. There is however considerable disagreement regarding the inverse, i.e., does the measurement of a quantity necessarily allow or imply a definition of it? Consider the case in point. A quantity, "acceleration," is defined in terms of a particular relation between lengths in space and durations of time. The idea of acceleration was used by Galileo, and it was found to be very convenient in the description of motion. It is easily amenable to measurement: one measures intervals of space (lengths or distances), along with the intervals of time needed to traverse the distances, and then relates the measured quantities according to the definition.

But what of the concepts of "space" and "time" themselves? At the outset, these fundamental concepts will be considered intuitive. Further experience and theorizing may, and will, modify one's ideas as to the properties of space and time: whether or not they are structured, whether or not they are both manifestations of the same basic manifold, whether or not they are reversible or essentially right-handed, etc. Yet, through it all, the essential concepts of "space" and "time" are assumed understood. Intervals of space and time are measurable. Whether or not the concepts themselves are thus defined is left an open question.

A measurement is essentially a comparison according to certain rules, between the quantity in question and an arbitrarily agreed-upon standard of the same quantity. There are strikingly few quantities that are directly measured. Space (i.e., lengths, areas, and volumes) and time, along with at most two or three others (perhaps number, mass, or electric charge) complete the list. In the physical sciences, a measurement of a defined quantity, e.g. acceleration, involves a relationship between measurements of the fundamental few.

These relationships are generally expressable in "equation" form, and are amenable to mathematical manipulation. This makes mathematical shorthand available for description, and the observed regularities may be presented as laws, couched in the language of the mathematician. One has "a formula for it".

Kepler's three laws of planetary motion are somewhat more sophisticated examples of this point. The Danish astronomer Tycho Brahe made very accurate observations of the position of the planets in the skies: he catalogued these observations, and recorded all the appropriate measurements. Johannes Kepler, convinced along with Copernicus that the solar system was centered at the sun, manipulated the geometric picture suggested by Copernicus and found that this model did not exactly fit the data which had been collected. The fact that Kepler trusted the data rather than the original model is what makes him a central figure in the development of science. Rather than trying to torture the data to make it fit his picture, Kepler set out to find the particular geometric picture that the data fit. As is well known, he was successful and he was able to reduce the reams of data to three simple rules which today bear his name. These simple rules, these "empirical" laws, these statements of observed regularities, were quantitatively accurate and could be expressed in mathematical form. This was a tremendous step forward: all the data was subsumed under one formula—a formula which could be readily manipulated and used for predictive as well as explanatory purposes—and the motion of a single planet could be "explained" in terms of the motion of others.

Recourse to these rudimentary laws is probably the lowest level of explanation in the physical sciences. Though rudimentary, these laws are however fundamental. They describe what is observed, and are subject to the dictates of immediate measurement. Galileo reported, as an observed regularity, that all objects fall toward the surface of the earth with the same acceleration. This report came in the face of Aristotle's dictum, deduced from a postulated explanatory pattern of much wider compass, that bodies fall

toward the earth with speeds that increase with their weight. The experiments of Galileo became the authority. Therefore, as broader and broader explanatory frames are invented to include more and more experience in a single thought structure, the deductions from the inclusive "laws" that characterize such frames must logically lead to expressions of the simple empirical laws. Using the analogy of the filing cabinet, one may devise better and broader systems for categorizing more and more material, but he still must properly file the individual folders.

7. There is a gravitational force pulling the ball to the earth. One is immediately struck with the fact that this answer is not a bald description of the sort previously considered. Indeed, the concept "force pulling" is related to the observation "ball falling" by recourse to the theory of motion invented by Isaac Newton. Admittedly borrowing and building upon the ideas and observations of his predecessors, the broad explanatory framework developed by Newton has been one of the most successful in the history of science.

Before going further, it is necessary to introduce another fundamental concept which is very familiar to the physicist—in fact, it is very familar to everyone—yet which is extremely slippery when one tries to define it. The concept is that of an object; better still, that of "mass". Here again, as in the case of space and time, one has one of those concepts which appear to be intuitive. The mass of one object may be compared with the mass of another, so that "mass" may be measured, but just what mass itself is, is not defined in terms of more fundamental quantities. Newton himself suggested, in a recognizably circular definition, that the mass of an object is the amount of matter it contains. Perhaps the way to leave the subject for now is to state that the mass of an object is that property that makes an object an object.

As far back as Arisotle, the idea of a "force" being a push or a pull was common. Furthermore, experience indicates that in the horizontal direction at least, it takes a push or a pull to start or stop a moving object. Newton generalized this experience and stated that forces cause masses to change their motion, i.e., to accelerate. A measure of a force becomes the amount of acceleration it imparts to a given mass. Thus forces may be defined and measured in terms of mass, distance, and time; the thre basic concepts.

What now, if an object is not acted upon by any force? Sharpening a conjecture of Galileo's, Newton stated his famous law of inertia: an object tends to remain at rest, or in a state of constant motion in a straight line unless acted upon by some external force. A free object therefore does not accelerate! A freely falling object is therefore not "doing what comes naturally": it is not "free". The idea of "natural" has changed. It is a mark of Newton's genius that he recognized at the outset what was to be meant by the "natural" or unperturbed state of a mass, even though in our experience no completely free object has ever been observed.

The finding and defining of a "natural" state seems to be imperative if one is to develop a broad framework for use in. description and explanation. Note, however, that this "natural" state is not necessarily the one that is most obvious at the outset. Consider the "natural" taste of water. Most folk would describe or think of it in terms of the fluid that comes from the faucet. Upon tasting pure water, the reaction is that it has a rather queer flavor. The "natural" state of water is really a most uncommon state. Might I be so bold as to suggest that perhaps one of the reasons that no broad underlying framework has as yet been developed in such areas as psychology, sociology, and even perhaps biology, is because no agreed upon "natural" state has been defined.

Now, using Newton's laws of motion, the effects of forces upon the motion and trajectories of objects could be predicted and described. The inverse was also true; given the observations of the positions and velocities of an object, one can deduce just how it is being acted upon by forces. So, since objects accelerate only when acted upon by forces, and since unhindered objects accelerate toward the surface of the earth when they are released, these objects must be acted upon by a force. We call this force "weight". The source of this force, though not defined and still only vaguely understood, is labeled "gravity". Thus the answer: "There is a gravitational force pulling the ball to the earth."

An elucidation of the behavior of the gravitational force was another of the fundamental contributions of Newton. He recognized that the falling of an object (an apple in the familiar story) was due to a gravitational force drawing the object to the earth. He further recognized that because the moon went round the earth, and because the moon is a mass which "tends to travel at constant speed in a straight line unless acted upon by some external force", there must be a force pulling the moon toward the earth. He then conjectured that the same force that pulls an object to the ground at the earth's surface might very well be the one that reaches out and pulls the moon. By thus extending the concept of gravitational force, Newton formulated a rule which described a general attraction between masses. Thc rule was amenable to mathematical manipulation, and could be written as an equation. Predictions based on it could be checked in the laboratory as well as by astronomical observations.

The success of this "law of universal gravitation" is well known: the scope and number of experimentally verified results deduced from this law are amazing. Using the rules of algebra, Kepler's three laws of planetary motion could be deduced. The spherical shape of the earth could be predicted, as well as the probability of the existence of an equitorial bulge.

The motion of the moon could be described and its future motion predicted. The existence of the tides is an expected result, deduced directly from the rule. A variation in weight with altitude was predicted and verified. A direct consequence of the law states the observation that at the surface of the earth, all objects fall with the same acceleration.

This law of universal gravitation is of a sort which is more general than the simple, direct, emperical laws of whch Kepler's rules were an example. A unifying concept—in this case the concept of gravity—has been extended to provide a theoretical basis, a framework if you please, for description, prediction, and explanation. Gravity itself is not defined; the rule descrbes the action of gravitational forces.

Notice a particular element of faith in the foregoing discussion. Newton assumed that the laws of motion which were validated by observations and experiments on the earth's surface, were applicable to the motion of the moon, an unreachable object far out in space. Not only was the idea of "gravity" extended, but the whole realm of the applicability of laboratory based experiments was vastly broadened. Today, this attitude is taken for granted: the chemistry of the stars is the chemistry of the earth; the laws of physics are applicable in the outer galaxies. The assumption appears very general: even in science fiction, the intelligent entities from other worlds are generally pictured as being the same sort of stinkers that we humans are.

The law of universal gravitation is an example of a good scientific theory. It correlates much data and experience. It relates hitherto unconnected events: the idea of the tides and the moon, the idea of the shape of the earth and the fact that it is revolving, the idea of weight varying with altitude. Its predictions, when they could be quantitatively checked, were found to be verified precisely. The law could be used to predict hitherto unknown phenomena.

Some one hundred years after the death of Newton, astronomers discovered a discrepancy between the predicted orbit of the planet and the actually observed orbit. Their discrepancy was small, but very definite. Either Newton's law of universal gravitation did not hold exactly for masses as far away as Uranus, or, there existed some hitherto unobserved mass out in the solar system, whose effect and presence had not been considered. Working backward from the observed effect, mathematicians in both England and France used Newton's law to calculate where in the sky this extra object must be. Astronomers looked, and the planet Neptune was found at the predicted location. The planet was discovered on paper before it was discovered in the heavens! Is it any wonder that the thinking of the world was shaken: one could presumably sit in an office, mentally juggle some numbers, and then tell an astronomer what he will see when he looks millions of miles out into space.

Other sources of forces were elucidated. Taking those into account, the past as well as the future behavior of a particle could be described and predicted in terms of a knowledge of its present position and velocity. With the rise of the atomic theory of chemistry, the Newtonian synthesis was made even broader. Everything is made up of tiny particles, and in the kinetic theory of gases, Newton's laws of motion were successfully applied to the individual atoms in order to predict the bulk behavior of gaseous materials. So far reaching was the success of Newton's ideas that to "explain" came to mean the giving or the describing of a mechanism: "giving a mechanism" meaning to describe in terms of particles obeying Newton's laws.

8. The object is in the gravitational field of the earth. The Newtonian framework was mathematically refined under men like Hamilton, Jacobi and others, and in time, it was also found that certain conceptual refinements were useful. Answers (8) and (9) illustrate a couple of these refinements.

The idea of a force acting across empty space is a bothersome one. To picture the transmission of a force, one needs some sort of "material" contact or connection. For example, just how does the earth reach out and hold the moon; how does the earth contact and twist a compass in order to make the needle line up north and south; how does a magnet reach out and pull a nail to itself? The idea of a force reaching out through space-action at a distance, as the physicists have called it—was repugnant even to Newton.

To circumvent this problem, a new concept was invented: the idea of a field. In the case of a magnet, the magnet is assumed to influence all of the space around it, and this region of influenced space is by definition the region in whch the magnetic field exists. Any other magnet or explanatory piece of iron brought into this region is influenced by the field; the stronger the field, the greater the influence. In a similar way, the earth is assumed to influence the region around itself, and to set up a gravitational field. Another mass in this region is attracted toward the earth by virtue of the presence of the field. It is convenient to picture these fields in terms of lines along which an exploring object will spontaneously move. In the case of the earth, the gravitational field would be pictured as lines extending directly out from the surface and a falling object comes in along one of these lines. The further out the lines go, the further apart they become, and therefore the weaker the field is pictured to be.

In physics today the concept of a field is considered more basic than the idea of a force although in the laboratory one still thinks in terms of forces and still measures intervals of space and time. The concept which was invented to make the explanation of a phenomena more compatible with one's feel for things, has become more basic than the original and perhaps more obvious concept that called it into existence. To a physicist, answer (8) is a simple, concise reply

to the original question. To the ordinary layman, it is probably unintelligible.

9. Objects tend to a position of lowest potential energy. Within the explanatory framework, certain combinations have been named. One of these is "energy".

The energy concept has proved to be tremendously useful in relating a number of previously disconnected observations. Heat, light, sound, motion, electrical currents, chemical bonding, etc., may all be correlated by the use of this concept. "Energy" is probably the most fundamental and most widely used concept in physics today: physics has sometimes been defined as the study of energy and its transformations.

The reason for the importance of this concept is that throughout every process which has so far been amenable to physical description, the amount of energy involved has been found to remain unchanged. That is, if one begins a process with a certain amount of energy, one finds that the same amount remains at the end of the process, although it may appear in a somewhat different guise. This particular observation is the basis of a different sort of law—a principle if you like—called the law (or principle) of conservation of energy.

There are several such conservation laws in use in the physical sciences. Throughout a chemical process, the amount of material involved at the beginning is the same as that at the end, although the properties of the materials may be considerably altered. This is the law of conservation of mass. The principle of conservation of heat is basic in the study of calorimetry. In modern science, conservation of mass and conservation of heat have been subsumed as merely special cases of the principle of conservation of energy. However, there are some other conservation laws: the law of conservation of linear momentum, the principle of conservation of angular momentum, the principle of conservation of electric charge, which are independent examples of this sort of rule. They are extremely convenient and in modern physics they are basic in their application.

Another principle, which to our knowledge has never been violated, states that when left to itself, a physical system tends to a condition such that its energy output possibilities are a minimum. Don't give up—this short statement is a succinct way of describing a variety of observations. Moving objects tend to slow down due to friction; hot objects tend to cool off; no engine is 100% efficient; water flows from a leak in a boiler; and of course, an object falls down when it is released near the earth's surface. This is the essence of answer (9).

By the year 1900 a language and a structure—called classical physics—based on Newton's mechanics and upon the theories of electricity and magnetism which had been developed in the nineteenth century had become the "common sense of the physicist." In fact, it was (and still is) the "common sense" of most people in the west. Space and time were fixed and absolute. They were continuous, and time flowed uniformly in one direction. In space, the shortest distance between two points was a straight line, and space was pictured somewhat like a big cupboard in which the galaxies, the solar system, as well as the atoms are situated, and in which all motions take place.

The universe was generally pictured as rather machine-like. Determinism in varied degrees became the rule of the day. Classical Physics was a closed system. All physical phenomena could presumably be explained within this one framework. Many philosophers and sociologists took a step further, and felt that the framework subsumed all of knowledge. Knowledge was limited; there was only a certain amount to learn because once learned, Newton's laws described the past and the future. Man was boundless; he was on his way to knowing everything. Although hindsight makes us feel that the folk at the turn of the century should have been much more suspicious, it is certainly true that a tremendous number of deductions which had been made on the basis of classical physics, did lead to descriptions and predictions which were experimentally verified.

10. Masses move along geodesics in space time. As new and more accurate experiments were performed, it became apparent that "common sense" was insufficient to explain all the observations. Internal inconsistencies arose: new deductions were not validated by experiment. Predictions as to the exact orbit of the planet Mercury could not be made without an uncomfortable stretching of the Newtonian framework. It could be deduced that one should be able to see a kettle of boiling water in a dark room, and this is just plain not the case. One should have different results if he performs electrical experiments on a moving train or if he performs them in a train station—a most discomforting prediction. Light falling upon certain metals was observed to release electric charges, and this fact could not be deduced in terms of the classical theories.

As in the case of all extensive explanatory frameworks, classical physics was very flexible. The "closed" system which is necessary for exact description and prediction was stretched and twisted in order to contain new information. However, it soon became apparent that the old system could not be reliably extended to explain an increasing number of new observations. The "closed system" had to be punctured. It still surrounded vast areas of knowledge, but it couldn't encompass all known physical phenomena. In the analogy of the filing cabinet: the old system had no room for a new set of folders.

New frameworks of thought have been invented and devised: quantum mechanics to describe events which occur in the realm of the extremely small, and relativity theory to explain events which occur in the realm of the extremely large or extremely fast. These new frameworks are far removed from "immediate ex-

perience." They picture a universe which has lost its machine-like qualities, but still is amenable to mathematical description. Relativity theory in particular has necessitated a change in our view of what space and time are like. Three-dimensional space and time have been combined in such a way as to form a four-dimensional manifold in which the concept of mass looses its substance and becomes a manifestation of distortion in the new space-time. These distortions then tend to coalesce in the shortest way possible. This is effectively what is meant by the statement that "masses move along geodesics in space-time."

Currently, the picture is by no means complete. It is true that classical physics is insufficient to explain all of the phenomena that has been observed, yet it is still the most complete and the broadest framework within which physicists may operate. In the past twenty years, ". . . the discrepancy between the classical mechanical thinking and the formal development of physics has further increased. At the same time there is no decisive advance in the emergence of a new comprehensive foundation that can be accepted with assurance."[4]

Conclusion. Explanation in the physical sciences means the logical (either inductive or deductive) fitting of an observation into an acceptable framework. Although perhaps implicit in the foregoing discussion, a final few paragraphs regarding the acceptability of a framework are necessary.

At least since the time of Galileo, a first (but perhaps not necessarily *the* first) criteria requires that predictions based upon deductions from the framework be experimentally verified. The verification must be quantitative and exact. In many of the newer theories, it is not required that the outcome of individual events be predictable, but statistical relations between these outcomes are to be exactly verified.

A second reason for the acceptance of a framework is its simplicity and mathematical beauty. In the rebellion which many feel heralded the dawn of modern science, Copernicus decried the cumbersome mathematical machinery necessitated in the Ptolmaic description of a geocentric solar system. The much simpler mathematics occasioned by the heliocentric picture was the only virtue of such a description: the predictions based upon deductions from the Copernican framework were no better than those deduced from the Ptolemaic. In more modern times, Dr. P. A. M. Dirac makes the following claim: "Relativity . . . was soon generally accepted by physicists. There are two reasons for this: (a) It is in agreement wtih experiment and (b) there is a beautiful mathematical theory underlying it, which gives it strong emotional appeal. The second reason is not so much talked about, but in my own opinion it is the stronger one . . . There is just one rock which weathers every storm . . . the assumption that the fundamental laws of nature correspond to a beautiful mathematical theory."[5]

Note that the mathematics may change. In the machine-like framework of classical physics the development of continuous connections between past, present, and future is describable in terms of continuous mathematics; the mathematics of the calculus and differential equations. In the newer theories, the beauty of the framework shows itself in a mathematics which deals more primarily with symmetries, with the mathematics of property, groups and classes of similarity. In any case, the beauty of the mathematics is a deciding characteristic of the accepted theories.

A third reason for the acceptance of an explanatory framework, a reason which might possibly be considered a subheading of the previous one, but which needs special emphasis, is noted in the following quotation from John Dewey. Concerning the acceptance of the theory of evolution, Dr. Dewey writes "If one . . . finds that some concensus of judgment has finally been reached, he discovers that this has come about not so much through exhaustive logical discussion as through a change in men's point of view. The solution is psychologically rather than logically justified."[6] Dr. Dewey is right. The theory or framework by which an event is explained must lead to verifiable predictions, yes; it must have a simplicity and a mathematical beauty, yes; but with it all, the scientists must like it.

EPILOGUE:
When initially presented, the ideas suggested in the above paper were made open for oral discussion and application. Since that is impossible here, the following short epilogue seems appropriate. Three points at which the foregoing material bears upon Christian thought and witness are noted, and are briefly presented as seed thoughts for further development and for grist in later discussions.

First, the tentativeness of physical theories—even the broadest and most widely accepted of them—has been stressed. Using pictures from the physical sciences as theological proofs or as foundations of faith is therefore both risky and suspect. The distinction must be clear: as theological analogies these laws and theories may be very helpful, but not as proofs. This statement is equally true for those who use the pictures of physical science as "anti-theological" proofs, and thus again just as truly, as foundations of faith.

Secondly, the movement in physics away from immediate experiment, the concomitant development of "axiomatic" formulations of historically empirically based theories, and the realization that these beautiful formalisms are the foundations of further thought has helped remove some of the so-called "scientific" bias against the "believing is seeing" emphasis in the message of JESUS.

Finally, in contrast with their counterparts in other disciplines, the physical scientists seem to worry less about attacks upon, or the demise of some well established theory. Physical scientists are also much

less prone to grace a mere guess with the description "theory": a tentative suggestion should be empirically, logically, and psychologically well established to merit that appellation. Thus, when a theory is found to be wrong or wanting, the reaction is often one of welcome excitement. (Witness the "overthrow of parity" in 1957.) The upshot is a frame of mind which is generally quite open—often quite open therefore, to a hearing of the message of the Gospel. At the same time however, the upshot is a frame of mind that eschews commitment—including commitment to JESUS, the CHRIST.

BIBLIOGRAPHY

1. Blurb from "Interscience Publishers", advertising the book "Philosophy of Science; Volume II", containing this quote from Nicholas Rescher, University of Pittsburgh.

2. Nagel, Ernest. *The Structure of Science*, Harcourt, Brace and World, Inc. (1961), chapter 2.

3. Aristotle. Physica. Book 2.3: see also Metaphysics, Book Delta 2.

4. Tisza, L. "The Conceptual Structure of Physics", in the Reviews of Modern Physics, Vol. 35, No. 1 (January 1963), p. 151.

5. Dirac, P. A. M. "Quantum Mechanics and the Aether", in the Scientific Monthly, Vol. 78, No. 3 (March 1954), p. 142.

6. Dewey, John. "Evolution and Ethics", in the Scientific Monthly, Vol. 78, No. 2 (February 1954), p. 57.

7. Ideas from so many books have been borrowed and presented in this discussion that it is impossible to note them all. Particular indebtedness, however, to the book "Introduction to Concepts and Theories in Physical Science" by Dr. G. Holton, and to the books "Concepts of Space" and "Concepts of Force" by Dr. Max Jammer, must be acknowledged.

Bibliography continued from page 78

Leakey, L. S. B., 1960 "The Origin of the Genus *Homo*", in Tax, 1960. 1961 "Exploring 1,750,000 Years Into Man's Past", *National Geographic*, October. 1963 "Very Early East African Hominidae and Their Ecological Setting", in Howell and Bourliere, 1963.

Leakey, L. S. B., J. F. Evernden and G. H. Curtis, 1961 "Age of Bed I, Olduvai Gorge, Tanganyika", *Nature*, Vol. 191, No. 4787.

Leakey, L. S. B., P. V. Tobias, and J. R. Napier, 1964 "A New Species of the Genus *Homo* from Olduvai Gorge", *Nature*, No. 4927, 4 April.

Simmons, E. L., 1963 "Some Fallacies in the Study of Hominid Phylogeny", *Science* Vol. 141, (6 September), pp. 879-889.

Straus, William L., and Charles B. Hunt, 1962 "Age of Zinjanthropus", *Science*, Vol. 136, No. 3513, (27 April) pp. 293-295.

Tax, Sol. (ed.), 1960 *Evolution After Darwin* Vol. II, *The Evolution of Man: Man, Culture and Society*. Chicago: University of Chicago Press.

VonKoenigswald, G. H. R., W. Gentner, and Lippolt, 1961 "Age of the Basalt Flow At Olduvai, East Africa", *Nature*, Vol. 192, No. 4804, pp. 720-721.

Warfield, B. B., 1911 "On the Antiquity and the Unity of the Human Race", *The Princeton Theological Review*, Vol. IX, pp. 1-25. Reprinted in his *Biblical and Theological Studies* edited by S. G. Craig, Philadelphia: Presbyterian and Reformed Publishing Company, 1952, pp. 238-261.

Whitcomb, J. C., and H. M. Morris, 1961 *The Genesis Flood: The Biblical Record and Its Scientific Implications*. Philadelphia: Presbyterian and Reformed Publishing Company.

Wilson, Donald R., 1962 "How Early is Man?" *Christianity Today*, Vol. 6, No. 24, (September 14), pp. 27-28. Reprinted in *The Christian Reader*, Vol. 2, No. 1 (Feb.-Mar., 1964), pp. 49-52.

BOOK REVIEWS

STUDIES IN GENESIS ONE

by Edward J. Young
Presbyterian and Reformed Publishing Co.,
Philadelphia, Penna., 1964. 105 pp., paper, $1.50.

This volume of the series of Biblical and Theological Studies edited by J. Marcellus Kik for Presbyterian and Reformed Publishing Company originally appeared as a series of scholarly articles by Professor Young in the *Westminster Theological Journal*. The concern of the author is strictly with exegesis of the Biblical text: he criticizes theological writers whose exegesis he thinks has been influenced unduly by science, and he himself tries to avoid encounter with scientific questions. Young argues against other theologians who interpret Genesis 1:1 as a dependent clause, against Rabast and Barth for their interpretation of the unformed state of the earth in Genesis 1:2, against von Rad and Orlinsky for their translation of "fearful storm" or "wind" instead of "the Spirit of God" in Genesis 1:2, and against Noordtzij and Ridderbos for their assertion that the form of Genesis 1 is that of a structural "framework" rather than a chronological sequence. Most ASA members will find these arguments too esoteric for a scientist to follow, requiring a technical knowledge of Hebrew, Greek, Ugaritic, and even Arabic—and with explanatory footnotes in Dutch, German, French, Italian, Latin, and Hebrew as well as English. However, peering at these technical arguments from the outside, a scientist does get the impression that even among conservative theologians who hold equally high views of the authority of Scripture there are many debatable points.

Young's conclusions are that the pattern of Genesis 1:1-2:3 is that of six days followed by a seventh, to be understood as a succession but with the length of days not specified; that the Hebrew word for day is used in two different senses in Genesis 1:5 and in a third sense in Genesis 2:4b; and that the terms "evening" and "morning" may be figurative ways of denoting a figurative "day," especially since the first three days were not solar days. Although the account of creation is in terms of fiat and fulfillment, process is not necessarily excluded, the language suggesting, for example, that the vegetation came forth from the earth as it does today. The purpose of the first section of Genesis (1:1-2:3) is to exalt the Creator who made heaven and earth by the Word of his power and adapted the earth for man's habitation, the chronological six-day format indicating that this was done step by step.

Young calls Genesis "semi-poetic" but regards it as straightforward history, meaning by history "that which actually happened," whether part of man's experience or not. The arguments that Genesis 1 is historical in this sense are that (1) it is closely tied to the subsequent genealogical part of Genesis, (2) the characteris-

tics of Hebrew poetry are lacking, and (3) the New Testament regards events in Genesis 1 as having actually taken place. Many ASA membrs will appreciate these conclusions but may feel there are theological problems yet to be faced by those who do wish to take scientific data into consideration. If we find creation "a very difficult doctrine to accept" it may be because of stubborn pride, as many theologians imply, but it may also be because the doctrine has been defined by conservative theologians in a way which we are not yet satisfied is truly Biblical.

For example, Young makes a deep distinction between God's work of creation and his work of providence without defining this distinction. Then he says that when we let our interpretation of Genesis 1 be influenced by what we know of science, we are limiting the power of God: "Why could not God in the twinkling of an eye have formed the stars so that their light could be seen from earth? We cannot limit the creative power of God by what we today have learned from his providential working." It seems possible to this reviewer that some of us might also be limiting the creative power of God by what we have learned exclusively from His revealed Word—or think we have learned from it. —Reviewed by *Walter R. Hearn, Associate Professor of Biochemistry, Iowa State University, Ames.*

THE NATURE OF THE NATURAL SCIENCES

by Leonard K. Nash
Boston: Little, Brown & Co., 1963. Pp. xix, 406.

It is not often that a reviewer has the right to claim for any book sufficient importance to deserve the attention of all his readers. But this is such a work: those who are interested in the eclectic purposes of our Association owe it to themselves to explore both the theme and the intelligent and highly informed analysis which Nash's study offers them.

The title is apt; the author actually does discuss the methodologies of working scientists, the formal structures of scientific theories and models as their advocates and critics have seen them, and the social character of the physical and biological sciences as they (or have been) lived internally and in external linkage with the general cultural atmosphere of the day. Most books on the philosophy and methodology of science tend to explore into the unrealistic paradigms which establish standards science never has, and probably never will, achieve. The scientist, consequently, finds them artificial and foreign to much of his thinking and action while the outsider (if he understands them at all) is given a distorted picture of real scientific work. Nash's work reveals a refreshing attempt to avoid this "idealistic" tendency. Again, few studies in the logic and operational work of the natural sciences pay sufficient attention to what one might call the psychology and sociology of science. Historians of science, sociologists such as Merton and Barber, and an occasional psychologist continue to remind us of the fact that the philosophy of science isolated from conditions of its development is blind, but not many listen. Nash is one of the few; possibly because he is a working chemist, and not a philosopher but, more than this, because he has really tried to understand what his fellow scientists have done and are doing and has obviously succeeded in gaining a great deal of wise insight as a result.

It is quite impossible to do justice to enumerating, let alone discussing, the theses of the book. Possibly an outline of some topics which are discussed will suffice to whet further interest. Nash begins with a fairly thorough treatment of the way in which we move from sense stimuli to constructs to concepts and to colligative relations among concepts. He then organizes this theme around the specific tasks of natural science in an interesting way. The foundation is now prepared for an extensive probing into the qualifications required of any subject matter claiming to be scientific and for a fine analysis of the cross-influences of scientific work and philosophy of the scientist. Following this Nash explores the sources of theories and laws on which such analysis is structured, and the use and nature of models. Finally, there is a neat dissection of the corroboration and falsification of scientific theories which leads directly both to discussion of the organization of the scientific community and to the psychological facets of research. The book concldues with the author's conclusions as to the character of the real world which science explores.

This reviewer, however enthusiastic, found a few points with which he disagreed and more where he felt there was oversimplification, but they cannot be explored here. None seems to seriously affect the values of the book. In any case, the work is so comprehensive and well-organized that anyone who desires to teach a course from it in the philosophy of science or in the nature of science for undergraduates will find it easy to leave the assimilation of the major proportion of the subject matter to the students' own reading and to use lecture time for elaboration and discussion of points of difference. That to my mind is the sign of a good text: not so simple as to be a useless adjunct to lectures and not so obtuse as to require slavish exegesis in class.

May I suggest that those reading, or teaching from, Nash's bok make the book even more valuable by supplementing it with readings from Bernard Barber or Robert Merton in the sociology of science, from Pap and Nagel and Popper in the philosophy of science, and with some papers from *Scientific Change* just published with A. C. Crombie as editor. If we take all this study to heart perhaps our attempts to place the sciences into a Christian world-view will be better informed and more heuristic than most of what I've read. —Reviewed by *Thomas H. Leith, York Universilty, Toronto, Ontario.*

THE PLACE OF PARADOX IN OUR CHRISTIAN TESTIMONY

J. OLIVER BUSWELL, JR.*

My contention is that our Christian program does not ask the non-Christian to believe any contradiction, seeming or real. My paper was written in answer to the view that paradox constitutes an essential part of our Evangelical testimony. Major attention is therefore given to such matters as the Incarnation and the Trinity.

I have written elsewhere on the ancient Greek[1] and modern mathematical paradoxes. The former were, in my opinion, well answered by Aristotle. The latter can be answered by a few rational principles such as: (1) A point is not a part of a line or space in any literal sense. (2) Infinity is not a "whole" or a sum or a total. (3) Changing definitions of symbols, as in modern arithmetic, does not produce real contradictions any more than any other shift of language or vocabulary.

Three distinct meanings of the word "paradox" must be recognized in good usage. (1) The word may mean *striking contrast,* or *startling and unexpected reality.* Examples are found in the words of the Lord: "He who wishes to save his life will lose it, but whoever loses his life for my sake, he will save it."[2] "Blind guides! Straining out a gnat, and swallowing a camel!"[3] Paradoxes of this sort give spice to our language and stimulus to our thought.

(2) A second type of paradox is *an apparent contradiction,* in which one is confident *that further light will remove the difficulty.* Of this type there are many Biblical examples: "Though He slay me, yet will I trust in Him."[4] God, though "omnipotent," and "not wishing that any should perish but that all might come to repentance," yet will abandon to "everlasting punishment" those who do not by their deeds give evidence of saving faith in Christ.[5]

(3) An *actual contradiction* is a third type of paradox recognized by lexicographical authorities. This type is not common in ordinary discourse. It is illustrated by any two unambiguous propositions which contradict each other, such as "All of the class S is included in the class P; and some of the class S is not included in the class P." Another illustration is an unambiguous self-contradictory proposition such as "Five plus seven equals ten." This proposition is a type-three paradox because the predicate contradicts the definitions of the terms of the subject.

BELIEVING A "TYPE-THREE" PARADOX

Since Hegel's principle of *Negativitat,* and especially since Kierkegaard's teaching that the Incarnation is a stark contradiction which must be accepted by the "leap" of faith, the movement in theology and philosophy which embraces paradoxes of this type and claims to believe both sides of palpable contradictions has been given great impetus. Thus Professor John Wild of Harvard and Northwestern frankly states that in Christian philosophy we cannot always adhere to the logical law of contradictions.

Now a self contradiction is a falsehood. The logical law of contradictories is an expression of the character of "God who cannot lie."[6] My first impulse is to call down fire from heaven upon those who "believe a lie"[7] and to class them all together with the followers of the "Son of Perdition."

However, two considerations modify,—not my opposition to self-contradictions,—but my attitude toward those who embrace them. (1) Many of these paradox lovers are *clearly not* of the class of people who "received not the love of the truth so as to be saved."[8] In fact, not to mention devout contemporaries, such saints as the anti-systematic Charles Simeon of Cambridge (1759-1836), and such heroes of faith as the inconsistent Martin Luther are among their number. Charles Hodges[9] cites a passage in which Luther vigorously denounces the doctrine that "what is true in religion is also true in philosophy."

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(2) A second consideration which deflects my indignation from the paradox lovers to their doctrine, is the fact that the evangelicals among them almost unanimously declare that they do not believe that "for God" any *actual* contradictions are "True." For human logic, they say, these type-three paradoxes are unresolvable, but God has a diferent kind of logic.

There is variety among these lovers of contradiction. (1) One group holds that God is the Author of the laws of logic, not in the sense that these laws are an expression of His immutable character, but in the sense in which an athletic commission may draw up the rules for basketball for 1963, and may modify those rules for 1964. God may even be expected to change the rules of logic in the middle of the game, or even retroactively. "Covenant Theology" emphasizes

that God keeps His promises, but this interpretation leaves us with no reliable promises of God which we can count on, for we may find that God's words do not mean what they say in terms of accurate lexicography.

True some of those who reason thus, hold that contradictions in Christianity must be limited and localized in a few areas like the doctrine of the Trinity and the doctrines of divine decrees and human responsibility. But it is not clear just how the contradictions are fenced in. If one equals three in the Trinity, why can I not use the same arithmetic in my income tax report? It solves so many problems!

(2) Another group of lovers of contradictions recognize the law of contradictories as implied in God's character of truth, and in the covenant character of Biblical revelation. For these no paradox which actually is of what I have called type-three is to be accepted as true. Yet a great amount of Christian doctrine which is hard to grasp, doctrine of the nature of the type-two paradox, is held to be actually unresolvable for finite understanding and so, for all practical purposes, of the nature of the type-three paradox.

The cliché "the finite mind cannot understand the infinite," has been taken by many as an axiom. This is not an axiom. It is a lazy minded false dogma. In mathematics the concept of infinity is well defined. It is a negative concept. We know the meaning of the term and know much of what we can and cannot do with it. In theology we know what we mean when we say "infinite power," "infinite knowledge", etc. Infinity is an intelligible negative concept, meaning "without limit."

I do hold that such phrases as "the infinite," or "infinity," without specification as to *what* is unlimited, are—not terms of mystery—but terms indicating clearly perspicuous nonsense. But the areas of theology in which the cliché "the finite cannot understand the infinite" is used to excuse unclear thinking, are areas in which the Bible makes positive statements in clearly definable terms.

If man is created in the image of God in the sense of John 10:34,35 where our Lord was quoting Psalm 82:6 —in the sense that man is a creature "unto whom the word of God happened *(egeneto)*," it would seem *a fortiori* that whatever God has said to man would be intelligible to man. The word of God requires the illumination of the Holy Spirit for its comprehension. It may be difficult, challenging, stimulating; but the notion that anything in the Word of God is *in principle* inscrutable, or contradictory for man as man, seems to me an improbable, yes, an evil dogma.

"THE CASE FOR PARADOX"

In a recent issue of the *Bulletin of the Evangelical Theological Society*[10] a scholar whose evangelical faith is above question has performed a genuine service in his article "The Postulate of Paradox." In well documented form, he has gathered together historical and contemporary material in support of a view of paradoxes which I consider erroneous. The article concludes, "Let us emphatically assert 'apparently opposite truths' remembering as a sort of criterion that very likely we are being loyal to the Bible as long as we feel upon our minds the tug of logical tension. Let us as evangelicals unhesitatingly postulate paradox."[11]

In the first place, the author fails to distinguish between the three types of paradox which I have defined above. He begins with I Cor. 1:18-24, and comments, "Yes, I seriously wonder whether we had better not reconstruct our apologetic and instead of keeping paradox hidden from sight . . . welcome it proudly into the very throne room of theology . . . So, begging the indulgence of my system-minded brethren, let me do some thinking out loud."[12]

But the propositions given here as an illustration, that God will save believers through a crucified Savior, astonishing as it is, is not in the slightest degree self-contradictory!

The article under review next brings in a distinction proposed by the Roman Catholic existentialist Gabriel Marcel, a spurious distinction between *problem* and *mystery*. Marcel says, "A genuine problem is subject to an appropriate technique by the exercise of which it is defined; whereas a mystery, by definition, transcends every conceivable technique."

It is the word "technique" which confuses the reader. If we understand by this word, a process which can be employed at will by the competent investigator, it is incorrect to say that problems are defined as being "subject to an appropriate technique." Many problems are of such a nature as to require waiting for revelation. Mr. Einstein was confronted with the problem as to whether light passing through vast astronomical distances, follows a Euclidian straight line, or whether it may be deflected by gravitational forces. Einstein had to wait for a certain eclipse of the sun before his crucial photographic experiment could be performed and the answer to the problem secured.

Similarly, whether we call our theological questions "problems" or "mysteries," to declare that clearer understanding of what is revealed can never, in this life, clear up our mysteries, is sheer arbitrary dogma, and negative dogma at that. I have discussed elsewhere[13] the scriptural meaning of the word *mystery*. It should be quite apparent that Marcel's usage of the word is quite contrary to that of the New Testament. A mystery is a secret. It may be hard to understand, but quite uniformly the New Testament writers, Paul especially, explain and clarify the mysteries to which they refer.

Further, in the article to which I am referring, we are told,[14] "Whatever may be the case in philosophy, in Christianity, as I see it, paradox is not a concession: it is an indispensable category, a sheer necessity—a logical necessity!—if our faith is to be unswervingly Biblical."

These words lead to the point that in common usage our word *logical* has different meanings. Strictly, the word signifies that which corresponds to the technical science of logic, the backbone of which is the law of

contradictories. But the loose usage is well established in good literature. We may properly say "The early explorers *logically* expected that they would find in the southern hemisphere great continents in the same proportion to the area of the ocean as in the northern hemisphere." In this latter sense, "logical" simply means "That which may reasonably be expected."

When we read "paradox is . . . a logical necessity," we do not understand that according to the science whose backbone is the law of contradictories we are to expect and believe propositions which violate this law. The kind of paradox which we expect, as Christians who believe the Bible, is not the paradox which violates the law of contradictories, but the paradox which reveals astonishing, unexpected truths.

Yet we read[15] ". . . before the bar of logic Biblical paradox is no mere seeming; it is a contradiction which cannot be broken down by the resources of human logic, not even by the resources of spirit-illuminated logic—at least in the world which now is." And again, "To be Biblically loyal must we postulate propositions which contain logically incompatible statements, doctrines which from the standpoint of reason are contradictory? Undeniably there are such paradoxes; and undeniably, therefore, we must formulate such propositions . . . at bottom what are those creeds except distilled paradoxes? Hence we must postulate paradox."[16]

In the article under review, the author proceeds to enumerate and discuss seven major paradoxes, that is, seven major doctrines in which, according to formal logic, he thinks, Christian theology must be held to be self-contradictory.

(1) "The Ontological Paradox." The author here introduces an extended quotation from Luther, including the words "But if He *[God]* should say from above, 'No, 2 and 5 are 8,' then I should believe against my reason and feelings." And the author concludes "There, starkly put is the ontological paradox of the Gospel."[17]

On the contrary, if I should think for a moment that I heard the voice of God saying "2 and 5 are 8," I should, on a moment's reflexion, know that it was not the voice of God which I had heard. The God of the Bible "cannot lie," and the statement "2 and 5 are 8," is simply a lie. The basic fallacy in what is here called the "Ontological Paradox" is the non-biblical assumption that the being of God is one in the sense of absolute simplicity without complexity. This has been stated in traditional theology, but it is not Biblical. It is Thomistic, derived in part from Aristotle, *Metaphysics* book *Lambda*. The Bible plainly teaches that "There is but one only the living and true God," and that the one only God subsists in complexity as Three Persons, each of whom possesses in absolute completeness all the substance and attributes of Deity. Even what little we know of human psychology ought to show us that here is no formal contradiction. James Orr suggests the complexity of individual human psychology in different centers of consciousness as a partial analogy to the Triunity of God. "Corporate personality" is not an unfamiliar concept in social psychology. True, these human analogies do *not explain* the Being of the Triune God, but from these illustrations it should be clear to all that when we preach the Gospel and declare the Trinity we are not asking men to believe a formal contradiction.

(2) "The Cosmological Paradox." Under this heading the author presents five distinct paradoxes, and it is hard to see any "logical" grounds for his subordination of these to the one heading. However, I shall pursue his order, since I do consider his article as an excellent presentation of the view which I would earnestly strive to correct.

(a) "Creation Out of Nothing." This doctrine is said to be "inconceivable," but here, as in so many instances, the word "inconceivable" is ambiguous. Probably the author means "beyond our imagination." There are many processes of which we cannot form a clear mental picture, but which are nevertheless rational concepts.

Creation out of nothing is not self-contradictory; it is the most probable cosmogony. The universe of things is made up of classes and particulars each of which is finite and perishable, none of which are evidently eternal. There are many reasons for doubting that the material universe is itself eternal. These I have discussed elsewhere. But if anything does now exist, then something must be eternal, or else something comes from nothing without a cause. If it is improbable that the material universe itself is eternal, it is still more improbable that something comes from nothing without a cause.[18] That the material universe was created, not from previously existing materials by a Personal Creator is the most probable of the alternatives ever suggested. In any case, the concept of creation out of nothing, surprising though it is, is not in any sense self-contradictory. Logically, either it is true or it is false, but there is no paradox involved.

(b) "Transcendent and Immanent." In this section the author quickly shifts ground from transcendence and immanence, in which obviously there is no contradiction, to *impassibility* and its opposite. He says "He *[God]* cannot, therefore, he thought of or spoken of in the passive voice. He is impassible."[1] This statement is preceded by the sentence, "That technical term of theology *[impassible]* is best understood from the grammatical use of the word 'active' and 'passive' for the two 'voices' of verbs."

To point out that in the Bible God is frequently the subject of a passive verb, is not a sufficient answer to this alleged paradox, for the notion of the impassibility of God has crept into the history of theology in a subtle manner and is firmly lodged in tradition. In the ancient church Sabellianism falsely taught that there is but one Person in the Deity, and that the Person who died on the cross is none other than God the Father, who assumed the *mode* of the Incarnation. The heresy of Sabellianism is a denial of the distinguish-

able Person of the Son, as well as the denial of the distinguishable Person of the Holy Spirit. But it is true that historical theology has sought to answer Sabellianism, not only by pointing out its anti-Trinitarianism, but also by advancing the doctrine of the impassibility of God.

Certainly *if* Deity is incapable of suffering, and if we maintain the Deity of Jesus Christ who suffered on the cross, we have a formal contradiction. But the answer is that the doctrine of the impassibility of Deity is wholly unbiblical, a merely pagan philosophical concept which has crept into Christian tradition through Thomas Aquinas from Aristotle's Unmoved Mover. The Bible presents no impassible God, but rather the opposite. In the Bible there is no paradox of impassibility.

In this same connection the author of the article under review introduces what seems to me a distinct subject, *perfection and changelessness.* Here again the problem comes wholly from pagan philosophy and not in the slightest degree from the Bible. God's perfection in the Bible is always presented as dynamic. God's character is perfect and does not change. God is always consistent and changeless in His *activities.*

(c) "Timelessness and Compassion." Here again we have the intrusion of a wholly pagan concept. Thomas Aquinas and Aristotle do have the notion of the Supreme Being existing in a static eternal *Now,* but this concept is wholly foreign to the Bible. God is clearly declared to be eternal in the sense that His Being has no beginning and no ending, and in the sense that His character is perfectly consistent at all times and under all circumstances. But the Bible never presents God as timeless in this static Aristotlelian sense.

(d) "Immutable and Compassionate." This is the same confusion expressed in different words.

(e) " . . . a Satanic power which . . . opposes God, a power so formidable that it could be conquered only by the death of incarnate Deity. But how can we reconcile this evil reality with monotheism and yet do justice to the Scriptural data concerning the power of this reality, a malignant will capable of defying God and necessitating the redemptive strategies of Gethsemane and Calvary?"[20]

This is more serious, not because it is at all difficult to see the fallacy, but because it is quite amazing that an evangelical should state the problem of evil in terms of God's limited ability to conquer the Devil! It is perfectly true that the Bible teaches that Christ by His death has potentially destroyed the power of Satan. This is clearly taught in Hebrews 2:14. But nowhere does the Bible teach that Satan's power could not have been destroyed in some other way, or that it was Satan's power which made necessary the sacrifice of Christ. Always in the Scripture Satan, since his fall, is presented as completely subject to the permissive will of God. This is well illustrated in the early chapters of Job, and in Christ's reference to the "binding" of the "strong man."

It may be argued philosophically that the permission of the existence of Satan actually intensifies and makes more vivid the sinfulness of sin, and the marvel of grace (cf. Luke 15:7); but that Satan could not have been destroyed except by the death of Christ is a preposterous non-biblical notion. It is not Satan but *the holy character of* God which requires the sacrifice of the cross. *If* God is to be *just,* as He eternally is, and at the same time the *Justifier* of the *unjust, then* the sacrifice of Christ is ontologically necessary. See Romans 3:26.

(3) "The Epistemological Paradox." The author argues, "Christianity insists . . . that such *[Gospel]* truth comes to us exclusively along the narrow corridor of Hebrew history. It insists . . . that such truth comes to us climactically in the strange career of a young Jew gibbeted on a cross. It insists, too, that such truth comes to us alone through the instrumentality of Holy Scripture . . ."[21]

But this is not what the Bible teaches! Peter said to Cornelius, "Of a truth I perceive that God is no respecter of persons; but in every nation he that feareth Him, and worketh righteousness, is accepted with Him."[22] Paul plainly described God's purpose that all men should "seek the Lord, if haply they might feel after Him and find Him, though He be not far from every one of us."[23] Paul emphatically proclaimed at Lystra that God "left not Himself without witness."[24] Harnack, in his work, *The Mission and the Expansion of Christianity in the First Three Centuries,* points to the universal design of the Old Testament prophecies. I have written elsewhere of the Biblical picture of Christ as a cosmic figure. Is it in vain that Abraham is said to be a believer in Christ, just as we are? True, the Judeo-Christian tradition is the *main stream* of revelation, but the Bible contains many references to the fact that Christ is "The Light that lighteth every man."[25] Who was Melchisedec? Or Balaam? Or who were the Magi who came to worship Christ at His birth? Did not these, outside the main stream, know the grace of God in Christ?

True, there is no salvation through any other name than the name of our Lord Jesus Christ, but the Christ of the Bible is the eternal Son of God "whose goings forth have been from old, from everlasting."[26]

(4) "The Anthropological Paradox." Under this heading the author groups three paradoxes.

(a) It is alleged that the Bible teaches that the image of God in man was *wholly lost* when man became a sinner, and yet that "the image of God can never be lost even in the greatest sin." But surely one must be a lover of paradoxes to find any contradiction in what the Bible actually teaches on this subject. I have referred above to the words of Christ as recorded in John 10 quoting from Psalm 82. Nowhere does the Bible teach that man's guilty, corrupt, and lost condition in sin involves the total loss of the image of God.

(b) Man's actions are said to be "simultaneously free and foreordained." But as I have pointed out elsewhere, Calvin in a truly Biblical distinction, explicitly teaches that God's permissive decrees are a part of His

total decree. Has the writer never read Charles Hodge's great chapter on the distinction between necessity and certainty?

To insist that there is here a paradox is to lay down the arbitrary dogma that *whatever ought not to be, ought not to be permitted!* One of the truths (among many errors) in the Progressive Education Movement is the value of learning by experience. By permitting Pharoah to sin[27] God brought into actuality in revelation His power, His name, His wrath, His ability to save, and His glory. Thus, by permitting this sin, He immeasurably enriched the spiritual and ethical values of the history of our redemption.

(c) "The Doctrine of Original Sin . . . is Biblical. You and I are guilty before God by virtue of Adam's sin." The writer forgets that the same representative principle by which the Bible teaches that we sinned through our representative, teaches that we died for our sins through our Representative on the cross of Calvary. After all, it takes serious meditation to comprehend the sociological fact of representation, even in secular sociology. It is no wonder that Biblical sociology has been so much neglected. But the point here in view is that the representative principle, in original sin, and in the atonement of Christ, is either true or false. There is no contradiction in the plain statement of the representative principle. Evangelicals must hold the principle to be true.

(5) "The Christological Paradox." In this case the difficulty depends entirely upon a pagan assumption brought in by Thomas Aquinas and others, the notion that God is the absolutely absolute or the infinitely infinite, as Spinoza says. Where in the Bible does one find that God is "unconditioned" in this sense of the word? I have written elsewhere at length in regard to the revealed attributes of God. Certainly the Bible teaches that God is omnipotent, omniscient, eternal, immutable in His character; but the notion that God is "unconditioned" in the sense in which this writer uses the term, is wholly unbiblical. The God of the Bible is intimately related to all the on-goings of the affairs of His universe.

The doctrine of the Incarnation does not teach that a square became a circle without ceasing to be a square. The doctrine of the Incarnation teaches that, since man is created in the image of God, there is no inconsistency in the concept that God has become man without ceasing to be God. See again the discussion of Christ in John 10, and His quotation from Psalm 82.

(6) "The Soteriological Paradox." One may deny that Christ, being free from sin, bore my sin in His own body on the cross of Calvary, but no one can point out any contradiction in the statement that He did so.

Furthermore in the statement of this so-called paradox it is assumed that the Bible teaches that Christ was a third party, originally unconcerned in my act of sin. On the contrary, the Bible teaches that Christ is the party sinned against, the second Person of the Triune Godhead. He is God against whom all sin is ultimately directed.

(7) "The Eschatalogical Paradox." Under this heading two alleged paradoxes are presented.

(a) The doctrine of the resurrection of the body is here declared to be contradicted by obvious physical facts. The fallacy, I think, lies in failure to note that numerical identity is in no way dependent upon identity of parts. Scarcely anyone would deny that the body in which one lives at the age of threescore and ten is the same body in which one was born. Yet probably there is not one molecule now in this body which was not added long after the individual's birth. The Bible simply teaches that the numerical identity of the body in the resurrection is one with the numerical identity of the body in which a mortal life is lived. The Bible is totally silent in regard to the molecular identity of the parts. The resurrection is a miracle, not involving any contradiction whatsoever.

(b) The paradox of "An Infinite penalty inflicted for finite transgression." But to speak of "finite transgression" is to neglect what the Bible actually teaches in regard to the nature of the sin of rejecting the grace of God in Jesus Christ. I have written at length on this subject. Let me point out briefly that the phrase translated "in danger of eternal damnation," in Mark 3:29 literally means "guilty of eternal sin." The one who rejects the grace of God in Jesus Christ and who is to be punished forever is one who has taken a settled attitude of hostility toward God's grace in Christ as mediated by the Holy Spirit. He is "guilty of eternal sin." He will never repent.[28] This fact is brought out by many Scripture passages. For example "If they hear not Moses and the prophets, neither will they believe though one should rise from the dead."[29] One may deny that the scriptural doctrine of eternal punishment for eternal sin is a profound truth, but certainly there is no contradiction in the doctrine itself.

WHERE DO PARADOXES BELONG?

Having enumerated the above alleged paradoxes, the writer proceeds in a little over four pages to attempt to show that he is not denying the rationality of the Christian faith. He tries to show that "the acceptance of paradox is no excuse for intellectual sloth."[30] I must state that for me this portion of the writer's argument is ineffective. In formal logic we learn that if a false statement is taken as true, every other conceivable statement is also true. Among Copi's illustrations one I remember is, "If Hitler was a great general, then I am a monkey's uncle!"

If something which the Bible declares to be true seems to me for the moment to be false, for me the only proper attitude toward the problem is to study and pray and wait for further light, while I cling to those plain and simple truths which are clearly revealed and not contradicted. But on the other hand, I am not required to believe that the Incarnation involves a contradiction analogous to the statement that a square has become a circle without ceasing to be a square. I am not required to believe that in the

Continued on page 96

MIRACLES AND THE STUDY OF ORIGINS

GEORGE F. HOWE*

Natural law *and* miracle *coexist as different but complementary activities of God. The thread of miracle is inextricably woven throughout Christ's life.*

Biblical *creation activity (Genesis 1) resembled Christ's earthly miracles (Matthew 15:28) because immediate results followed spoken words. God's consistent use of miracle when establishing new works (e.g. Mosaic exodus, Apostolic church) is evidence for miraculous creation. Construction demands more intense activity than does maintenance.*

Scientific *evidence points toward creation by miraculous means. Geochemistry still demonstrates the gross improbability of spontaneous generation. Genetic mutations are nearly all harmful. Only minor changes occur within the rich gene pools of original "kinds." Paleontology manifests multitudes of unfilled gaps. Evangelical Christianity holds the missing key to the origins problem—miracle (Isaiah 55:9).*

I. NATURAL LAW AND MIRACLES.

God has chosen to maintain the universe in a partly predictable fashion and at the same time man was endowed with the gift of prediction by means of the scientific method. Science is therefore man's realization of God's mandate to study the "natural laws" of the created universe, the laws by which God governs His handiwork. Concerning these cosmic laws, Colossians 1:17 says, ". . . and in him all things consist." God can likewise move miraculously, producing effects without any apparent natural causes. Such non-repeatable activity falls outside the domain of human inquiry because it cannot be subjected to laboratory analysis. Miracles are governed by direct spiritual causality which, by its very nature transcends all temporal "natural causality."

Natural law and miracle complement each other. Without God's natural law there could be no miracles. Alexander Bruce says that, "In the absence of fixed order, anything may happen, a centaur may turn up or a dead man come to life." (2, p. 46) God's maintenance laws are a uniform background against which His miracles become recognizable. Far from conflicting with each other, natural law and miracles are Divine counterparts.

Many books and papers have been written attempting to establish some relationship between natural law and miracle. Presently it will suffice simply to recognize that both phenomena exist and that each is of God.

Miracles play an important role in God's economy. Miracles demonstrate that natural law is *of* God but not *above* God. As R. C. Trench says,

> Did miracles serve no other purpose than this, namely to testify the liberty of God, and to affirm his will, which, however it habitually shows itself in nature, is yet more than and above nature, were it only to break a link in the chain of cause and effect, which else we should come to regard as itself God, as the iron chain of an inexorable necessity, binding heaven no less than earth, they would serve a great purpose, they would have not been wrought in vain. (12, p. 14)

Bruce suggests that if God's activity is restricted to natural laws only, then, "The world is not only God's dwelling-place, but His prison;. . " (2, p. 21)

The thread of miracle is inextricably woven throughout the entire fabric of Scripture. Miracles have been used by God to draw attention to Himself and to seal new revelation. Working through early prophets, God caused fire to come from heaven, bears to destroy delinquent youths, a dead child to live, oil to continually flow from a vessel, and a fiery chariot to appear. God also chose to use miraculous means in bringing His son to earth. Christ was born of a virgin, lived a sinless life, and returned bodily several days after His death and entombment. Not one of these propositions can be adequately explained in terms of God's maintenance laws. Christ performed a host of beneficent miraculous deeds during His three-year ministry. Warfield says,

> When our Lord came down to earth He drew heaven with Him. The signs which accompanied His ministry were but the trailing clouds of glory which He brought from heaven, which is His home. The number of the miracles which He wrought may easily be underrated. It has been said that in effect He banished disease and death from Palestine for the three years of His ministry. If this is exaggeration it is pardonable exaggeration. Wherever He went, He brought a blessing:
>
> One hem but of the garment that He wore
> Could medicine whole countries of their pain;
> One touch of that pale hand could life restore.
>
> We ordinarily greatly underestimate His beneficent activity as He went about, as Luke says, doing good. (13, p. 3)

The following passages from Bruce shows that the entire supernatural framework of the Christian faith is closely tied to the miraculous elements in the Gospel: "Remove the miraculous elements from the Gospel and few people would doubt the existence of a wise, philanthropic Judean sage!" (2, p. 79)

Any philosophic system which eliminates either natural law or miracle as a phase of God's activity falls into immediate error. Mediaeval supernaturalism erred in attributing many natural phenomena to miraculous

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Presented at the Nineteenth Annual Convention of The American Scientific Affiliation, at John Brown University, August 27, 1964.

intervention. At the other extreme, some Christian apologists today attempt to relate all miracles to natural law or some unknown "higher natural laws." Such a view treats God's miracle-working power inadequately and is (in the words of Bruce) "an eclectic half-way naturalism." (2, p. 13)

The goal of origin studies is to discover what methods God used in creation. Did He employ extra-natural means to establish life, or did He rely upon the same natural laws that can be measured now? This question is the heart of a controversial issue. It would be fruitless for Christians in natural science to argue individual opinions about how God created. We must ask, rather, "What does God *reveal* about how He created?" An answer can be attempted by turning to the Word and to the world.

II. MIRACLES AND CREATION IN SCRIPTURE.

An interesting parallel is seen between Christ's miracles and the Genesis 1 description of creation. Our Lord's spoken words brought immediate resultant action, without any apparent natural mechanism. For example when He spoke a word of rebuke, winds ceased and waves settled (Matthew 8:26). The words, "be it done unto thee" were spoken and a Canaanitish woman's daughter was healed (Matthew 15:28). As recorded in Matthew 21:19, one sentence left the mouth of Jesus and a fig tree immediately withered. Three words spoken by Christ in John 11:43 brought dead Lazarus out of the tomb. Christ's earthly utterances led directly to events that He willed. Turning to Genesis 1, a striking similarity is seen. The phrase, "and God said," appears at least 9 times. Six of these 9 spoken commands were followed by the phrase, "and it was so." God spoke and it was so. Thus the record of creative activity parallels the New Testament miracles in which Jesus spoke and events transpired. The very language used by Moses breathes of supernatural working. There is no indication of a long, naturalistic, uniform development. Other Bible descriptions of creation also indicate that miraculous results followed creative words. Hebrews 11:3, "By faith we understand that the worlds have been framed by the *word* of God, so that what is seen hath not been made out of things which appear." The very name given to the creating God demonstrates creation's method. It is significant and appropriate that He is called the "Word" in John 1. One *word* is spoken and worlds appear. As more divine *words* are pronounced, plants sprout from the pristine earth. Psalm 33:6 says, "By the *word* of Jehovah were the heavens made and all the host of them by the *breath* of his mouth." The language of Psalm 33:6 might be relegated to "poetic figure" were it not for other records of God's miracles. A comparison of this passage with the creative miracles of Christ on earth shows that the Psalmist is simply describing the exact and unprecedented creation phenomenon. After mentioning stars, light, waters, angels, and the moon, the psalmist says, "Let them praise the name of Jehovah for he *commanded* and they were created." (Psalm 148:5)

New workings of God, such as the establishment of the Christian church in apostolic days, were frequently heralded by supernatural demonstrations. Creation again runs parallel since it too is a novel or new situation. It is therefore entirely in keeping with God's nature to create and establish the universe by miraculous means and then to maintain it by natural laws. Such a change of action is seen in the construction business. While assembling a skyscraper, tools such as the bull-dozer, pile-driver, hammer, and power saw are used. Once the structure is completed, however, routine maintenance requires a different set of tools and activities. The riveting of girders and the pouring of foundations are replaced by the swish of a mop or the turning of a screwdriver. Construction calls for a more intense activity than does maintenance. The use of miracles in creation is therefore indicated in Scripture, in keeping with God's nature, and in keeping with the nature of the task.

III. MIRACLES, CREATION, AND SCIENTIFIC EVIDENCE.

Natural science will never be able to repeat and test any of God's miraculous acts in systematic fashion. The only way to estimate the scientific likelihood of miracle in origins is to see if life appears to have been established by non-uniform means. Evidences from three broad scientific disciplines will be briefly reviewed. There are obviously more than three sciences that have direct bearing on origin studies but the three selected yield the most direct and relevant evidence.

A. Geochemistry. Much stir has accompanied the recent laboratory synthesis of amino acids, proteinoids, and other organic substances under supposedly "prebiologic" conditions. Zeal has sometimes triumphed over knowledge in evaluating the geochemical data. Results, which are actually meager, are sometimes exaggerated and arbitrarily welded to transformistic theory. The experiments fall far short of demonstrating spontaneous generation or "abiogenesis." Paul Zimmerman cites Mora's estimate of the laboratory data as follows:

> These polymerizations are only exercises in synthetic organic chemistry. They use similar monomers, but they do not really resemble a self-perpetuating, coordinated process, and they do not lead to the synthesis of a living unit with the characteristic urge. They do not even produce functional polymers with a specific structure. (15, p. 15)

In two recent works, Zimmerman paints a realistic picture of the geochemical data (14) (15). These statements are not a depreciation of honest biochemical achievement but rather an appeal for a more scientific estimate of the *actual* accomplishments. The experimental syntheses themselves should be greeted with interest by Christians in science. Such studies will help reveal how much of creation work God could have performed by natural means, had He so chosen. As more studies are completed it will be possible to estimate more clearly where God's possible natural component in creation ends and where the miraculous component may begin. By natural means it may be possible to construct some crude models of living systems.

Such work would contribute basic information which could be used in the fight against disease and in the synthesis of food.

Yet even some of the compounds presently synthesized by natural means may have been established miraculously as components in created organisms. For example, weeks can be spent tending grape vines, picking the fruit, pressing the grapes, straining the mash, and finally producing wine. Christ did the same thing in an instant without appeal to natural means. In like fashion it is entirely possible that some of the molecules presently produced in laboratory syntheses were originally miraculously established.

Some geochemists argue that any reaction sequence which can be engineered in the laboratory will occur under natural conditions if enough time is available. The following illustration will demonstrate that such reasoning may be mathematically valid but scientifically meaningless. Cotton seed fibers can be harvested and spun to form thread. A weaver can then produce cloth on a loom. Skillful cutting and sewing will eventually yield human clothing. Thus by plan and purpose cotton fibers can be transformed into useful goods. But almost an *infinite* amount of time would pass before a "wash-and-wear" suit would arise from the cottonfield by chance. It is impressive that certain simple steps in the synthesis of protein and DNA have been accomplished *in vitro* within the multi-million dollar laboratories of state-sponsored universities and under the skilled guidance of Ph.D. biochemists. There is, however, no reason to believe that even such scanty steps would have occurred by chance in ages past within some supposed primordial brew. Concerning the argument for the "improbable becoming probable in time," Zimmerman cites Mora as stating,

> Using such logic we can prove anything . . . When in statistical processes the probability is so low that for practical purposes indefinite time must elapse for the occurrence of an event statistical explanation is not helpful. (15, p. 215)

B. Genetics. If special, miraculous creation was indeed God's method, then genetic studies should reveal stability of genotypes and only minor variations within the created "kinds." Experimental genetics indeed demonstrates the existance of smoothly functioning groups that permit very little crossbreeding and only slight modifications.

First class genetic evidence for miracles in creation lies in the fact that nearly all mutations are somewhat harmful. In recent articles, William Tinkle (11) and Walter Lammerts (9) (10) have showed the inadequacy of mutation and selection as a system of origins. Because it rests upon minor gene changes as the final wellspring of variability, neo-Darwinian transformism lacks a mechanism capable of producing the wide variety of well-adapted organisms. This problem was clearly seen by Richard Goldschmidt who took refuge in hypothetical "macromutations." Concerning the supposed role of micromutation and selection in producing the organisms of today, J. J. Duyvené de Wit has said,

> As a result of mutation we may get *alterations* with respect to certain *existing* characters, for example in the number and size of hair bristles in *Drosophila*, but it appears that after a number of X-ray treated generations, the induced mutations pertaining to a selected character reach a limited ceiling beyond which no further change occurs. This has become clear from extensive investigations by Scossiroli (1954). Moreover, and this is of crucial importance, mutations, and even series of directed mutations, never gave rise to the appearance of essentially new characters of generic magnitude. From this, it clearly appears that mutational changes remain structurally restricted to the basic genotype to which the race or species in question belongs. In other words, transformation of a given basic genotype into another one as a result of a series of one-directional mutations cannot be produced experimentally. (5, p. 9)

In another unpublished review, Duyvené de Wit concludes that selection and speciation do not yield richer gene pools and higher forms of life, but lead rather to genetic death through depauperization of existing gene pools:

> Natural selection acting upon the genomes of these genotypes decreases the amount of recombinational genic material contained in the gene pools of successive genetically related populations, ultimately leading to genetic death (as a result of genic exhaustion) of the end terms of the lineage or phylum as testified by the paleontological record. (6, p. 15)

C. Paleontology. Fossils yield the most direct evidence regarding origins. My recent review of paleobotanical evidence demonstrates that many of the major plant groups have appeared in the rock layers with no hint of any evolutionary ancestry (7). This evidence is a predictive consequence of a creationistic origins model but fits evolution theory only after considerable embarrassment, afterthought, and rationalization. Even scientists outside the ASA (who make no open claims of establishing a theistic science) recognize the overwhelming fossil evidence for creation. E. J. H. Corner of Cambridge University Botany School writes,

> Much evidence can be adduced in favour of the theory of evolution—from biology, bio-geography and palaeontology, but I still think that to the unprejudiced, the fossil record of plants is in favour of special creation. (4, p. 97)

Concerning supposed taxonomic evidence for evolution, Corner continues by stating that,

> If however, another explanation could be found for this hierarchy of classification, it would be the knell of the theory of evolution. Can you imagine how an orchid, a duckweed, and a palm have come from the same ancestry, and have we any evidence for this assumption? The evolutionist must be prepared with an answer, but I think that most would break down before an inquisition. (4, p. 97)

Seward (author of a four-volume classic in fossil botany) believed that the plant kingdom shows, ". . . not progressive development but persistence of types and the sudden appearance of new types." (14, p. 31) The same non-integration and good evidence for extensive polyphylogeny is apparent in the record of the animal world as reviewed by Kerkut (8), Duyvené de Wit (5) (6), and Berg (1).

Duyvené de Wit shows (5, pp. 4-6) how human paleontology demonstrates a gap of over 40 million years between the presupposed ancestor of the oldest known fossil men and the most human-like animal primate that could be considered his nearest cousin from the transformist point of view. Thus even if uniformitarian geological assumptions are granted, man stands alone, separated biologically from the animal kingdom by a vast paleontological gulf. The gulf which separates him culturally from the animal world has been

clearly presented by James Buswell III (3).

In the light of direct scientific evidence, special miraculous creation appears not only possible, but quite probable.

In conclusion, any creation philosophy which underrates the possibility of miracles is basically irrational for Christians. The admission of but one extra-natural act in Jehovah's dealing with mankind opens the door to considering hosts of supernatural deeds during creation week. There is ample evidence in both science and Scripture to grant miraculous creative action. All totally uniformitarian schemes of origin omit one essential item. The evangelical Christian in theoretical science holds the missing key to the origins problem—*miracle*. Two final Scripture passages demonstrate that God's activities are definitely beyond our scrutiny. Isaiah 55:9, "For as the heavens are higher than the earth, so are my ways higher than your ways and my thoughts than your thoughts." Romans 11:33-36 (Williams translation):

How fathomless the depths of God's resources, wisdom, and knowledge! How unsearchable His decisions, and how mysterious His methods! For who has ever understood the thoughts of the Lord, or has ever been His adviser? Or who has ever advanced God anything to have Him pay back? For from Him everything comes, through Him everything lives, and for Him everything exists. Glory to Him forever! Amen.

CONCLUSION:

Abstract: Both natural law and miracles exist. There is evidence in Scripture and science that God used miraculous methods in creating the universe.

REFERENCES

1. Berg, L. S., *Nomogenesis*, Constable and Co., Ltd., London, 1926.
2. Bruce, Alexander B., *The Miraculous Element in The Gospels*, A. C. Armstrong & Son, New York, 1897.
3. Buswell, James O. III, "The Origin of Man, and The Bio-Cultural Gap," *JASA* 13(2):47-55, June, 1961.
4. Corner, E. J. H. "Evolution" in *Contemporary Botanical Thought*, (Edited by Anna M. MacLeod and L. S. Cobley), Quadrangle Books, Chicago, 1961.
5. Duyvene de Wit, J. J., "The Paleontological Record and The Origin of Man, " Unpublished paper based on an address given to the Scientific Society of the University of the Orange Free State; August 28, 1963.
6. ———————, "Explanatory Supplement to The Paleontological Record and the Origin of Man," Unpublished paper, 1963.
7. Howe, George F., "Paleobotanical Evidences for a Philisophy of Creationism," *Creation Research Society Annual*, 24-29, 1964.
8. Kerkut, G. A., *Implications of Evolution*, Pergamon Press, New York, 1960.
9. Lammerts, Walter E., "Neutron-Induced Variation of Roses," *JASA* 13(1):2-6, 1961.
10. ———————, "Growing Doubts: is Evolutionary Theory Valid?" *Christianity Today* 4(24):3-6, September 14, 1962.
11. Tinkle, William, "Creation, A Finished Work," *JASA* 13(1): 15-17, March, 1961.
12. Trench, R.C., *Notes on The Miracles of Our Lord*, Reprinted by Baker Book House, Grand Rapids, Michigan, 1951.
13. Warfield, Benjamin B., *Miracles: Yesterday and Today, True and False*, Reprinted by Wm. B. Eerdmans Publlshing Company, Grand Rapids, Michigan, 1953.
14. Zimmerman, Paul A., (Editor and author of one chapter) *Darwin, Evolution, and Creation*, (Chapter by Wilbert Rusch also quoted) Concordia Publishing House, Saint Louis, Missouri, 1959.
15. ———————, "The Spontaneous Generation of Life," *Creation Research Society Annual*, 13-17, 1964.

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nature of God, 3 equals 1 at the same time and in the same sense of the words. I reply that as one who believes what the Bible really says, I refuse to hold such propositions permanently in suspense. ("Tension" I believe is the more melodramatic word!) I refuse to give allegiance to contradictions.

Paradoxes have a place in Christian experience and in Christian testimony; so has smallpox and so have broken bones. When I am confronted with an apparent paradox the last thing in the world that I can do with it is to accept it. I may have to wait for some time before the apparent contradiction is resolved. But, thank God, many apparent contradictions have been resolved by prayer and careful study. It seems to me that the only consistent attitude for one who believes in the God of truth, is to pray for a resolution of apparent contradictions as rapidly as God makes possible, and in the meantime to keep paradoxes in rigid quarantine until they are cured.

REFERENCES:

1. For these see "Zeno of Elea" in Ency. Brit.
2. This is one of the "doubly attested sayings." See Luke 9:24 and parallel passages.
3. Matthew 23:24.
4. Job 13:15.
5. Revelation 19:6; II Peter 3:9; Matthew 25:45,46.
6. Hebrews 6:18; cf. Titus 1:2; II Timothy 2:13.
7. II Thessalonians 2:9-12.
8. II Thessalonians 2:10.
9. *Systematic Theology*, Volume III, p. 80.
10. Vol. 7, No. 1, Winter, 1964.
11. P. 20.
12. P. 3.
13. Unless otherwise specified, my references here to what I have written elsewhere will be found in my *Systematic Theology*, and can be located by use of the index or the tables of contents.
14. P. 5.
15. P. 6.
16. P. 6.
17. Pp. 6f.
18. See the views of Fred Hoyle, the Cambridge physicist.
19. P. 8.
20. P. 9.
21. P. 10.
22. Acts 10:34, 35.
23. Acts 17:27.
24. Acts 14:17.
25. John 1:9.
26. Micah 5:2.
27. See Romans, Chapter 9.
28. Hebrews 6:6.
29. Luke 16:31.
30. P. 19.

LETTER TO THE EDITOR

May I venture a remark in connection with Thomas A. Leith's most instructive paper on Philosophy of Science in Volume 17, Number 1 of J. A. S. A.

On studying nature analytical-constructive reason (or reasoning) finally arrives at empty, abstract concepts of magnitudes, relations and forms. Mathematics is a product of pure reason. Thus at the end of the road down at the atom and sub-atom level reason sees itself in a mirror as it were. It seems that to "geometrical" (Pascal) reasoning the respective equations are what the empirical outer world "is." Not so to the mind as a whole. Logic is just its tool. Philosophy of Science investigates and explains the scientific method of gathering, measuring, counting, weighing, integrating, dematerializing observational data. Philosophy of Nature incorporates analytical reasons' last word in gnoseology. Philosophy of Science and Philosophy of Nature have little to offer Philosophy of Religion in its quest for meaning. Thank you.

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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.

OREGON — Ted W. Cannon, 633 N. 13th, Corvallis, Oregon

SAN FRANCISCO BAY — Richard Bube, 753 Mayfield Ave., Stanford, Calif.

SOUTHERN CALIFORNIA — David F. Siemens, Jr. 8222 Yarmouth Ave., Reseda, Calif. 91335

WASHINGTON-BALTIMORE — George H. Fielding, 5 Holiday Drive, Alexandria, Va.

WESTERN MICHIGAN SECTION — Albertus H. Elve, 1519 Rosewood Ave., S.E., Grand Rapids, Mich.

WESTERN NEW YORK — Philip H. Harden, Roberts Wesleyan College, North Chili, N. Y.

Membership application forms, ASA publications and other information may be obtained by writing to: AMERICAN SCIENTIFIC AFFILIATION, 325 Brett Building, Mankato, Minnesota 56001.