JOURNAL OF THE
AMERICAN
SCIENTIFIC
AFFILIATION

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

VOLUME 18 NUMBER 1 MARCH 1966

The Journal of the American Scientific Affiliation

The Journal of the American Scientific Affiliation is a quarterly issued in March, June, September and December. The office of publication and business office is Room 325—Brett Building, Mankato, Minnesota 56001. The printer is the Free Church Press, 1515 E. 66th Street, Minneapolis, Minnesota 55423, the editor is Russell L. Mixter, Biology Department, Wheaton College, Wheaton, Illinois 60188; the managing editor is Neal O. Brace, North Park College, 5125 N. Spaulding, Chicago, Illinois. Total copies printed is 2200, average number issued 2200, paid circulation 1600.

The subscription price is, one year $5.00; two years $9.00; three years $12.00. Single copies may be purchased at $1.25 each. Second class postage paid at Mankato, Minnesota. Back issues: $1.25 per issue from 1963 to date: $2.00 per volume or 75c per single issue before 1963.

Concerning subscriptions, changes of address, requests for back issues, and other business, address: Executive Secretary, The American Scientific Affiliation, 325 Brett Building, Mankato, Minnesota 56001.

Concerning manuscripts, notes, and letters for publication, address the editor.

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

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

MARCH, 1966 PRINTED IN THE UNITED STATES OF AMERICA VOLUME 18, NUMBER 1

VOLUME 18 1966

Published Quarterly by the
American Scientific Affiliation,
Room 325 — Brett Building, Mankato, Minnesota 56001

Printed in the
United States of America

THEOLOGY AND PSYCHOANALYSIS

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During the early centuries of scientific development science and theology had a mutually modifying influence on each other. More recently this modification has given way to antagonisms. Currently there is an acute lack of effective dialogue between evangelicals in science and theology, and an inability to communicate with each other. Too often attention has been focused on substantive issues instead of the metascientific *issues, which has led to confusing polemics. An example of this confusion is the issues involved in psychoanalysis, psychology, and psychotherapy. Personal examples of non-dialogue may provide helpful insights into more adequate approaches to mutual synthesis.*

A Prologue to Dialogue

There are several intents in these comments: a direct reply to R. L. Harris' comments in the December 1964 JASA, an open letter on evangelical theology and Christian thinking in science, and finally, a summary on the nature of psychiatry and psychoanalysis as related to this. My comments are purposely personal because the issues are personal, and the solutions lie on a personal basis. I am speaking of the collaboration between the evangelical theologian and evangelical scientist, perhaps partly represented in the American Scientific Affiliation and the Evangelical Theological Association. As a member of A.S.A. and E.T.S., and being both a licensed minister and a research psychiatrist, I would like to cite some of my personal experiences which exemplify the need for, and the lack of, collaboration.

As Example 1, about four years ago I organized a monthly seminar for evangelical scientists and ministers which met for almost a year. Several scientists attended along with the minister from his own church. Our striking and disconcerting experience was that the two could not talk to each other, could not comprehend the other's frame of reference, and could not find a mutual language to share thoughts and experiences. In lecturing at Christian colleges in scattered sections of the country I have found this same dichotomy among the faculty—the arts and science faculty and the religious faculty are not engaged in effective, or even intelligible dialogue.

The problem recalls C. P. Snow's[24] celebrated discussion on the dysjunction of the two cultures of science and literature. It is worth noting that a series of letters appeared in *Science* during 1964 refuting Snow's pessimism. Generally, the correspondents reported successful collaboration of the two cultures, *when* and *if* professionals in each tried to make themselves understood and tried to understand the other. I think that there is a lesson here for us. John Dillenberger[7] has beautifully documented the mutual modifications theology and science made upon each other until the middle of the eighteenth century. From that point onward theology assumed a defensive pose and ceased to modify or be modified by science.[15] Such has been our legacy, and remains our crucial problem today as Stevick[25] so forcefully reminds us.

As Example 2, I have recently presented several papers on theological perspectives in psychology.[18,19,20] In preparation I reviewed the systematic theologies and commentaries of many prominent evangelical theologians. I must regretfully report that they were of no help, because they seemed not to have taken modern psychology into consideration in their thinking. All theological systems rely upon some assumptions regarding the human nature, which affects the exegesis. The church fathers and the reformation theologians framed their theology upon the psychology of their

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day—and their exegesis shows it. Unfortunately, evangelical theology continues to operate upon the assumptions of medieval psychology and has not come to grips with implications of those assumptions or the assumptions of modern psychology. I do not propose that historic theology should be overthrown in the radical manner of many contemporary critics. But I do assert that evangelical theology has yet to seriously apprise itself of its own psychological assumptions, nor has it systematically studied the assumptions of psychology as they influence the construction of theology.[8,26] I must report that I have had to turn to other theologians,[17,23] instead of my evangelical colleagues, when I study such issues because my colleagues have not entered the dialogue yet. Parenthetically, our Roman Catholic colleagues have taken this issue seriously and have produced some provocative and constructive volumes.[4,6,16]

As Example 3, let me quote Harris' opinion that "the school of psychoanalysis is so directly anti-Christian that a Christian should directly disassociate himself from it." Such an opinion does not seem to be offered in the spirit of dialogue, or if it is, it is not a very inviting invitation! First, it appears from Harris' remarks that he is ignorant of differences between psychoanalysis, psychiatry, and psychotherapy. Second, I happen to personally know many, if not most, of the psychiatrist and psychologist members of A.S.A. While I do not presume to speak for them, to my knowledge most of them use psychoanalytic theories, concepts, and techniques in one way or another. Further, many of us were trained in psychoanalytically oriented psychotherapy, and some have completed their own psychoanalysis. Would Dr. Harris wish to excommunicate us? I think not. But I do think that this represents an instance of *non-dialogue*. There are other issues where I am sure there is honest disagreement between scientists and theologians who share the same evangelical commitment. May I suggest that we need our mutual resources to complement and modify each other's perspectives. But this can only occur as we respect each other, learn to understand each other, and try to communicate with each other.

Metascience in Dialogue

Although the phenomenal success of the experimental method allowed scientists to long ignore the logical processes and assumptions from which experimental methods proceed, the philosophy of science has now become a major preoccupation of twentieth century philosophy.[3,12] Related to the philosophy of science is *metascience* which is concerned with the logical framework of scientific theories and the role and nature of experimental assumptions.[2]

Every scientific discipline has its particular metascience structure and questions. It is rare that theology is directly relevant to the empirical operations of science. Rather it is at the level of metascience that the theology is not only relevant but indispensable. This fact is lost sight of in much theology-science dialogue. Take, for example, the replies and counter-replies on the Whitcomb-Morris volume, *The Genesis Flood*.[13] Almost all of the discussion is centered around specific scientific data, which cannot settle the theological issues. The real issues at the metascientific level were never raised and discussed. So I doubt that the disputants really can say where the honest disagreements lie, and then proceed to work out means of settling the issue by collaborative effort.

Another example of metascientific issues can be seen in the discussion about the role of psychological theories as they underlie various professions. Harris' takes exception to my use of professional role as a guide line. As a matter of precision, I was alluding to the method of social analysis which follows Talcott Parsons' functional social theory. It would be fruitless for Harris and me to argue cases without first reaching common agreement on the sociological frame of reference. Here we would need some sociologists to assist in the dialogue, and probably a philosopher to keep watch over our logic. (I might add that ASA sociologist Paul Peachey has just published a brief monograph which surveys some of these systematic issues.[21])

To sum up this point, the specific content of many theories is not the question, it is rather the construction and application of that theory. If we are to engage in more than idle speculation I would suggest that we engage in rigorous study to develop working propositions. In many areas of research today the complexities demand interdisciplinary research teams, and the same need exists for us. Can we respond at such a level of constructive collaboration?

A Case for Dialogue: Psychoanalysis

Since psychoanalysis has been a volatile issue in religious circles for some time it may serve as a timely example of some of the confusions that surround attempts at dialogue. It is necessary to distinguish between:

a.) Freud and his personal religious views
b.) a psychoanalytic theory of psychology
c.) psychoanalytic techniques and their modifications
d.) a metaphysical extrapolation of psychoanalysis

The reaction to Freud has often been all or none; usually not tempered by any critical knowledge. One of the predominant religious reactions has been violent hostility to both Freud and his theories. Personally he was agnostic and his well publicized monographs on religion were highly critical of organized religion. But Rieff[22] has called attention to his commitment of humanism and moralism, and Freud himself admits to the positive effects of religion upon personality. Yet this should not deter us from separating the man from his theories. The truth of Einstein's theories has nothing to do with the fact that he was as ardent an agnostic as Freud.

Many religionists turned from Freud to other psychoanalysts, Jung, Adler, and Rank who framed their

theories in more religious terms. This was no more satisfying since only the words were reassuring—the meanings were no more pro-Christian than Freud's. Others looked to the neo-Freudians, Horney, Fromm, and Sullivan, only to find a metaphysical humanism. Thus the reaction to Freud's personal views without coming to grips with his observations led to premature conclusions about his work. The critics were reacting to the scientific data instead of looking at the metascientific issues. Further, it has often been *either* psychoanalysis *or* some other psychology, as if they were mutually exclusive. This fails to appreciate phychoanalysis as part of the whole science of psychology, and its adequacy as a theory will be determined by the interplay of continuing modifications within general psychological theory. And finally, I do not know of *any* psychological theory which is either more or less Christian as a theory, such is not the issue. On the other hand, there are issues of how a theory is related to an over-all metascientific understanding of man.

There are issues of psychotherapeutic technique to which theology is relevant, but we have to ask the right questions. A common error is to assume that the psychoanalytic model is the standard for all psychotherapy. There are limited and specific indications for this model. Actually, all psychotherapy techniques involve certain moral and ethical questions which we need to seriously examine.[1,10,14] But this is not limited to psychoanalysis.

Finally, it is true that some psychoanalysts have taken their professsion as their religion and are highly critical of Christianity. But the same is true of certain biologists, chemists, physicists, etc. Unfortunately, Freud and psychoanalysis have been the scape-goats and whipping-boys for those who do not understand the issues and persist in the demolition of straw men instead of working at constructive syntheses.

In conclusion there are certain issues which do require our attention in psychoanalytic metascience. They are the questions of: a.) determinism, b.) hedonism, c.) relativism. It is beyond our scope to seriously discuss these issues, save to suggest that they have been misunderstood by some, rethought by others, and are being modified in contemporary psychoanalytic thinking, as exemplified in the work of Colby,[5] Hartmann,[11] and Erickson.[9] It is at this level that Christian theology may appropriately contribute.

Summary

I have chosen some of my personal experiences to illustrate the lack of, and need for, constructive dialogue between the evangelical theologian and scientist. I have suggested that such dialogue must concern itself with fundamental issues at the level of metascience. Further, such dialogue needs to reserve its judgment and develop working hypotheses on the basis of interdisciplinary collaboration. Finally, I have outlined some of the confusions which exist in the dialogue about psychoanalysis. Often there has been misguided hostility, whereas we need constructive contributions to issues where our Christian commitment is relevant.

REFERENCES

1. Buhler, C. *Values in Psychotherapy.* Free Press of Glencoe: New York, 1962.

2. Bunge, M. *Metascientific Queries.* C. C. Thomas: Springfield, Ill., 1959.

3. Burtt, E. A. *The Metaphysical Foundations of Modern Science.* (rev. ed.) Doubleday: Garden City, 1932.

4. Caruso, I. A. *Existential Psychology—From Analysis to Synthesis.* Herder & Herder: New York, 1964.

5. Colby, K. M. *A Skeptical Psychoanalyst.* Ronald Press: New York, 1958.

6. Daim, W. *Depth Psychology and Salvation.* Ungar: New York, 1963.

7. Dillenberger, J. *Protestant Thought and Natural Science.* Doubleday: Garden City, 1960.

8. Doniger, S. (ed.) *The Nature of Man in Theological and Psychological Perspective.* Harper: New York, 1962.

9. Erickson, E. *Insight and Responsibility.* Lectures on the Ethical Implications of Psychoanalytic Insight. W. W. Norton: New York, 1964.

10. Frank, J. D. *Persuasion and Healing.* Johns Hopkins Press: Baltimore, 1961.

11. Hartmann, H. *Psychoanalysis and Moral Values.* Inter. Univ. Press: New York, 1960.

12. Horowitz, I. L. *Philosophy, Science, and the Sociology of Knowledge.* C. C. Thomas: Springfield, Ill., 1961.

13. Letters to the Editor and Revlews. *J. Amer. Sci. Affil.* 16: 59-63, June, 1964.

14. London, P. *The Modes and Morals of Psychotherapy.* Holt, Rinehart, & Winston: New York, 1964.

15. Merton, R. K. "Puritanism, Pietism, and Science." In *Social Theory and Social Structure.* (rev. ed.) Free Press of Glencoe: New York, 1957.

16. Oraison, M. (ed.) *Sin: A Symposium.* Macmillan: New York, 1962.

17. Outler, A. C. *Psychotherapy and the Christian Message.* Harper: New York, 1954.

18. Pattison, E. M. *An Evangelical Theology of Hostility.* Read to the Psychiatry Section of the Christian Medical Society, May, 1963, St. Louis.

19. Pattison, E. M. *On the Failure to Forgive or to be Forgiven. Amer. J. Psychotherapy,* 19:106-115, Jan., 1965.

20. Pattison, E. M. *Contemporary Views of Man in Psychology, J. Religion and Health* 4:354-366, 1965.

21. Peachey, P. *Who Is My Neighbor?* (Institute of Mennonite Study Series, No. 4) Faith & Life Press: Newton, Kansas, 1964.

22. Rieff, P. *Freud: The Mind of the Moralist.* Viking Press: New York, 1959.

23. Roberts, D. E. *Psychotherapy and a Christian View of Man.* Scribners: New York, 1950.

24. Snow, C. P. *The Two Cultures and the Scientific Revolution.* Cambridge Univ. Press: New York, 1959.

25. Stevick, D. B. *Beyond Fundamentalism.* John Knox Press: Richmond, 1964.

26. Tillich, P. "The Impact of Pastoral Psychology on Theological Thought." In *The Ministry and Mental Health.* Hoffman, H. (ed.) Association Press: New York, 1960.

"A careful Christian thinker will realize that both 'projection of culture' and 'domestication of the universe' occur in Christian thinking to a greater or less degree depending upon the sophistication of the thinker. We are all too prone to interpret God in our own image rather than realizing that the picture which He has given of Himself Who is on the supercultural level has to be expressed in cultural terms in order to be intelligible to us who live on a cultural level."

William A. Smalley and Marie Fetzer in *Modern Science and Christian Faith,* F. Alton Everest, editor, Scripture Press, Wheaton, Ill. Reprinted by permission.

THE CONFLICT BETWEEN CHRISTIANITY AND BIOLOGICAL SCIENCE

DAVID F. SIEMENS, JR.*

The estrangement of Christianity and science, generally held to begin with Copernicus or before, developed much later. The real battle came after the publication of Darwin's The Origin Of Species. *The crucial event was the debate between Thomas Henry Huxley and Bishop Samuel Wilberforce, behind whom stood Sir Richard Owen. The development leading to this event is traced.*

In a previous article (*JASA*, 16:12-15, March, 1964), I noted that Copernicus, Galileo and Kepler were not persecuted for their scientific discoveries. There was fundamentally no official distrust of science or of scientists. More recently there has been great mistrust of religion by scientists and suspicion of science by Christians. How did the official encouragement of Copernicus and Galileo by the church turn into distrust?

To be sure, the action of the Inquisition in trying Galileo was taken by Descartes as an attack on scientific conclusions rather than as a personal vendetta. He wrote to his friend Mersenne:[1]

> You doubtless know that Galileo was recently arrested by the inquisitors of the faith, and his opinion about the movement of the earth was condemned as heretical . . . I well know that one can say that all that the inquisitors at Rome decided is not an article of faith, and that it is first necessary that a council pass them; but I am not so much in love with my thoughts as to want to take advantage of such exceptions in order to maintain them; and I desire to live in peace and continue the life I have begun in taking for my motto *"bene vixit qui bene latuit."*†

Other Catholics such as Gassendi, the noted philosopher and physicist, felt that there was no restriction on science as a result of Galileo's condemnation. However, in the decades following, the anti-scientific feeling increased. For example, in 1693, when Viviani wanted to publish a corrected edition of Galileo's *Dialogue*, he was told:[2]

> There is a general movement here in Rome against the physicists. . . . there is talk of a general prohibition against all authors of the new physics, including Gassendi, Galileo and Descartes.

However, this anti-scientific attitude generally died down. For example, Niels Steensen (Nicolaus Steno), called "the Father of Modern Geology," made his contributions to geological science after his conversion to Catholicism in 1667, yet rose to become a bishop.

This disapprobation of science was not a problem outside of Catholic countries. No conflict between science and the Reformed or Lutheran faith was recognized. Francis Bacon, for example, presents a thoroughly Reformed view of nature in his urging of scientific research. He says that science is "for the glory of the Creator and the relief of man's estate."[4] And the work of the Royal Society is "for the Glory of God."[5] Newton wrote more theological treatises than scientific ones. He may have been heterodox, but not in his exaltation of Scripture.[6] Other leaders in science were clergymen, such as Adam Sedgwick and William Buckland, geologists, and Joseph Priestly, the chemist. There were devout Christians, such as Michael Faraday, James Clerk Maxwell, Lord Kelvin, Robert Boyle, Robert Hooke, noted physicists; Louis Pasteur, bacteriologist and chemist; Carl von Linne and John Ray, biologists; William Whewell, mineralogist. Such devout men were in the forefront of science, something that

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has not been true for most of the last century. Indeed, it was just over a century ago that the battle really began, with encounters between Protestants and scientists. It is notable that the Catholics were not so seriously affected.

By the start of the battle I am not referring to the publication of the *Origin of Species* in 1859. The start of the battle came the evening of June 30, 1860, at Oxford. The first skirmish was fought between Samuel Wilberforce and Thomas Henry Huxley. Up to this time, there had been no sharp division between the views of scientists and theologians: there had been discussion of the theory of evolution, but scientists and theologians had been together in both opposition and acceptance. But after the debate, scientists became more and more mobilized against the Bible. Why? Because Wilberforce represented himself as the defender of orthodoxy, and his claim was believed. But Wilberforce did not know the scientific aspects of the matter. So he filled in with guesses, misinformation and, most important, sarcasm. This so alienated the scientists that they turned against religion almost in a body. Even today, Christians face special problems relative to science. It is not usual to find the clear faith of a Galileo, that the Word and the world agree.[7] The members of the American Scientific Affiliation are a notable exception to the isolation of Christianity from science. To understand the occasion of the estrangement, we need to go back before that June evening, to become better acquainted with the participants in the debate.

Huxley was, at the time of the debate, thirty-six years old, a professor of natural history and paleontology at the Government School of Mines in London, a well-known lecturer—both in popularizations and on the technical level, an investigator and author. He had begun his career as a naval surgeon on the frigate *Rattlesnake,* which, during a three-year period, mapped the waters of northeastern Australia. He published two papers during this period, and gathered additional material to write up. His researches were so notable that he was elected Fellow of the Royal Society and awarded the Royal Medal. It was during this period that Richard Owen, the most famous English biologist of the time, had helped him. Owen, the British Cuvier, had helped a number of promising young scientists. But he had two major flaws: First, he adopted the unfortunate idealistic theories of Oken and maintained them in defiance of fact. Second, he became very jealous when his protégés showed too much promise. Indeed, shortly after Owen had helped him the first time, and about the time he was writing an excellent letter of recommendation for Huxley, the latter noted that he had better keep a new paper out of Owen's hands to avoid its being delayed.[8] But even more, Owen was offended when Huxley vigorously attacked Cuvier, the patron saint of comparative anatomists.

Owen thought he had a chance to trim Huxley down to size when, in 1856, Owen was given permission to lecture at the School of Mines, where Huxley was professor. Owen deliberately took the title Professor of Paleontology, which belonged to Huxley. This was challenged by the school, which asked for an explanation. This Owen could not give. This impertinence completed the alienation of Huxley, who was the wrong man to alientate, for he was an accomplished scientist, one who made valuable contributions in anatomy, anthropology, comparative anatomy, embryology, paleontology and taxonomy. Now he felt completely free of any debt, ready to tackle Owen's ideas without any qualms.

Owen opened himself to attack in a paper read to the Linnean Society in 1857. He declared that there were areas of bone in the human skull which are not homologs of primate bones, while at the same time declaring that man and monkey are homologous down to the last metatarsal.[9] Huxley, in a series of papers, began to point out the inconsistencies in Owen's views. Then, in 1858, he launched a devastating attack in the Croonian Lecture before the Royal Society. With pointed cruelty, the lecture was delivered on an evening when Owen was chairman.

Owen wanted to retaliate, but he knew he would have to be careful. He, the most noted scientist in England, had been humiliated by a relative upstart. When Huxley espoused the cause of Darwin's *Origin,* Owen attacked the book in a bitterly critical review, but anonymously. He also thought he had found a way to squash Huxley: he would sic the finest debater in England on him.

Samuel Wilberforce, Bishop of Oxford, was a brilliant man, an exceedingly hard worker. But he also had a way of getting into trouble. He later got the nickname "Soapy Sam," which he explained with, "I am always in hot water and always come out with clean hands." While Wilberforce was noted for his work for the church, he was equally noted for his strenuous efforts to help himself. And this was a time when he needed to be advanced. Two brothers and a brother-in-law had left the Church of England for the Church of Rome, and people were wondering if Samuel would do the same. They might well wonder, for his daughter and son-in-law and another brother would also become Roman Catholic. Further, he had just mishandled a controversial situation involving the appointment of a man accused of Arianism as a bishop. As a result, Wilberforce's wisdom and leadership were being questioned. He needed something to bolster his prestige. A notable success in this debate would build him up again as the champion of orthodoxy. He felt that he could not lose. The debate, at the meeting of the British Association for the Advancement of Science, would be held at Oxford, where he was very popular among both students and townspeople. Not only would he have a friendly audience, but he would have the coaching of the great Owen—whom he overrated as much as Owen overrated himself. Wilberforce felt he could not lose.

Wilberforce had a quick and retentive memory, but a few hours cannot give a man a thorough enough scientific background for debate with a brilliant scientist. The closest Wilberforce could come to scientific training was an honors degree in mathematics, nearly as old as Huxley. As a result, Wilberforce made some erroneous statements in the debate—matters which were not lost on the scientists in the audience, and which were pointed out by Huxley for the benefit of the lay audience. When Wilberforce, in his conclusion, descended to asking whether Huxley claimed descent from monkeys on his mother's side, trying to appeal to the Victorian prejudice that made women angels, Huxley had him.

Huxley's reply, "I would rather be descended from a poor chattering ape than from a man of great talents who would appeal to prejudice rather than to truth," was devastating.[10] Wilberforce was finished, and so was any possibility of presenting Biblical Christianity to the scientists, for Wilberforce's claim to speak for orthodoxy was believed. Hence orthodoxy was associated with shallowness, prejudice, ignorance, error, egotism and opposition to science. This association has hardly been lived down today. Anyway, the first books on the battle between religion and science appeared in 1874 and 1895.[11] They read the then current situation back into the earlier period.

Some have wondered whether this analysis does not place too great blame on Wilberforce. Would not the same results have been reached eventually? It is always a problem to second-guess history. However, it may be noted that it would be difficult to find another man who would, before the world, be so definitely a representative of orthodoxy.[12] Disraeli and Gladstone, as laymen, did not have this identification. And, had the battle not been engaged, it is doubtful that William Jennings Bryan would have been recognized as the knight-errant of orthodoxy at the Scopes' Trial in 1925. It seems rather that the communication of scientists and theologians would have continued.[13]

This would not have solved all the problems. But, where there is communication, there is at least a chance for finding solutions. And, further, the continuation of communication would have helped to keep the problems in proper perspective: the battle is not the study of the universe and the creatures in it versus the study of God's self-revelation. It is the philosophy that denies God or tries to reduce the Deity to man's petty standard versus the acknowledgement and worship of the Almighty. But whenever ignorant, self-seeking men intrude, the picture changes. Confusion is introduced. And, always, the cause of the Christian, who worships the Source of all truth, suffers; for God cannot be honored nor His kingdom advanced by falsehood, egotism, ignorance and prejudice. May He deliver us from such.

REFERENCES

1. On January 10, 1634. Quoted by Giorgio de Santillana, *The Crime of Galileo* (Chicago: The University of Chicago Press, 1955), p. 319f, n. 21. Author's translation.

2. De Santillana, *op. cit.*, p. 197, n. 5.

3. Niels Hansen, "Steno, Nicolaus," *Catholic Encyclopedia*, 14:286.

4. Francis Bacon, *Advancement of Learning*, Bk. I, v, par. 11. In *Great Books of the Western World*, 30:16.

5. Cited by Edgar Zilsel, "Genesis of the Idea of Modern Progress," *Journal of the History of Ideas*, 6:348 (1945).

6. Note, for example, his studies of prophecy, published posthumously. His *Historical Account of Two Notable Corruptions of Scripture* indicates a high regard for the exact word of Scripture. This work has been made grounds for attributing Socinian views to Newton, but this interpretation is questioned in the *Dictionary of National Biography*, 14:391.

7. Galileo, *Letter to the Grand Duchess Christina*, in Stillman Drake, *Discoveries and Opinions of Galileo* (Garden City, N.Y.: Doubleday Anchor Books, 1957), p. 182f.

8. The original published letter omits the name. See Leonard Huxley, *The Life and Letters of Thomas Henry Huxley* (New York: D. Appleton and Company, 1900), 1:105f. But see Cyril Bibby, *T. H. Huxley, Scientist, Humanist and Educator* (London: Watts, 1959), p. 72, and William Irvine, *Apes, Angels and Victorians* (New York: McGraw-Hill Book Company, Inc., 1955), p. 39.

9. Irvine, *op. cit.*, p. 40.

10. There is no exact record of Huxley's extempore remarks, and so there is no agreement as to the exact words he used. But this is accurate enough. The matter is discussed at length in Huxley, *op. cit.*, 1:192-204. Reference is made in Charles E. Raven, *Science, Religion and the Future* (Cambridge: Cambridge University Press, 1957) and David Lack, *Evolutionary Theory and Christian Belief: The Unresolved Conflict* (London: Methuen & Co. Ltd., 1957), which may be consulted for information on the period, along with the biographies of the participants. See also Edward Leroy Long, Jr., *Science and Christian Faith: A Study in Partnership* (New York: Association Press, 1950).

11. John William Draper, *A History of the Conflict Between Religion and Science* (1874). An abridgement by Charles T. Sprading was published in 1926.
Andrew D. White, *A History of the Warfare of Science with Theology in Christendom* (1895). It was republished as recently as 1960.

12. This is the studied opinion of Raven, *op. cit.*, pp. 35f, 41, and Long, *op. cit.*, p. 25f. It is denied by Lack, *op. cit.*, p. 12f.

13. See Raven, *op. cit.*, pp. 35f, 46f.

† A misquotation from Ovid, *Tristia*, Bk. III, eleg. 4, line 25: "*Bene qui latuit, bene vixit,*" who has hidden well, i.e, lived obscurely, has lived well.

"In fact it has been the observation of the best translators of the Bible into 'primitive' languages that the truth of the Scriptures can be expressed in any language, even though neither the language nor the culture has specialized in philosophical or theological questions, and even though the culture itself is entirely different from the culture described in the Scriptures. If one language has a richer literature than another, such a fact is the reflection of the extralinguistic cultural setting, of a poetic, narrative, or even philosophical attitude developed by the emphasis of the culture or of a part of it."

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THE WHOLE AND THE SUM OF ITS PARTS

A UNIFYING PERSPECTIVE ON MAN AND THE WORLD

RICHARD H. BUBE*

Introduction

The geometric axiom that the whole is equal to the sum of its parts is familiar to every high school student of geometry. Not so familiar, however, is the application of this axiom as a basis for the understanding of man and the world. In transplanting the axiom from its geometric context into a metaphysical context, two types of fallacies are frequently introduced.

The first fallacy is that the whole is *identical* with the sum of its parts. It is contended that if all the parts are understood as separate entities, then the whole that exists as their sum is also understood in terms of the same characteristics that define the parts. No characteristic or property of the whole can exist that does not exist in the parts from which the whole is composed. This is a fallacy of scientism.

The second fallacy is that the whole is more than the sum of its parts because something has been added from *"outside"* above and beyond the parts that compose the whole. To the parts, each of which may be understood in separation, has been added a mystic extra that exists independently of the parts. This is a fallacy of mysticism.

Both of these fallacies are common in treatments of the problems relating to man and the world. A more complete and adequate understanding of problems involving body vs. spirit, material vs. spiritual, natural vs. supernatural, evolution, human interactions, and religion, results from a perspective on the relationship between the whole and the sum of its parts that avoids these two fallacies. It is the purpose of this paper to introduce and illustrate this kind of understanding, especially as it is related to common concerns in science and Christianity. It is hoped that this discussion may lead others more skilled in the disciplines involved to interact with the proposed perspective.

Foundations

It will be easy to interpret some of the proposals of this paper as the result of a desire to substitute "natural processes" for "God's processes." Nothing could be farther from the truth. All of the discussion is based on the foundation that "natural processes" *are* "God's processes." In accord with Hebrews 1:3 and Colossians 1:17, man and the world are viewed as upheld in all respects by God. This means that if God were to vacate His position as Upholder, the result for the world would not be the initiation of chaos where before there was order; the result for the world would be the cessation of existence. In such a case the world would lapse into the nothingness from which it was called into being in the biblical creation. Thus even to speak of God acting by "using" natural law is inappropriate. God does not use natural law as a man would use a shovel that exists independently of him; the very existence of natural law depends on the upholding work of God. Everything said in this paper is intended to be consistent with these foundations.

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Physical Examples

To orient our thinking we consider first several examples of the relationship between the whole and the sum of its parts as drawn from the physical world.

Consider a hydrogen atom. It consists of a proton and an electron. The electron can exist in a number of allowed energy states. The atom has mass, velocity, and both kinetic and potential energy. The isolated atom, however, cannot exhibit vibrational motion and cannot possess vibrational energy. The existence of vibrations implies the presence of a restoring force to an equilibrium situation. Vibrations result, for example, when a weight suspended from a spring is stretched; the restoring force is supplied by the spring and the weight executes vibrational motion about its equilibrium position. A single hydrogen atom has nothing "against which" to vibrate.

When two hydrogen atoms are brought together, an *interaction* between them gives rise to a binding energy resulting in a stable hydrogen molecule. The hydrogen molecule consists of two atoms separated by such a distance that the binding energy is a maximum. If one or both of these atoms in the molecule is displaced slightly from its equilibrium position because of some other influence, vibrations about the equilibrium position result. Although it was not possible for the isolated atoms to have vibrational energy, it is possible for the two interacting atoms in the molecule.

In the case of the hydrogen molecule, therefore, the whole is more than the sum of its parts. There is an additional property of the molecule that neither atom possesses in isolation. But this property of vibration is not something that was superimposed upon the system from the outside. It arose from the interaction of the parts comprising the whole. If the molecule is again separated into atoms, its vibrational property does not now "return" to another realm in which it has independent existence. The property of vibration follows directly from the nature of the hydrogen atoms, the parts, but is a property exhibited only by the whole. It is the effects of interaction that make the whole more than the sum of its parts, yet this "more" is a natural result of the properties of the parts themselves.

Other examples abound. The interaction of isolated atoms gives rise to all the complex properties of crystals. The interaction of wood and oxygen gives rise in combustion to flame. The interaction between light waves gives rise to interference effects. Almost every phenomenon investigated in physical science results from some kind of interaction. The phenomenon is not observed without the interaction, yet the phenomenon is implicit in the properties of the interacting species once interaction is possible.

Note that the "more" added by interaction is of a qualitative and not only a quantitative kind. The electrical and optical properties of crystals is qualitatively different from that of isolated atoms. The properties of a flame are wholly dissimilar to the properties of non-interacting wood or oxygen.

Body-Soul Considerations

The body vs. soul problem is one of long standing. Interpretations of the situation have led to a wide variety of errors ranging from identification of sin with the body as opposed to the spirit, to spiritualism with its concept of a universe occupied by disembodied spirits.

Treatments of the problem traditionally involve one form or the other of the whole-parts fallacy. On the one hand there are those who maintain that man consists of individual processes each of which are or soon will be capable of description in terms of purely physical (biochemical or biophysical) terms. They therefore conclude that man, the whole, is no more than the sum of his parts, and is therefore only a rather complex biochemical machine, a kind of organic computer.

On the other hand there are those who maintain that man, as he exists here and now in this world, possesses (or "is") a soul or spirit that exists independently of his body. The "I" of a man is divorced from his body. They commonly speak of man's spirit as living "in" his body. When death comes, this same immortal spirit leaves man's body behind and departs for independent existence to await the reunion of disembodied spirit and spiritless body at the resurrection.

The present perspective seeks to eliminate both of these fallacious views by insisting that man's spiritual capabilities are the result of complex interactions between the many "physical" parts of which man is composed. Just as the vibration of a hydrogen molecule results from the interaction between two hydrogen atoms, so it may be suggested that man's soul or spirit results from the interaction between the biochemical or biophysical parts that compose his body. Such a position is in accord with the biblical view of man as a psychophysical unity, a position amply illustrated by recent development in psychology and medicine. It is also in accord with the biblical stress on the importance of the resurrection, an emphasis at least a little surprising if the existence of a man's "I" is really concentrated in his spirit, independent of his body.

The spirit of a man is quite real and qualitatively different from his body. But the spirit, at least in man as we know him in this life, is not properly considered as having independent existence apart from the body. The question may be immediately raised as to the meaning of such a statement relevant to events after death. This is clearly a theological area, quite distinct from the questions of the nature of man's spirit and body in this life. As such it is not susceptible in the same way to the investigation of science. Real knowledge of events after death must await our ultimate experience. Even in speaking of the resurrection of

the body in I Corinthians 15:44, Paul speaks of the resurrected body as being a "spiritual" body in contrast to the "natural" body that previously died. We can speculate as to his meaning in view of the immediate context of his statement, but we cannot mechanistically describe the significance of a transformation from a natural body to a spiritual body. If our statement above that man's spirit should not be conceived as having an existence independent of his body seems in hopeless conflict with the promise of Jesus in Luke 23:43, or the affirmation of Paul in II Corinthians 5:8 (a conflict that we personally do not believe is necessarily hopeless at all), it is still a theological possibility to propose a change in man's spirit upon death. Paul's identification of the resurrection body as a "spiritual" body suggests the necessity for a "spiritual" spirit to replace man's present "natural" spirit. Further delving into such subjects on the basis of our present knowledge or experience can hardly be more than playing with words.

Evolutionary Hypotheses

There is a definite relation between the perspective of this paper and problems raised for Christians by evolutionary hypotheses. It is not our intention here to enter into the evolution controversy. Our own personal bias is that the evolutionary hypotheses concerning the development of man's body are neither established by scientific evidence nor in violation of the teachings of the Bible on the metaphysical or spiritual purposes behind the creation of man.

One of the most persistent problems is the meaning of man's spirit if man's body has been formed by natural evolutionary processes. The usual implication of a contrast between natural processes and God's work is without foundation. In addition, the objection to evolutionary hypotheses on the grounds that a spirit would have to be infused into man from "outside" at some moment in the development of his body is not valid. In accord with the present perspective, the existence of man's spirit results from the interaction between his bodily parts. There is thus no need to insist on the infusing from within of an "alien" spirit into man's body.

In this framework to speak of "spiritual evolution" is not contrary to the biblical teaching of the creation of man. By "spiritual evolution" is meant no more than that God's work in the development of man's body manifested itself in those characteristics of man that we commonly associate with his spirit. Just as the flame bursts suddenly into being as a qualitatively new entity due to the interaction of wood and oxygen, so the spirit of man can be envisioned coming into being under the guidance of God. In fact, it would seem that if the evolutionary hypotheses concerning the development of man's body are ever to be accepted as sufficiently corroborated in Christian circles, this contention would be almost a necessary corollary.

Continuity of Development

Several other problems related to body vs. spirit and evolution also find a more satisfactory resolution in the proposal that man's spirit is the result of interaction between his physical parts. Here we consider just three examples.

1. At what point in the development of a human embryo does the spirit come into existence? If the spirit is considered as something infused from without, then the embryo is considered one moment to be spiritless and the next moment, after a supernatural intervention by God, to be in possession of a spirit. Such a view has no satisfactory counterpart in physiological understanding of embryonic development. The bodily development is continuous. If a spirit is infused at some moment, then the independence of spirit from body is given exaggerated statement. The view that the spirit is a natural result of interaction between bodily parts, however, preserves the observed continuity of development and does away with the "intervention from outside" view.

2. What differentiates human spirit from animal spirit? Anyone who has lived with a pet animal, such as a dog or cat, is not able to believe that such animals have nothing of that property we call spirit in man. How then does one describe the similarity and the difference between human and animal spirit without resorting to an exaggerated body-spirit dichotomy? On the present view, spirit is always related to body. An animal has just as much spirit as his body can "hold." That is to say, the physical functions of an animal are such that their interaction produces the kind of spirit we observe. The physical functions of a man are such that interaction produces human spirit. There need be no scientific or theological discontinuity to safeguard the uniqueness of human spirit on the one hand, or its relationship to animal spirit on the other.

3. What is the unique distinctive of life itself? Discussions seeking to define the meaning of "life" are usually fruitless. It is suggested here that life is not an ingredient that some bodies have and some have not. Like spirit, the property we call "life" results from the interaction of constituent parts, no one of which need possess "life" in itself. This is why life, like spirit, is so elusive. In general if the parts are separated to look for it, life has vanished. Thus the view advanced here provides also for the continuity of life from inanimate to animate matter, as well as for the continuity of spirit from non-human to human beings.

Material-Spiritual Problems

All that has been said so far are special cases of a more general problem that takes the form of a material vs. spiritual, or a natural vs. supernatural conflict. It is almost universally assumed that material realms and spiritual realms are intrinsically separate and of a different genre, that natural and supernatural have no common meeting ground.

It seems a reasonable proposition that many of these conflicts result from a whole-parts fallacy. There is a failure to recognize that the interaction of material parts may involve a spiritual whole, or that the spiritual nature of reality need not be imposed from "outside" upon the material, but may have its origin within material interactions themselves.

Likewise the supernatural need not be a violation of the natural on the premise that the sum of natural events can only be a natural event and nothing more, but may fittingly be included in a more general view that sees the manifestation of the supernatural in the interaction of natural events. We need to be more prepared to see the supernatural as the natural result of natural interactions, yet no less the supernatural because of it. It is not possible to do justice to this subject, but it seems probable that a large measure of our difficulties at the present time lies in our attempts to express reality in terms of a false dichotomy that we have drawn between the material and the spiritual, and between the natural and the supernatural.

Such a dichotomy is all the more surprising in the light of abundant biblical evidence that supernatural judgment, for example, is manifested through strictly natural chains of events. The judgments against sin are built into the natural structure of the world, yet are completely the judgments of God. The drunkard, the adulterer, the liar, the covetous—all bring God's judgment upon themselves as a direct and natural result of the very sin committed. This is in part the vitality of the Ten Commandments, that they set forth the relationships of love necessary for existence without judgment in the world as it is.

Personal Interactions

Man's emotions are often the focus of an investigation of the characteristics of man's spirit. A little reflection suggests that such emotions as love, hate, courage, envy, jealousy etc. all have one thing in common. They are the expressions of interactions between persons. If there were only one man alone, they would have no meaning. Such emotions are like the characteristic of vibration for a hydrogen atom. Put two persons together, and these characteristics spring into being. In a strict sense they are not characteristics of *a* man, but of interpersonal interactions.

Thus the attributes of man living in society can be associated with interactions between men, just as spiritual attributes of man can be associated with physical interactions within man. Religion itself is the result of a personal interaction between man and God, and much of religious activity is the result of interactions between men who individually and corporately interact with God. It is not by coincidence that the Bible correlates the activity of the Spirit with the interactions of Christian individuals in the church.

Summary

A new dimension is added to our ability to understand and describe occurrences in man and the world around us if we adopt a dynamic rather than a static perspective. Parts *interacting* with one another may impart attributes to the whole that are qualitatively different from the parts, yet arising directly from them. In such a case the whole is not identical with the sum of its parts. Nor are the unique attributes of the whole superimposed from "outside" where they have separate existence independent of the parts. Suggested areas for application are *spirit* in animals and in man, *life,* and the origin of the *spiritual* or *supernatural.* In every case the upholding work of God necessary for the very existence of the created world is emphasized.

"Christianity gives purpose to science. The aim of science from the Christian position is twofold: to glorify God, and to improve the welfare of man. It is to be noted that these two aims of science run parallel with the commands of God as Jesus summarized them:

'Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind, and with all thy strength . . . Thou shalt love thy neighbor as thyself.'

"Protestant Christianity has in general fostered science. When Christianity was revitalized in the Wesleyan and evangelical revivals, did not science enjoy a greater freedom than it had had for centuries? The countries in which Christianity has had its greatest influence have always been in advance of the other countries. Thus, Christianity has fostered and promoted science."

Roger J. Voskuyl in *Modern Science and Christian Faith,* F. Alton Everest, editor, Scripture Press, Wheaton, Illinois. Reprinted by permission.

ABSTRACT

TRADITION, COMPOSITION, CORROBORATION, AND RECONSTRUCTION IN CLASSICAL AND BIBLICAL STUDIES

Edwin Yamauchi, History Dept., Rutgers: The State University. Paper presented at the 20th Annual Convention at King's College, Aug. 23-27, 1965.

As ancient documents, both the classics and the scriptures have been subjected to similar methods of literary criticism. It is instructive to compare the developments that have taken place in both fields.

Generally speaking, in the nineteenth century both literatures were subjected to analytical dissection which was quite negative in its appraisal of the historic worth of the traditions. Enforcing the reaction against such hypercriticism has been the development of archaeology, which has tended to confirm the historic values of the traditions.

The study attempts to illustrate some of the parallel and also the divergent trends of classical and biblical studies, taking as representative documents Homer and Herodotus, on the one hand, and Genesis and Daniel, on the other.

Paper to be published in *Biblical and Theological Studies* of Presbyterian and Reformed Publishing Co.

COSMOGONY-SCIENCE, MYTH, AND GENESIS

ROBERT M. PAGE*

A brief description of the modern exploding universe hypothesis of cosmogony is given, together with a scientifically plausible account of the formation of the earth as it might have appeared to an hypothetical observer at the surface of the earth.

This is followed by an account of the famous Babylonian Genesis, much of it given by direct quotation of lines translated from the clay tablets unearthed by archeologists, and in turn, by a similar account of the first half of the first chapter of the Book of Genesis, dealing with the same subject matter.

The paper concludes with comments on similarities and contrasts among the three cosmogonies.

It has sometimes been a popular pastime to equate the Bible to mythology of ancient times. This is particularly true when it comes to subjects of scientific nature and thoughts having to do with the origin of the universe. It is our present interest to consider the creditability of Biblical cosmogony.

Of modern theories of cosmogony there is one that has fairly wide acceptance, and whether or not it is correct, it is considered to be creditable by a large body of today's scientists. It is based on the observation that the galaxies of our universe appear to be receding from us and from one another with a velocity that is proportional to their distance of separation, and reasons as follows:

If remote bodies are receding from us they must at some time in the past have been much closer to us and closer together. In fact, if their relative velocities are proportional to their relative distances, extrapolation backward in time should yield a definite time in the past when all the matter of the universe was tightly packed in one place, from which it is in the process of exploding. This extrapolation places the time of initiation in excess of five billion years ago. This view is held by a number of scientists, one of whom, George Gamow, has given us a fairly detailed account of how it might have happened.

In the original tightly compressed state, which is the earliest state science can know anything about, the temperature would be too high for matter to exist at all, and all the sum total of the matter and energy of the universe would be in the form of radiant energy. Thus the earliest phenomenon that can be postulated with any scientific foundation is a blinding flash of light intense beyond the capabilities of human imagination to conceive. On expanding from its point of origin, it would cool, at first with extreme rapidity. Five minutes after the first generation of this energy, the temperature would have cooled down to a billion degrees. At this temperature, protons, neutrons, and electrons could exist, but not atoms. In the succeeding 25 minutes all the original elements would be formed, for at the end of the first half hour the temperture would have dropped too low for nuclear reactions to take place.

Today the mass density of matter in the universe far exceeds the mass density of radiation. If, as has been postulated, the universe started out as all radiation, there must have been a time when the total mass density was equally divided between radiation and matter. On this subject let me quote from Gamow.

> Computing the mass densities of radiation and of matter at various epochs, we can find the date of the great event when matter took over from radiation, i.e., surpassed it in mass density. The date was about the year 250,000,000 A.B. (After

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the Beginning). The temperature of space was then about 170 degrees absolute, and the density both of radiation and of matter was comparable with the present density of interstellar gas. The universe, in short, was dark and cool.

This statement appeared in the March 1954 *Scientific American*.

The gradual transition from radiation to matter has been likened to slow precipitation of a solid from solution. As matter gained the ascendency over radiation, it began to react to the forces of turbulence and gravitational attraction, and formed into great clouds of gas. In time these clouds contracted by gravitational attraction to form the beginnings of galaxies. But turbulence produced many secondary and tertiary centers of contraction, so that whole hierarchies of suns and planets and satellites were formed. The pressures created by gravitational attraction produced local heating, the larger accumulations becoming quite hot. The maximum temperature thus produced in any star depends on the mass of the star. Those that became hot enough to initiate sustained nuclear fusion became maintained at still higher temperatures from this process.

Let us now examine the model we have been describing in terms of the origin and evolution of the earth. We start with that phenomenal burst of radiant energy, the solvent for all matter, and call it the birth of our universe. In the first 30 minutes we see all the original elementary particles formed and organized into atomic nuclei. Then nothing but cooling and expanding as matter continues to precipitate out of radiation, until all is dark and cold. Then slowly at first, a great cloud begins to form out of the turbulence, and separate itself from other similarly forming clouds as they all shrink into more dense masses of gas. As the cloud shrinks it breaks up around many centers of turbulence. And since the whole cloud was rotating as a part of the general turbulence, all the bodies of concentration were also rotating as they formed, the speed of rotation of each body increasing as matter was drawn together in smaller volumes. And as the bodies became more concentrated, pressures at their centers increased, with corresponding increase in temperature, until the larger ones became incandescent, shining one by one, all through the galactic system. One of these stars was our sun, and when it "lit up" it illuminated a host of planets with their satellites. One of these planets was the earth. When the earth reached its maximum temperature it was too hot to retain water, so all the water of the oceans and the moisture of the soil existed as a dense shroud of stream completely enveloping the earth and continuous right down to the earth's surface. And as the earth cooled, the steam condensed into pools of hot water on the surface. Eventually the moisture in the air dropped below the saturation point, and the fog began to rise, leaving a clear separation between the water surface and the cloud blanket overhead, much as we see it occasionally now. Then the wet land began to become dry by evaporation, and conditions were favorable for the appearance of vegetation. When vegetation appeared, it sustained itself by reproduction, according to laws of heredity that have been the subject of much study since Mendel's time. The mechanism seems to be that each kind of plant has its seed within itself and reproduces after its kind.

As moisture continued to condense and fall as rain to the earth, the cloud blanket became thinner and ultimately broke up. Then for the first time the sun, moon, and stars were visible on the surface of the earth, and available for telling the time of day and the seasons of the year.

Now we should have a fairly good bird's eye view of what our universe is, and how it got to be that way, according to a most probable modern scientific speculation. Let us turn now to some other cosmogonies, pausing first to contrast the scientific atmospheres of past and present. Science to us is a partnership between philosophy and technology. This partnership was first seriously joined by Sir Isaac Newton. Before Newton's time, fruitful interactions between the two were rare. When we probe farther back to the Greeks and the Egyptians, the Hebrews and the Babylonians, philosophy and technology were totally unrelated, if not even mutually hostile. Even had the thought occurred to join them in partnership, the crude technology of ancient times was a poor match for the philosophical conviction that all natural phenomena were direct actions by conscious gods whose behavior was as capricious as that of men. It is important that we recognize this when dealing with ancient cosmogonies, and maintain a sympathetic attitude as we attempt to place ourselves in the position of ancient philosophers.

There are many cosmogonies among the mythologies of antiquity. We can not discuss them all, but we will examine two of them. First we will review what has been called the Babylonian Genesis. I quote,

When above the heaven had not (yet) been named,
(And) below the earth had not (yet) been called by a name;
(When) only Apsu privemal, their begetter, (existed),
(And) mother Ti'amat, who gave birth to them all;
(When) their waters (still) mingled together,
(And) no dry land had been formed (and) not (even) a marsh could be seen;
When none of the gods had been brought into being,
(When) they had not (yet) been called by (their) names, and
(their) destinies had not (yet) been fixed;
Then were the gods created in the midst of them.

The created gods were the sons and grandsons, daughters and granddaughters of Apsu and Ti'amat. But the children always became greater than their parents, and they also became mischievous and annoying, as younger generations sometimes do, until the old grandparents, Apsu and Ti'amat could not rest. Finally Apsu decided to put an end to the annoyance. Again I quote,

Apsu opened his mouth
And said to Ti'amat, the holy (?) one:
"Their way is annoying to me,

By day I cannot rest, by night I cannot sleep;
I will destroy (them) and put an end to their way,
That silence be established, and then let us rest!"
When Ti'amat heard this,
She was wroth and cried out to her husband;
She cried out and raged furiously, she alone.
(For) the malice (of Apsu) disturbed her heart.
"Why should we destroy that which we have brought forth?
Their way is indeed very annoying, but let us take it good humoredly!"

But Apsu would not be dissuaded, and he plotted to kill his children. But the plot leaked out, and he himself was killed by his own offspring. In ensuing conflicts, Ti'amat was slain by Marduke, who drained out her blood and let the wind carry it away. He then split her body in two, made the vault of heaven from one half, and from the other half, made the earth. Gods who had supported Ti'amat were enslaved. When they complained of their slavery, the kind-hearted Marduke took their leader's blood and mixed it with clay to make men. Then he assigned to men the task of serving the gods, and set the captive gods free.

This whole account is recorded in cuneiform writing on clay tablets. It consists of seven tablets, totaling over a thousand lines in all, of which approximately eight or nine hundred have been recorded and translated. It is representative of the general character of most mythological cosmogonies. As one might expect, it bears no real similarity to our own modern cosmology. Under the circumstances, this is not surprising.

Now permit me to review just one more ancient cosmogony. This one I will give in an unpublished translation, since the published translations are old, words change their meaning from generation to generation, and recent findings of archaeology and philology have added to our concepts of what the originals really meant. This is the cosmogony of the ancient Hebrews, and in one form or another may have been contemporaneous with the Babylonian. I paraphrase freely, in the attempt to recapture the original thought as determined by the work of modern scholars, making liberal use of the terminology of modern cosmology.

In beginning, the Omnipotent God created the heaven and the earth. And the earth was without form, and nebulous, and darkness reigned throughout all space. And the Spirit of God was brooding upon the face of the waters. And God said "Let there be light," and light appeared. And God saw the light, that it was good. And God divided time into periods of light and darkness. And God called the time of light Day, and the time of darkness He called Night. And this completed the first epoch of the creation of the earth.

Let me suggest that the appearance of light on the earth as here recorded could arise from the heating of the sun to incandescence, while the diurnal periods of light and darkness could result from the rotation of the earth in its shroud of steam and fog, even though the sun itself were not visible on the earth.

And God said, "Let there be an expanse of clear space in the midst of the waters, and let it divide one part from another." And God made the expanse of clear space above the earth, and divided the waters which were under the clear space from the waters which were above the clear space. And God called the expanse of clear space Heaven. And this ended the second epoch of the creation of the earth.

And God said, "Let all water under the heaven be gathered into one bed, and let the dry land appear." And it was so. And God said, "Let the earth bring forth grass, the herb yielding seed, and the tree yielding fruit, whose seed was in itself, after his kind." And God saw that it was good. And this ended the third epoch of the creation of the earth.

And God said, "Let there be lights in the expanse of heaven to divide day from night, and for indication of the seasons, days and years, and let them shine in heaven to give their light on earth," and God caused to shine on the earth two great lights, the greater for daytime, the lesser for night time. The stars also he made to shine on the earth from the expanse of heaven . . . .

There is more in this Hebrew cosmogony with which we will not concern ourselves at this time, since it deals with a quite different realm of science than we are considering. I should point out, however, that the account of the appearance of lights for indicating times and seasons does not make reference to the original creation of the lights at this time, but rather the making available of the lights to the earth, such as would occur by a clearing away of the clouds of moisture around the earth.

I think this very cursory review suggests a parallelism between the Hebrew cosmogony and our own. This parallelism is rendered even more remarkable by its striking contrast to the corresponding Babyonian version. It is true that some students of ancient records have attempted to show an extensive parallelism between the Babylonian and the Hebrew cosmogonies. Close scrutiny, however, shows the points of similarity to be purely superficial, and of negligible consequence relative to the overwhelming importance of the contrasts. On the other hand, the amazing harmony between the concepts of Hebrew cosmogony and our own poses a question which science has not answered. How did those ancient Hebrews, without aid of telescope, spectrometer, electronics, atomic theory, mathematics, and all the other components of the foundations of modern cosmology, come into possession of the comprehension of prehistoric nature exhibited in their cosmogony?

"While there may be some use of metaphor in the first chapters of Genesis (as there certainly is elsewhere in the Bible), to relegate the entire account of creation to metaphorism will bring one to serious difficulties in the interpretation of Scripture as a whole. Furthermore, to say that the account of creation is purely metaphoric does not really solve the basic problem of man's origin. Whether one takes the words of Genesis 1 as literal or as metaphoric, one has to take account of a definite point of time at which man appeared; for, to be sure, the most careful evolutionist would admit that an eternal spirit could never be evolved from an animal body."

William A. Smalley and Marie Fetzer in *Modern Science and Christian Faith,* F. Alton Everest, editor, Scripture Press, Wheaton, Ill. Reprinted by permission.

SCIENCE AND BEGINNING

A. VAN DER ZIEL*

Given the initial conditions and the laws, science can uniquely predict the future of any particular system, provided that the system does not belong to the atomic or sub-atomic domain (uncertainty principle). Can science also predict the past *of a system from the present situation and the laws in a unique manner? It can* not, *for we do not know when and where to stop. This means that science has difficulty in qualifying an early situation as a* real *beginning. Theology does not have such difficulties, since it qualifies any beginning, whatever and whenever it may have been, by saying: "God began."*

To use arguments taken from science to establish or make plausible the existence of God or to arrive at God's attributes (natural theology), means ignoring the Biblical usage of contemporary "scientific" notions. Such notions are used in four ways:

1. In instruction in the doctrine of creation (Gen. 1). The contemporary notions of science are here used not to bolster the faith, but to spell out in detail the confession "God created all."

2. In preaching God as Creator (Gen. 2). The contemporary notions of science are here used to preach God as Creator in a very vivid and concrete manner.

3. In praising God as Creator (Psalms). We should follow in the footsteps of the Psalmist and praise God as Creator within our *frame of reference.*

4. In giving people confidence that God has not left them (Isaiah).

A. *Science*

The models used in science are deterministic. That is, given the laws governing a system and given the initial conditions of that system, the future of the system can be predicted, unless we are dealing with systems in the atomic and sub-atomic domain. Consequently, if we deal with macroscopic systems, such as the earth, the solar system, our own galaxy, or the Universe, one would expect full predictability of the future provided that the laws and the initial conditions are known with sufficient accuracy.

Can we also predict the past? At first sight there seems to be no reason why one cannot extrapolate the predictions back into the past. But a closer look gives a different picture, for we see that we run into two difficulties:

a. We may not know where to stop with our extrapolations.

b. For systems obeying the second law of thermodynamics the past is obtained from the future by inverting the sign of time.

Both difficulties hamper us in qualifying a "true" beginning.

Now, there is little doubt that some conclusions about beginning are quite valid. For example, from the constitution of volcanic rocks one can deduce that all are samples taken from a molten system that is about 4½ billion years old. It is therefore not unreasonable to state that the earth is about 4½ billion years old or to conclude that the earth "began" about 4½ billion years ago. There are also quite sound reasons to assume that our solar system is not much older. It may thus be concluded that our solar system "began" not much more than 4½ billion years ago. In the same way one can determine the age of stars. Some are old-timers, like our sun, others are much younger. Trouble arises, however, when one tries to predict the age of the *Universe.*

Let me illustrate the first point first. Suppose somebody throws a stone. It describes a parabola in space and time. Suppose I measure with what velocity (both in magnitude and direction) the stone hits the ground. I can then predict the parabola that was described. Somewhere along this parabola the stone was given the initial velocity that made it describe this orbit. But from the observations made, one cannot conclude where the stone started. To find that out, I must either have earlier information or I must use plausible reasoning. For example, if I had *observed* the throwing of the stone, I would know the exact beginning of the orbit. Or, I might make the plausible assumption that the stone was apparently thrown from the ground; then I could have a fair idea about the location of the stone thrower. But the point is, one cannot conclude it from observations at the end point *alone.*

*Aldert van der Ziel is Professor of Electrical Engineering, University of Minnesota. Paper presented at 19th Annual Convention of the American Scientific Affiliation, August 1964, at John Brown University, Siloam Springs, Ark.

Let me illustrate this by another example. Suppose I have a spherical bomb in space and I trigger it at a given time. The fragments of the bomb speed away from the explosion site. When these fragments are observed after a long time, it is seen that their speed is proportional to their distance to the explosion site, as expected. If we now extrapolate back into time, we should not extrapolate back to the time when all the pieces *coincided*, but rather to the time when all the pieces *fitted together* to form the hull of the bomb. In other words, extrapolating back to full coincidence of the fragments leads to a fictitious beginning whereas the true beginning, where all the pieces fitted together to form the hull of the bomb would probably go unnoticed in this extrapolation. Moreover, our extrapolation would never find out what started the explosion.

This last example brings us to the theory of the expanding Universe. We know that the light of distant galaxies shows a red shift that increases with the distance of the galaxy under observation. The most likely explanation is that this red shift is caused by a Doppler effect. Adopting that explanation, it can be concluded that the galaxies move away from us with a speed proportional to their distance. Our previous model thus applies fully. Extrapolating this back into the past, one can determine the time at which the galaxies coincided. As our example indicated, however, this extrapolation is a very doubtful procedure that leads to meaningless conclusions about what went on around that time.

It therefore seems that one should not draw theological conclusions about the expanding Universe. It is reported that when Pope Pius XII heard about the theory of the expanding Universe he rejoiced that the scientists had hereby "set the date of creation at about 4½ billion years ago." Actually the theory of the expanding Universe does not "set" the date of creation at all. For there is no reason to assume that the coincidence of all galaxies or pre-galaxies actually constituted a *true* beginning. Extrapolating back to full coincidence is a meaningless procedure.

Moreover, why should one stop at full coincidence? Why not go back further in time and see the explosion of the universe as a consequence of an earlier *implosion?* For who can give a guarantee that a supposed set of initial conditions did not have a precedent? Because of what went on at the moment of impact, all information about the pre-explosion state of the universe would be lost. Nor can we say anything about the starting date of this "implosion." The supposed beginning thus recedes back into the past deeper and deeper and tends to disappear altogether.

Science has thus difficulties in qualifying a true beginning of the Universe. It does not do badly for smaller systems, about which we have earlier information or about which past we can make plausible inferences. But the Universe is, at present at any rate, too big for that. We should not be ashamed to admit this. Science provides many answers, but it does not provide *all* the answers.

Next consider the difficulties introduced by the second law of thermodynamics. We state this second law here as follows: "A system left to itself tends to go from a less probable to a more probable state." This law applies successfully to the future. Does it also apply to the past? It does not, and the reason is in the innocently looking words: "left to itself." We shall see that they imply something about the system. They imply that the present state of the system came about by huge spontaneous fluctuations.

Let me illustrate this with an example. Let us assume that a hot metal ball is suspended on a thin insulating wire. It is more probable that the heat is evenly distributed between the ball and the surroundings than that a large excess of it is concentrated in the metal ball. Hence the ball will lose its excess heat by radiative heat exchange with its surroundings. This comes about with an exchange of quanta between the ball and the surroundings. Since the temperature of the ball is larger than the temperature of the surroundings, the ball will on the average radiate more heat than it receives and as a consequence it will cool down.

The expression "left to itself" means that the only process operating is the exchange of quanta. What does a hot body "left to itself in the past" mean? It means that only the process of exchange of quanta was operating in the past. How can a body get hot by exchange of quanta with its surroundings? Only because, by a strange coincidence, it receives more radiation than it emits. This is an improbable event, but since we required that the system was "left to itself," it is the only event available to heat the system. The *requirement* "left to itself in the past," thus amounts to assuming a very rare spontaneous fluctuation in the emission and reception of quanta** as the cause of the initial conditions.

What holds for this one system applies equally well to all systems to which the second law of thermodynamics is applied. The assumption that the system was "left to itself in the past" requires that the present state of the system came about by a huge spontaneous fluctuation. Since this is a ridiculous result, especially for macroscopic systems, one should be careful not to apply thermodynamical considerations to the past. This avoids the kind of trouble we just talked about.

This discussion was used by some Dutch physicists to argue in favor of creation. "For," they said, "if spontaneous fluctuations are ruled out as an explanation of the present, then the present situation must have arisen from a very improbable situation in the distant past. Since this improbable situation did not arise from a spontaneous fluctuation itself, it must have been *set.* The setting of this improbable situation we call *creation.*"

There is a scientific and theological flaw in this argument. The scientific flaw is that we cannot pinpoint a "beginning of the Universe." The theological flaw is that the Creator introduced in this argument looks more like an engineer who turned the switch at the time $t = 0$ and then retired. This is more the God of the Deists than the God of the Bible. Apart from this, I can quite understand why this argument had considerable appeal.

B. *Theology*

We saw that science has difficulty in qualifying a set of initial conditions as a true beginning. Does theology have a similar difficulty? It would if, like science, it started with data about the world around us. But it does not do so, it starts with *knowledge of God,* as He revealed Himself, and any conclusions, even those about the world around us, are drawn from and dependent on this knowledge.

One of these conclusions is that this God, Who thus revealed Himself, is also the creator of heaven and earth; that is, of everything. The aim is here not to make scientific conclusions about the world around us; rather it is *to connect* the world that we see *to God.* Any beginning of this world and in this world thus means: "God began." And such a beginning is a true beginning in the theological sense, for beyond God we cannot go.

The conclusion, that God is creator, is a conclusion of faith. This conclusion coincides with similar conclusions drawn in the Old and New Testament. The key concepts of the Old Testament are that God revealed Himself to Israel and chose Israel as His people. Based upon this faith the Biblical writers conclude that this God is also the creator of heaven and earth. The key concept in the gospel of St. John is the Incarnation (. . . And the Word was made flesh, and dwelt among us . . .). The conclusion is that this Jesus Christ, the incarnate Word, is *also* the creator of heaven and earth (. . . All were made by Him; and without Him was not anything made that was made . . .). The statement that creation is a conclusion of faith is thus entirely Biblical.

It has often been tried to draw conclusions from science that can strengthen the faith. For example, one has tried to find parallels between what science teaches about the beginning and what the first chapters of Genesis teach about beginning. I do not think very highly about what has been achieved in this manner, for in my opinion this procedure dims our view of the Biblical message instead of enlightening it. It seems to me that it is more fruitful to learn how the Biblical writers make use of the scientific notions of their times and then decide how we can follow in their footsteps.

The Biblical writers use the scientific notions of their times in four ways:

a. In teaching that God is Creator (Gen. 1).
b. In proclaiming God as Creator (Gen. 2,3).
c. In praising God as Creator (Psalms).
d. In teaching the people that God has not left them (Deutero-Isaiah).

Let me say a few words about each of these problems and then conclude what our Christian task as scientists is in these matters.

Biblical scholars (von Rad, etc.) tell us that Gen. 1 is teaching of the priests. What is taught, is that God is Creator. Hence these long lists of creation events. They are not told so that we get a better idea what went on at the beginning. Rather they are told so that one might understand better what it implies that God is creator. It implies that *all* the world that we see is God's good creation; the firmament, the dry land, the sea, the plants and the trees, the sun, moon and stars, the birds and the fishes, cattle and man. There is nothing to be worshipped but God, for even the most powerful things or beasts are fellow creatures, and there is nothing to be feared, not even the whales of the sea.

When we look at it from this angle we see how skillfully the ancient concepts and the ancient world view are used in this teaching. And since this is God's word, and is thus binding for us, this means that the church should follow the same path. Its task is not to defend ancient concepts and ancient world views. Rather it is its task to use *modern* concepts and *modern* world views with equal skill in the teaching of God as creator. And it is here that scientifically trained people can help and support the church.

Biblical scholars tell us that Gen. 2 is more proclamation than teaching. Who is proclaimed? The God of Israel is proclaimed as creator of all. Again ancient concepts and ideas are used to the fullest extent. Creation is here seen mainly in the light of the blessings and the benefits given to man. His environment, his life, his task, his wife, they are all God's good gift to man. And since this is God's word and is thus binding for us, this means that the Church should follow the same path. Its task is not to explain how man could be made of clay or how Eve could be made of Adam's rib; these are purposely chosen statements to underline how closely man is related to the ground he tills and how intimately man and wife belong together. Rather it is to proclaim that all the benefits that have been bestowed on modern man, are God's good gifts to man. And it is here that scientifically trained people can help in making others better aware of all these benefits.

But still another side of the proclamation that God is creator must be stressed. The example for that is given in Genesis 3. Here it is proclaimed that man is a sinner and that God is the punisher and the forgiver of sin. The glory of God as creator is not that he leaves man in his sin but that he comes to seek him, to punish and to forgive him. The Creator does not let go of the work of his hands. He comes to seek what was lost, as he has shown especially in the coming of Jesus Christ.

The Bible also *praises* God as creator. Psalms 8, 19, 104, to mention only a few, are full of this praise. Again we can note how freely ancient concepts and views are used by the Biblical writers. The Church should therefore use modern concepts and modern views in its praise of God as creator with equal freedom. And again, it is here that scientifically trained persons can help the church.

Not all of us are gifted with the gift of poetry, of course. But nevertheless here is a task for us that we can perform either in prose or verse. And the subject brings its own poetry with it. The world of the almost infinitely small, the world of the atom and the nucleus, is God's creation. The world of the almost infinitely large, a vast universe of stars, galaxies and supergalaxies, is His domain. The world of the almost infinitely distant past, with ages measured in billion's of years, is God's world and is the scene of His love and care. The almost infinite numbers of forms of life, they are all His creatures. Who can help but being awed by the vastness of God's creation and who can help but becoming a poet when speaking about it!

But here we must be careful. We do not harnass all these facts to present a good case in favor of creation. We use them in our *praise* of *God the Creator.* This might well be the best way of bringing the message that God is creator.

Finally there is another use of the concept of Creator. It is found in the second half of the book of Isaiah. Israel is here in captivity, far from the promised land. It seems to them as if God has rejected them. Here the prophet comes once again with the message that God is creator. And that means that He will not let go what He has begun. He Who made the world and made Israel will remain true to His creation and will help Israel and restore them. The theme of creation is here once again not an end in itself but is a means of strengthening and heartening a defeated people.

There is a connection between the second part of Isaiah and Gen. 3. The connecting theme is that God does not let go what He has begun. Human sin and human misery do not have the last word, but God has the last word. In this, that God shows Himself powerful enough to overcome sin and misery, He shows that He is the Creator indeed.

Our Christian task as scientists is not to provide a more powerful apologetics, though apologetics may sometimes be needed. Rather it consists in helping the church to teach and to proclaim that God is Creator, to praise His work and to strengthen and hearten defeated people, bent under sin and misery.

**As a further consequence, if the future state of the system is described by a function f(t), where t is the time, then the past state of the system is described by the function f(-t) and $f(-t) = f(t)$.

"If Genesis is only a book of human origin and its allusions to astronomy reflect the knowledge extant at the time of writing, we would expect it to be full of gross scientific errors. If, on the other hand, we find Genesis to be in agreement with the latest developments known to modern astronomy, such agreement would be evidence that God supplied the information just as the book claims.

Today there appears to be considerable harmony between astronomy and Genesis. This does not mean that all astronomers believe the Genesis account, although it seems to the author that astronomers as a group often possess a more reverent atitude toward God than do other scientists. It means that a careful study of the fact and well-established hypotheses of astronomy reveals a striking consistency with the outline of origins found in the first chapter of Genesis."

Peter W. Stoner, M.S. in *Modern Science and Christian Faith,* F. Alton Everest, editor, Scripture Press, Wheaton, Ill. Reprinted by permission.

"The Sophist begins his dialogue by proclaiming the absence of truth or fixed principles of which we may have a sure knowledge. He then asks us to rely on the undefined concept of *truth* in his own argument, asserting that while all other fixed positions in the universe are but mere products of the mind that would make them so, his position is, of all things, *true.* This reminds me of the deist assertion that God created all things and then passed away. To which we simply say, if He did in fact create all things He created time and therefore never came into being nor passes away. These are purely temporal concepts of which He was the creator. If the Sophist has truly destroyed the concept of truth, how can he possibly revert to this very concept as the reason for accepting his doctrine? If truth does not exist, then it certainly cannot be true that there is no truth. Scientific positivism has seen this weakness in the ancient relativism of the Sophists and has given the old doctrine a new twist."

Ervin Page Bailey, *The Sunday School Times,* Nov. 7, 1964. Reprinted by permission.

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within the context of other references mentioned by reviewers Ault and Roberts and used by Morris and Whitcomb. However, to express myself succinctly regarding the value which this born-again Christian personally attaches to *The Genesis Flood,* I re-affirm the following recommendation prepared shortly after the book appeared in 1961:

After close scrutiny of this book, I recommend it particularly to American youth in science courses. The authors have accomplished a unique preliminary report of a new scheme of historical geology based upon Biblical revelation within which scientific data may be interpreted.

This book, which provides thorough documentation, will help students encounter the circular reasoning of bold evolutionists, and will point out basic objections to uniformitarian geology and radioactive timekeeping. By their discussion of some major problems, the authors have shown clearly that religion can be a stimulus to a re-thinking and re-studying of "actual observed" data of geology.

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REPORTS ON THE SESSIONS OF THE INTERNATIONAL CONFERENCE ON SCIENCE AND CHRISTIAN FAITH OXFORD, ENGLAND JULY 22, 1965

CONSIDERATION OF "MAN"

JAMES O. BUSWELL III*

When 37 men from 16 different disciplines and 12 different countries meet together morning, afternoon, and evening for nine days there are bound to be some results. Speaking personally, this was an experience of learning, leveling, broadening, and blessing.

There were disagreements and criticism, more problem raising than problem solving, much good humour and fellowship testimonies and prayers; moments of deep thought, even tears, brought by a sharing of a moving experience or by the dawning of a new understanding; and always the continuing intellectual stimulation of conversations, formal and informal, before the tape recorder or around the tea table, between two or three walking on the lawn, between groups of four or five at dinner or at the close of an evening session. Here an elder scientist had the rapt attention of the whole conference; there a physicist received instruction from a philosopher and vice versa; or here a British geologist was roasted by a Dutch historian; or there an American anthropologist had his terminology overhauled by an American geneticist! And always the common effort to achieve meaningful communication by a consensus of presuppositions and precision of vocabulary.

The definition of terms and concepts occupied considerable time. Australian psychologist, Malcolm Jeeves, had written in his contributed paper:

> Failure to define exactly how a particular term is to be used not only leads to confusion between psychologists of different viewpoints but more important for the present discussion it may well lead a Christian to think that the psychologist is saying something which he has no intention of saying, or that by omitting to talk about certain things or use certain words he is thereby denying something else. ("Scientific Psychology and Christian Belief", p. 6.)

For "psychologists" we could read "scientists" and it would apply to us all. As an example consider the following: Upon attempting to establish the distinction between a naturalist and a supernaturalist, some of us were rather shocked to hear one speak up and claim, "Well, *I* certainly am not a supernaturalist!" And another "That goes for me, too!" There was immediate confusion. Those who had taken a supernaturalistic position completely for granted were at a loss to grasp

*James O. Buswell III is Associate Editor of the Journal of the American Scientific Affiliation. Report read before the Twentieth Annual Convention of the American Scientific Affiliation, meeting jointly with the Inter-Varsity Christian Fellowship at The King's College, Briarcliff Manor, New York, August 25, 1965. One of seven reports given by American participants in the International Conference on Science and Christian Faith sponsored by the Research Scientists' Christian Fellowship, Regents Park College, Oxford University, July 17-26, 1965.

the premises for such a claim. I, for one, was bewildered. Was this really a denial of belief in God? Were we, after all, to be split at this basic issue for the remainder of the conference? After another session or two and several conversations, it became clear that there were at least three different ways in which certain of our colleagues were disclaiming supernaturalism while believing wholeheartedly in the existence of God. In the first place, some were very eager to *avoid* saying, "I believe that God is the only necessary explanation for all natural phenomena." And they wanted it clearly understood that they operated within the realm of the laws of nature, in addition to which they believed in God's role as the creator and sustainer of all of nature.

In the second place it was argued that for the Christian, God's existence is perfectly "natural" in the sense of the normalcy and acceptability of Christian belief. "*God* is certainly not super-natural" it was stated, and the premise was held that, in terms of Himself and of our belief in Him as the author of all that is, this is to be conceived of as perfectly "natural."

In the third place, we learned that in Britain, perhaps, more than elsewhere, the spiritualists—those who deal in haunted houses, poltergeists and communication with the dead—had in a measure appropriated the designation of "supernaturalists" and Christians in legitimate science didn't want any part of it!

Thus from a *particular* background of being misunderstood in certain circles as theists, and of particular connotations and associations of the term, they were able to claim without paradox, "I am not a supernaturalist."

Similar difficulties surrounded the terms "instinct", "evolutionist", "creation", "literal", "man", and others.

The spectrum of evolutionary position represented at the conference was fairly wide with regard to how much or how little God had interfered in the process. One extreme, that of the thoroughgoing theistic evolutionist was represented by a British professor of geology who stated in his contributed paper that:

> Evolution may be defined as the derivation of species from pre-existing species by a process of descent with modification. This descent is a fact, and runs through the whole organic world, including man himself. The fossil record supplies abundant examples which establish beyond reasonable doubt continuity at all taxonomic levels. (F. H. T. Rhodes, "Evolutionary Theory and Its Broader Implications: A Historical Review", p. 12).

And again:

> Now there can be no reasonable doubt that man's brain evolved by natural selection from those of pre-existing "animal" (non-human) species. (p. 35)

Others held that this was greatly overstated in view of the discontinuous appearances of fossils which is particularly marked in the case of even the earliest human remains; that more than a little "reasonable doubt" exists if one limits one's appeal to the fossil record.

When the session on Man drew near it was decided that a definition of man should be attempted rather than to address ourselves to the problem of his origin or evolution as such. This proved to be sufficient to yield at least some indications of the relation of man's origin to his nature. The spectrum of opinion present included those who would deny that man's nature has anything to do with his origin.

The following definition of man was drawn up for the consideration of the conference: It is frankly based upon the terminology and conceptualization of American anthropological literature on the subject over the past 40 to 50 years.

There are three parts to the definition. A. morphological B. cultural and C. spiritual.

A. *Morphologically* — Man is an animal because he is not a plant; and the distinctive features of his anatomy as a member of the Hominidae as usually indicated are principally five:

1. gross size and proportional size of brain.
2. distinctive features of skull including the mandible.
3. distinctive features of the dentition.
4. distinctive features of the foot.
5. distinctive features of the vertebral column.

B. Culturally — Culture has been lightly defined by Kroeber as "that which man has and animals lack." Culture is to be conceived of in terms of what it is, and what it is not.

In the teachings on racial differences race and culture are distinguished by pointing out that race is determined by parenthood and is a strictly physical concept while everything that one becomes after birth is learned and thus "cultural."

"Cultural" means that it is conditioned, internalized, acquired—learned, from one's environment. In human beings this environment is made up most often by the mother, and then the rest of the family and then the society at large. The "enculturation" process in human beings is remarkably subtle and is only partly encompassed in the concept of "socialization."

Another conventional way of distinguishing "cultural" uniqueness in man is to draw the contrast between the learned behavior of man and the dominance of instinctive or genetically built-in behavior of non-human animals. Anthropologists will forthrightly say that humans have no instincts but only biological drives which are all satisfied differently in different cultures. So, man's behavior or social activity is seen as learned, while non-man's behavior is seen as mainly, at least, genetically fixed according to his species. This is not to say that animals do not learn. It is agreed that they do. It is only to say that the proportion of animals' learned behavior in comparison with their built-in behavior is so different from man's that although it might conceivably amount to a difference in degree, it is more often conceded that the

difference is of such a magnitude that it amounts to a difference in kind. For animal species, to be sure, vary in the proportion of learning which contributes to their total behavior. But there are no tribes of peoples which have a lesser proportion of learned behavior and more instinctive or built-in behavior than others.

The sheer diversity of human culture constitutes the evidence for this opinion. There are no cultural correlations with any racial type or ethnic status which could be cited as indicating that here we had a higher proportion of human instinctive behavior evident, and there we had less. For example, there is no such thing as "primitive language." There is only the vast diversity of human language, which is different in kind from all non-human systems of communication. Those aspects of culture that do show correlations are either internal cultural correlations such as that the mother's brother usually has a prominant role in training his sister's children in a matrilineal society; or obvious environmental ones such as that agricultural peoples are more sedentary than hunting peoples, or, negatively, that igloos are never built by jungle tribes.

The diversity of human learned behavior, then, and the products of this behavior, constitute their culture and it is this concept that constitutes for the anthropologist the distinctive human quality. It is also this cultural designation that so frequently eludes those in other disciplines who address themselves to a definition of human distinctiveness. Thus Mortimer Adler in a film on evolution must employ elaborate scientific circumlocution to explain man's uniqueness without ever employing the term; and Professor Rhodes in a section on "The Uniqueness of Man" states:

> Looked at *biologically*, man's uniqueness springs largely from his *conceptual thought*, resulting as it does in *true speech*, *cumulative tradition* and the *manufacture of tools*.....(Ibid., p. 29. Emphasis mine.)

Conceptual thought, true speech, cumulative tradition, and manufacture of tools—none of them biological; all of them cultural.

C. Spiritually — Now as a believer I must add the third distinctive characteristic of man and that is whatever constitutes the *Imago Dei*. Call it "spiritual nature" or what you will, I believe that this must be included in any complete definition of man. In the methodology of Christian anthropologists this and the theological heart of Christianity have been called the supercultural or supracultural, that level of human involvement which is above and beyond culture, e.g., noncultural. The entire rationale of Christian missions, in the face of doctrines of cultural relativism and accusations of religious imperialism by those who count all religion as merely cultural, stands forthrightly upon the legitimacy of the persuasive communication of a super-cultural message which is absolute and thus applicable to any culture, while its forms and expressions remain relative and indigenous.

In conclusion, with respect to origins, I believe that the supercultural aspect of man is co-terminous with his capacity for culture, full-blown, and not a product of development. That is, a spiritual and cultural nature are seen as distinctive of man and may be said to constitute the *Imago Dei*.

From this extended definition of man, it was argued that the origin of these distinctive aspects of humanity are much more important to consider than the never-ending speculations upon the origin of man's body. The conceptual transition from biological, species-determined behavior to culturally determined behavior is for anthropologists and primatologists who assume that there was an evolutionary crossing of this bio-cultural gap, far more of an exercise in hypothetical reconstruction today than the alleged morphological transition ever was. Furthermore the problem in much the same terms has been emphasized by scientists from Alfred Russell Wallace to Teilhard De Chardin.

Two questions now face us. These were presented to the Oxford conference but their answers were not attempted. Perhaps it will be helpful to consider them here:

Questions:

1. What theological imperatives are there regarding the *Imago Dei* and what it signifies as related to the question of man's uniqueness?

2. What theological imperatives or stakes are there in speaking about the origin of man:
   a. as a sovereign act of Deity identical with continuous evolution;
   b. as an intervention of Deity in an organic continuity;
   c. as an introduction by Deity of a unique form of life.

A BRIEF REPORT ON CYBERNETICS, DETERMINISM, AND FREE WILL

DAVID O. MOBERG*

The discussion on *Cybernetics and the Concept of Mind* was based on a paper by Dr. Siegfried H. W. Buchholz of Germany. Technical developments in cybernetics raise questions about the nature of man. He can be seen as a "cybernetic machine." This new era of the technological view of man coincides with a process of self-alienation. Dr. Buchholz sees this as a loss of the personal center of human existence because man sees himself only in relation to himself, not in a relation to God. It is the fallen man who

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turned away from God who regards himself as a "rational" being, independent of God and yet unable by reason to perceive God's speaking.

Cybernetic approaches to man can lead to misinterpretations of "man as a control mechanism" which do not correspond to reality. First of all, views of "man as a unity" are depreciated by making thinking identical with intellectual operations of the brain, by identifying language with information, by seeing human learning as the same as programming a machine, by making conscience the same as a psycho-hygienic control mechanism, etc. Secondly, identification of reality with mathematical models gives a mistaken significance to cybernetic methods in biology, medicine, and education. Thirdly, by subjecting human reactions to the constitutional economy of circuit changes and interpreting mental functions, health, and disease accordingly, man is seen as a self-regulating construction and his emotions are interpreted as psychic control mechanisms. Fourthly, the over-stressing of control processes reduces everything to an aspect of expediency. Wrong scientific conclusions thus lead to a wrong self-understanding of man.

The mechanical brain is seen by Günther ("Metaphysics of Cybernetics") as a possible image of man which, by means of an *"imitatio dei,"* can help man to understand himself. The fact that all science can be seen as nothing more than re-thinking something already existing (that is, something pre-thought by the Creator) became evident when the feedback systems found in nature were rediscovered and made useful in computers. The body, soul, and spirit (soma, psycho, and pneuma) of man was compared by Gödan to three cybernetic control circuits with "open access to God." Many questions of man and information deserve attention in the light of cybernetic models.

Dr. Buchholz concluded that "Man as an 'integral being' (FRANKL) can only be seen as a complex unity, he can be healthy or ill only as a whole, he can be a real human being only as a whole. The knowledge of cybernetic relations achieved until now offers very remarkable, new aspects of the design of creation, but no final truth about the 'system' man, by a sudden insight."

In the discussion on cybernetics, it was indicated that during the first seven years of automation about 20,000 papers were published on the subject, but books on man as a machine appeared at least a couple hundred years ago. Every view of man is always a result of a "spiritual" decision. A computer program can be written for any logical specification that can be broken into component parts. Specification is as yet impossible on such topics as creativity, for we cannot break it into a catalog of parts.

Instead of seeing the machine as the image of man who is in turn the image of God, some participants felt that the best study of man is man and that the study of feedback tells more about the communication process than about man. Cybernetic models are helpful in understanding the control mechanisms of the body and the storage of information in the brain. But man's intimate knowledge of himself may be the chief difference between man and machine.

The discussion of *Determinism and Free will* grew out of two papers by Prof. Malcolm Jeeves, Psychologist in the University of Adelaide, South Austrailia. Because of the relatively slow development of the behavioral sciences and the lack of firmly grounded theory in them, Christians tend to adopt a god-of-the-gaps position in their views on science and human behavior. This is evident, for example, in an article on psychology in the JASA, Dec. 1964. Unnecessary hostility to scientific psychology by some Christians and indefensible assertions about the impact of scientific psychology on Christian beliefs by some psychologists result from basically the same reasons. "They both arise from a failure to think sufficiently carefully about the language used by scientific psychologists and a failure to try and see specifically which Christian doctrines are supposedly threatened by the common methodological assumptions and presuppositions of practicing scientific psychologists." The methodological assumptions of scientific psychology include (1) *determinism* (the belief that the regularities apparent in human behavior are capable of rational causal explanations and the working assumption that any kind of behavior is orderly, predictable, and lawful in the scientific sense), (2) *reductionism* (the assumption that all descriptive psychological statements can be translated into statements in the language of physiology, biochemistry, or physics and chemistry), and the (3) *repeatability* of scientific research studies. If Christians either hold that determinism is all right as a research strategy but that this does not prove that all behavior is in fact determined, or if they hold that behavior items cannot be completely predicted, they may be using "a convenient temporary escape hatch which is slowly being closed" with every new development of psychology; the god-of-the-gaps is slowly pushed out of man's explanations.

The problem of man's "free choices" and determinism is related to personal responsibility. Some choices are modifiable by praise and blame, but others are not. Religious behavior is accounted for psychologically in terms of (1) social learning theory, which helps us understand the perpetuation of existing traditions but cannot account for the rise of new beliefs, (2) theories of the mechanism of religious conversion, some of which are social and others physiological, and (3) other hypotheses. This has important implications for man's responsibility and for the Christian evangelical notion of "decision." In the future it will be increasingly difficult to discern where the boundaries lie between using behavioral science knowledge, which will enable the manipulation of persons as if they were things, and truly Christian communication of the Gospel. Forethought is therefore advisable.

Prof. Jeeves concluded that two constantly recurring sources of unnecessary conflict between the behavioral

sciences and Christian beliefs are the failure to make explicit the methodological assumptions underlying scientific research and the failure to recognize the change in the use of everyday language when common words and concepts are appropriated and modified by psychologists to build their theories.

In the discussion that followed, Prof. MacKay drew a distinction between definitions which equate freedom with unpredictability and those which see freedom as "the ability to do otherwise." We are free as long as we are not *bound* to do what we do. But in addition there is a logical redress in brain action. All other cognitive systems have inescapable, binding specifications, but not the brain. As soon as conclusions like predictions are built into the system, the very process of reaching conclusions makes the system incomplete, for the effect becomes a new cause.

The self-fulfilling prophecy process in the social sciences was also related to this. Social science predictions of events can be used to avoid the predicted outcome, for man's future is not completely determined by the past which science has studied. Scientific prediction can thus increase man's freedom by giving him a more realistic basis for decision-making.

As long as behavior is modifiable, man is not rigidly determined. Yet it was also indicated that man is not completely free; there are limits to his freedom, including the problem of susceptibility to suggestibility and the question of normality. Prof. Jeeves pointed out that we assume we are normal or healthy organisms and that the mentally ill and the mentally deficient are not. But there may be subtle differences between health and disease which are not yet recognized and which may have a significant impact upon our beliefs pertinent to determinism and free will.

THE STUDY OF SPECIATION

J. FRANK CASSEL*

The Species (See Mayr, 1957)

Biologists have long been concerned with naming the organisms with which they work. Linnaeus greatly facilitated this task by developing his binomial nomenclature, in use today. Each species has its own distinct combination of two names, as *Homo sapiens*. Although Linnaeus assumed that each species he named was the equivalent of a Genesis "kind", which had remained unchanged since creation, Darwin suggested that natural influences and events might bring about changes in species with the eventual development of new ones.

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Darwin's suggestion brought about increasingly careful evaluation of the similarities ("relationships") of organisms. Rapid progress in the new fields of genetics and ecology supplemented this increased activity in taxonomy. Coupled with continued concern with the origin of species, this activity raised the question as to the exact nature of a *species*. In the years just prior to World War II, the interpretation that a species was an actual living entity in nature (a group of interfertile organisms) began to replace the concept of a species being an unchanging group of organisms represented by specimens in a museum drawer.

The New Systematics

This "new systematics" was strongly supported in America by Dobzhansky (1937), Mayr (1942), and Simpson (1944), and the idea that species are formed by a series of "micromutations" fixed in small isolated populations of organisms soon became the accepted interpretation. Any assessment of relationships or phylogenetic trends are made from this basis—a marriage, as with Darwin, of heredity and environment, limited by the nature of small mutations and how they are selected for in the particular habitat of the organism. Ideas such as Goldschmidt's (1940) on macromutations brought forth such invectives as Mayr's (1942), "To accept Goldschmidt's idea of macroevolution would be to accept vitalism."

The force and frequency of publications by the micromutationists, coupled with such unwillingness to tolerate alternative views, have molded American evolutionary thinking for the past quarter century. It is quite exceptional to have Olson (1960), in his Darwin centennial paper, list views other than that which has come to be known as the synthetic view of evolution. Huxley (1960) at the same conference, though British, hewed nobly to the party line.

Important to our considerations are the current rise of two approaches which are successfully, I believe, modifying if not indeed questioning some of the precepts of the micromutationists.

Numerical Taxonomy

The one questions the helpfulness of the concept of a species being an entity delineated by the usual impossible-to-assess characteristic of interfertility, and suggests that even phylogenetic concerns are best elucidated by finding out more about how organisms are similar and in what ways they differ. With the advent of computers we are now able to analyse many more and much smaller characteristics and thus can ascertain differences never before possible. The possibilities have been summarized by Sokal and Sneath (1963), who say in their introduction,

> Numerical taxonomy aims to develop methods which are objective and repeatable, both in evaluation of taxonomic affinity and in the erection of taxa. In addition, we believe that numerical methods may open up a wide field in the exact measurement of evolutionary rates and may provide a more critical approach to phylogenetic problems.

This method, then, is attempting to ascertain phylogenetic trends by statistically examined data rather

than by intuition, upon which to a large extent the synthetic evolutionist has been depending. Many of the older systematists maintain, at least orally, that the judgment of an experienced taxonomist is more reliable in assessing the evolutionary significance of a given character than is the statistical analysis of a computer.

Population Genetics

The second approach is one which questions the importance of mutation as a significant factor in the origin or development of species. This approach is concerned with the Darwinian concept of "fitness"—but defines fitness not in negative terms of survival, but in the positive terms of productivity. That group is most fit which consistently produces the most offspring under the particular conditions of its habitat. The emphasis in this concept is upon phenotypic variations in populations, recognizing that any such variations occur in genetically heterozygous populations. Any variation which affects either positively or negatively the reproductive efficiency of the organisms exhibiting such a character will very quickly be reflected in the genotype of the whole population *(natural selection)*.

This approach, although still conceiving of a species as an interfertile entity in nature, lays stress on its being composed of many genetic units in the form of small "Mendelian populations" called demes, within which there is continued exchange of genetic materials. Trends may also be influenced by *gene migration* from deme to deme or by pure "statistical error" *(genetic drift)* within a deme. Although mutation does from time to time introduce new possibilities into a deme, mutation pressure seldom has appreciable effects because of the general stability of genes as well as the infrequency of phenotypic expression of mutations (Li, 1955; Sheppard, 1960).

According to this concept, *evolution* is defined *as a change in gene frequency* in a gene pool (all the genes in a deme). A single mutation has negligible effect upon gene frequency except in very small demes.

Summary

1. For the past quarter century micromutationists using the synthetic approach to systematics and evolution have exerted a marked influence on all facets of evolutionary thinking (Mayr, 1942, 1963; Simpson, 1944, 1961, 1964; etc.).

2. Newer, productive concepts are resisted by some leaders in the field. Two promising areas not yet fully adopted or widely appreciated are:

   a. Methods of numerical taxonomy.
   b. Dynamics of population genetics.

3. The significance of the various concepts to our concerns in the area of the relations of science and Christian faith must be assessed from the standpoint of their internal consistency and their consistency with other concepts and data derived from both Biblical and scientific studies. Like many other facets of science, population biology is an intricate, dynamic, and (to the observer) exciting part of God's creation which can provide deep insights into the nature of both God and the Universe.

REFERENCES

Dobzhansky, T. 1937. *Genetics and the Origin of Species.* Columbia Univ. Press, New York. 364 pp. (3rd Ed., 1951).

Goldschmidt, R. 1940. *The Material Basis of Evolution.* Yale Press, New Haven.

Huxley, J. 1960. The Evolutionary Vision, pp. 244-261. In Sol Tax, ed., *Evolution after Darwin,* Vol. 3, Univ. Chicago Press, Chicago.

Li, C.C. 1955. *Population Genetics.* Univ. Chicago Press, Chicago, 366 pp.

Mayr, E. 1942. *Systematics and the Origin of Species.* Columbia Univ. Press, New York. 325 pp.

1957. *The Species Problems.* A.A.S., Washington Publ. No. 50; 1-395.

1963. *Animal Species and Evolution.* Harvard Press, Cambridge, Mass. 797 pp.

Olson, E.D. 1960. Morphology, Paleontology, and Evolution, pp. 523-545. In Sol Tax, ed., *Evolution after Darwin,* Vol. 1, Univ. Chicago Press, Chicago.

Sheppard, P.M. 1960. *Natural Selection and Heredity.* Harper & Brothers, New York, 209 pp. (Harper Torchbook No. 528).

Simpson, G. G. 1944. *Tempo and Mode in Evolution.* Columbia Univ. Press, New York. 237 pp.

1961. *Principles of Animal Taxonomy.* Columbia Univ. Press, New York, 247 pp.

1964, *This View of Life.* Harcourt, Brace and Co., New York, 308 pp.

Sokal, R.R., and P.H.A. Sneath. 1963. *Principles of Numerical Taxonomy.* Freeman & Co., San Francisco & London. 359 pp.

Tax, S., ed. 1960. *Evolution after Darwin.* Chicago Univ. Press, Chicago. 3 vol.

EVOLUTION

J. FRANK CASSEL

Discussion in this area rested firmly upon the presuppositions established early in the conference that this is God's Universe—which he has created and is continually sustaining, (Col. 1, etc.). Some conferees were more impressed than others with Christ's specific role in these processes but all agreed that both the Universe and Scripture should be approached theistically, taking care not to fall into either the deistic or pantheistic heresies.

The longest preliminary paper circulated to conferees was Frank Rhodes' on *Geology and Evolution* and he summarized his views to introduce the session. Briefly, Rhodes takes the position that since no consistent alternative explanation of the fossil sequence has been

presented, he will accept the evolutionary interpretation. He feels that despite obvious gaps in our present knowledge, enough such gaps in our past knowledge have been bridged by more lately discovered sequences of fossils (e.g., horses), some of which were previously predicted (e.g., Seymouria), that a Christian acceptance of the General Theory of Evolution is warranted. (Interestingly, he is disturbed by the suffering he sees in nature, inherent in the struggle for existence, although this point was not considered by the conference.)

Although not content to wholeheartedly endorse his position American biologists in preliminary discussion with Rhodes had agreed that the emphasis in the session should be on the Biblical-theological implications of such a view, rather than on its scientific validity. Hooykaas was not content with this position, however, and consumed the allotted time berating Rhodes for his "fielders choices", claiming they were not warranted by the evidence. Hooykaas leaned heavily on Kerkut in his scientific rebuttal.

It developed in post-session discussions that Hooykaas was not particularly disturbed by the possible Biblical implications of evolution. In fact, the view that Genesis reflected the cosmological views of its time and not a detailed scientific account of creation seemed quite generally though not unanimously accepted by the conference. Hence, there were few conversations concerning detailed correlations of Genesis with geology on the assumption that such conversation would be fruitless because exact or even reasonably specific correlations were impossible. On the other hand, there was no feeling that this view compromised in any way either the integrity or authority of the Bible as God's written Word and revelation.

THE MEANING OF CREATION

WALTER R. HEARN*

I. *Creation in the Scientific Sense*

Two types of cosmological theories compete with each other today: those which state that the universe had a definite beginning in time as a superdense concentration of matter, and those which argue that the universe has always existed in a steady state without a beginning. The former theories, due to Lemaitre, Gamow, Milne, and others are often referred to as "creationist cosmologies" even though their authors have been careful not to mention God as Creator or First Cause in their technical expositions. Milne, in his posthumously published *Modern Cosmology and the Christian Idea of God,* may have moved toward a theistic concept of God, but the deistic "Creator of the laws of the universe" was limited by mathematical reasoning in Milne's *a priori* cosmology as never to have any "bifurcation of possibilities." Although Gamow's cosmological arguments are presented in a book entitled *The Creation of the Universe,* Gamow obviously eschews any theistic interpretation of creation.

The alternative to the creationist cosmologies is the steady-state cosmology developed by Bondi, Gold, and Hoyle, the major feature of which is the concept of "continuous creation" of matter *ex nihilo* at a rate sufficient to maintain a uniform density in the universe over the whole of both time and space. In spite of the theological origin of the term "creation *ex nihilo*" it is clear that the proponents of the steady-state cosmology do not use it in any theistic context and in fact regard the concept as a final elimination of God from our picture of the universe.

Mascall's discussion of creation in theology and science is valuable in clearing up confusion engendered by use of the term *creation* in a non-theistic sense by cosmological theorists. He also warns against construction of an "entropological argument" for the existence of God of the sort seized upon by Pope Pius XII from evidence that the universe is expanding. From a scientific standpoint such an argument is weakened by the meaninglessness of extrapolating backwards to a point of full coincidence and by the impossibility of ruling out an implosion before the explosive phase. From a philosophical standpoint there is the danger of ascribing unwarranted metaphysical significance to the conservation of matter and energy, and of assuming that the notion of time as we experience it bears any direct relation to "time" in remote cosmological epochs.[1]

The term *creation* has also been used in scientific discussion of the origin of presently living forms and more recently of life itself. Even while criticising the *"elan vital"* of Bergson's *Creative Evolution,* Driesch's "entelechy", and du Nouy's "telefinalism" as unworthy of serious scientific consideration, G. G. Simpson concedes that vitalistic theories "established the fact that evolution involved forces that are directional in nature and *creative* in aspect".[2]

In scientific discussions of creative evolution, of the creation of life in a test tube or on the primitive Earth or on Mars, or of the creation *ex nihilo* of matter in the universe at a distant point in time or continuously throughout time, *creation* clearly involves nothing more than the appearance of something new, either matter itself or a new arrangement of matter.

II. *Creation in the Artistic or Inventive Sense*

There is another sense in which the word creation is used by scientists, however: we speak of some colleagues or students as being more creative than others. The fact that we distinguish between investigators who are merely "productive" and those who are "creative" implies that here innovation is not the major connota-

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tion; research productivity itself means turning out papers with new experimental data and new interpretations. A creative scientist is sometimes compared to an architect who designs buildings and a productive scientist to the bricklayer who builds them.

It might be argued that man in his role as a scientist is actually not creative but merely inventive: a scientist does not create the laws of the universe but merely discovers and describes them. God alone is creative in the ultimate sense; however, human creativity in the artistic sense has a well-established meaning in our vocabulary. Creativity has frequently been discussed on an esthetic level but it also is of interest to psychologists and other scientists: poetry and music have been produced by electronic computers as models of human creative process.

Anthologies such as Ghiselin's *The Creative Process* point to the essential similarity of the creative process in fields as varied as art, science, and religion.[3] Mysteries of the creative process have been probed by artists and writers such as Arthur Koestler.[4] Serious scientific study of creativity has been stimulated partly by the interest of granting agencies in identifying potentially creative individuals in the sciences as the worthiest recipients of financial support. Although a recent collection of essays and research reports on scientific creativity leaves the impression that creativity cannot as yet be rigorously defined, some general conclusions about the human creative process can now be drawn.[5]

Although novelty is one criterion of creativity or inventiveness, it is clearly not the only criterion, as seen in legal questions of patentability or in esthetic appreciation of "pop" art, for example. The mere appearance of a new arrangement of matter does not imply that a creative act has taken place. Creation in this sense implies a purposive act involving "creative effort" on the part of inventor or artist, the essence of which in either art or science is the random scanning of the stored data of experience for possible new relationships plus the selection of the arrangement most propitious for the creator's purpose.

III. *Creation in the Biblical Sense*

The following conclusions are based on Scripture itself but are no doubt influenced by the particular theological writings consulted:[6]

1. The cosmology of the people of the Old Testament was probably not very different from that of the peoples surrounding them: the habitable world was thought of as surrounded by waters of chaos which would engulf the world unless held back. In this "three-decker" universe of heavens, earth, and waters below, the earth was generally thought of as resting on pillars; hints of this cosmology appear in the "Priestly" account of creation, Gen. 1:1-2:4, and in Gen. 7:11, Ps. 24:1-2, 104:5-9, and 148:1-14.

2. However, the Old Testament creation account is completely *demythologized* and radically different in character from the creation accounts of other primitive peoples; remnants of the pagan language survive in places only as poetic speech in praise of Jahweh, as in Ps. 74:9-17, 89:5-11, Isa. 26:20-27, and 51:9-10.

3. The dominant idea of the Hebrews was Jahweh as the God of history, not the God of nature. In fact, the idea of man as part of "nature" probably seemed almost a pagan idea to them, surrounded by the "nature religions" of Babylon, Egypt, and Canaan; in these pagan religions there was a mythology but not a divine history. In two similar accounts of why Israel should praise God, the earlier narrative does not mention God as having created the universe, beginning with Abraham's call (Deut. 26:1-11); the later account (Nehemiah 9:1-15 and 9:32-38) begins with "Thou hast made the heavens . . ." The idea of the God of history is linked explicitly with the God who created the world in passages such as Jer. 27:4-7 and 32:16-25.

4. The idea of the God of creation as revealed to the writers of the Old Testament was a natural extension of the idea of the God of history to account for the beginnings of history. Two almost inconsistant ideas are repeatedly expressed: the constancy of nature as a pledge of God's faithfulness, as in Jer. 5:20-31 and 31:31-37, and the use of nature by the Creator to direct the course of history, especially in thwarting the enemies of Israel, as in Exod. 14:19-15:18 and Judges 5: 19-21.

5. The idea of the God of history links closely the ideas of creation and redemption throughout both the Old and New Testaments, so that God's action in history is seen as a process of continually creating. The idea that God is acting continually or repeatedly in history to "create a people of God" is expressed clearly in Ps. 74:9-19, in Isa. 43:1-7, 43:15, 43:21, 44:2, 44: 21-24, and 45:11-13; New Testament passages such as Eph. 1:3-14 present the sweep of God's activity "from the foundation of the world" to the culmination of history in the future.

6. The absolute sovereignty of God over His creation is emphasized; the created world of nature is to be accepted as God's handiwork but never worshipped. The figure of speech of the potter and his handiwork is used to emphasize God's sovereignty in Gen. 2:7 as in Isa. 29:15-16 and in Rom. 9:20-21.

7. The creative work of God is revealed as being accomplished by His *word,* which is not a sound nor an idea but action which carries out God's purpose, as in the Genesis creation account, "And God said . . . Let there be . . . and it was so." The creative word is also referred to in Ps. 33:6-9, 148:5, Isa. 45:11-12, 55:10-11, John 1:1-5 and Heb. 11:1-3.

8. The idea of creation *ex nihilo* in contrast to molding or shaping matter already in existence does not seem to be a dominant theme of the Old Testament, although it is clear that God was "in the beginning" and that "all things" were created by Him. The New Testament does contain several explicit statements, in

Heb. 11:1-3 and Rom. 4:17, that God "calls into existence things that do not exist."

9. There is harmony and goodness in God's creation, not because of any inherent "order in nature" but because of the sovereign purpose of God; Job 38 and Ps. 19 are whole chapters devoted to this idea, and other references include Ps. 104:24-35 and I Tim. 4:4—"For everything created by God is good, and nothing is to be rejected if it is received with thanksgiving."

10. Man has an exalted place in creation: the earth is created *for* man, to remind him of God's goodness. Man is made "in God's image" to work with God in carrying out His purpose, experiencing fellowship with God in this task. To many commentators, this is the principal theme of Genesis creation narrative.

11. Two threats are seen to God's creation: the forces of chaos which could wreck the order of nature set by God, as depicted in Ps. 46:1-3 and Rev. 21:1, and the sin of man which could thwart the continual creative activity of God in history, as depicted in Gen. 3, Gen. 6:5-8, Jer. 8:4-7, and 4:23.

12. The promise of a new creation, of new heavens and a new earth, is made in the Old Testament through the prophets, as in Jer. 31:31-34 and Isa. 66:22-23; the New Testament interprets this promise as being fulfilled in Christ, again by the action of the Creator God in history, as in Rom. 8:18-25 and Eph. 1:3-10. In three passages Jesus Christ is clearly identified with the Creator of the world (John 1:1-18, Col. 1:15-20, and Heb. 1:1-4); and, "if anyone is in Christ, he is a new creation" (II Cor. 5:16-21).

IV. *Conclusions for a Christian Philosophy of Science*

1. A theological definition of creation adequate for a Christian philosophy of science should emphasize the *purposive* activity of God in bringing into existence that which is new. Creation should be thought of not primarily as events or processes but as the inherent relationship between the material world and the God of Scripture, who is both transcendent over His creation and immanent in its workings. Natural science excludes consideration of theological purpose, so it is both possible and necessary to look at any event in man's experience from both a natural and a supernatural point of view. It is more appropriate to speak of complementary naturalistic and supernaturalistic interpretations of events than of natural and supernatural events. Novelty is an important aspect of creation, but novelty of relationship or arrangement should be emphasized; restriction of the doctrine of creation merely to the bringing of matter into existence *ex nihilo* is essentially a deistic rather than a theistic view and possibly a reification of matter both un-Biblical and philosophically unjustified.[1]

2. Emphasis in the doctrine of creation should be placed on *processes* at least to as great an extent as on discontinuous or instantaneous events, although it is understandable that apparently instantaneous events may stand out in man's experience with dramatic intensity; an example is the importance placed on the "sudden flash of insight" in descriptions of the overall process of human creativity. The point here is that such events are not to be considered "more supernatural" or "more miraculous" simply because they seem at the time to be unexplained or unexplainable in naturalistic terms. The whole concept of time needs to be thought out carefully in theology in the light of difficulties in interpreting Biblical references to time and in the light of God's dual relationship to it: *i.e.*, His transcendence implies His being outside of time and His immanence requires His involvement in time as experienced by Man. Creation *of* time and creation *in* time are both legitimate concepts for theological consideration. Pollard makes the valid point that the word *time* in physics is used in a unique way, since the physicist who actually lives in historical, unidirectional time can re-set his time-scale to zero with each experiment.[8] Recalling that the Bible speaks primarily of the God of history, we might conclude that the God of history is not the God of physics; indeed, we may have no need for the concept of a God of physics, although we have great need for the God of physicists, who *is* the God of history.

3. The human creative process as it is now being studied scientifically, should not be overlooked as a possible *theological model* of the Divine creative process; the equivalence of creativity with random scanning of possibilities plus selection may serve as an effective analogy of the contingency of the creation upon Divine will. Furthermore, participation of apparent randomness at some point in what is recognized at the level of human consciousness as a non-random creative process may help Christians to avoid equating God with "anti-chance," setting up a false dichotomy between random natural processes and non-random supernatural events.[9] Inability to visualize participation of apparent randomness at some level of creative activity has rendered the outlook of some evangelicals not only anti-evolutionary but eventually anti-scientific as well. "Special creation" and "providence" perhaps could be considered as two different levels or modes of creative activity, analogous to the two different levels of human creative activity pointed out by Ghiselin.[10] Finally, consideration of human creativity as a model of Divine creative activity might have an influence on the personal lives of Christians, challenging us to stir up the largely untapped imaginative powers inherent in our *imago Dei* natures; thus we might strive to imitate God in His creative aspect also, as well as in His justice and love. May we follow the example of our Lord Jesus Christ by being both creative and redemptive with our lives.

REFERENCES

1. See Mascall, E. L., *Christian Theology and Natural Science*, Longmans, Green & Co., London, 1956, Ch. 3 "Cosmology and Contingency" and Ch. 4 "Creation in Science and Theology" for an excellent discussion and pertinent references; for a non-theist's viewpoint see Singh, J., *Great Ideas and Theories of Modern Cosmology*, Dover Publications, Inc., New York, 1961 (paper), Ch. 16 "God and Cosmology."

2. Simpson, G. G., *The Meaning of Evolution*, Mentor, New American Library, New York, 1951 (paper), pp. 131-132; for serious discussion of biological evolution by theists, see Mixter, R. L., ed., *Evolution and Christian Thought Today*, Wm. B. Eerdmans Publishing Co., Grand Rapids, 1959, or Lever, J., *Creation and Evolution*, Grand Rapids International Publications, Grand Rapids, 1958.

3. Ghiselin, B., ed., *The Creative Process*, Mentor, New American Library, New York, 1952 (paper); MacIver, R.M., ed., *Moments of Personal Discovery*, and *The Hour of Insight*, Institute for Religious and Social Studies, Harper & Bros., New York, 1954.

4. Koestler, A., *The Act of Creation*, MacMillan Co., New York, 1964; Sartre, J. P., *The Imagination*, University of Michigan Press, Ann Arbor, 1962; Nahm, M.C., *The Artist as Creator*, The Johns Hopkins Press, Baltimore, 1956.

5. Taylor, C. W., and Barron, F., eds., *Scientific Creativity: Its Recognition and Development*, John Wiley & Sons, New York, 1963, esp. Ch. 1 by N.E. Golovin, "The Creative Person in Science."

6. Anderson, B. W., "Creation," in *The Interpreter's Dictionary of the Bible*, Abingdon Press, New York, 1962; Richardson, A., *Genesis I-XI*, Torch Bible Commentaries, SCM Press Ltd., London, 1953; Young, E. J., *Studies in Genesis One*, Presbyterian and Reformed Publishing Co., Philadelphia, 1964.

7. Barr., J., *The Semantics of Biblical Language*, Oxford University Press, London, 1951; Barr, J., *Biblical Words for Time*, Studies in Biblical Theology, No. 33, SCM Press, Ltd., London, 1962.

8. Pollard, W. G., *Chance and Providence*, Charles Scribners & Sons, New York, 1958.

9. See, for example, Clark, R.E.D., *The Universe, Plan or Accident?*, the Paternoster Press, London, 1961; or Morris, H. M., *The Twilight of Evolution*, The Presbyterian and Reformed Publishing Co., Philadelphia, 1963.

10. Ghiselin, B., "Ultimate Criteria for Two Levels of Creativity," Ch. 3 of Ref. (5).

"The Biblical interpretation of origins is essentally based upon the supernatural. It has long been the opinion of the writer that the most difficult verse in the Bible is the first one. If this verse can be received in full significance, all the miracles, prophecies and other evidences of the supernatural will hold nothing but interpretive exegetical difficulty for the reader. If it is not received, there will be a stumbling block in nearly every chapter of the book."

Edwin K. Gedney, M.A., Sc.M. in *Modern Science and Christian Faith*, F. Alton Everest, editor, Scripture Press, Wheaton, Ill. Reprinted by permission.

"The preaching of the gospel of Jesus Christ must be oriented to the life and thought, to the language and culture of the people to whom it goes. Anthropologists study foreign and primitive peoples with the purpose of getting a wide perspective of culture. The missionary who meets these foreign and primitive peoples may profit greatly from these culture concepts and from the information contained therein. The most worthwhile potential area for applied anthropology is in Christian missions."

William A. Smalley and Marie Fetzer in *Modern Science and Christian Faith*, F. Alton Everest, editor, Scripture Press, Wheaton, Ill. Reprinted by permission.

LETTERS TO THE EDITOR

THE ANTIQUITY OF WARFIELD'S PAPER ON THE ANTIQUITY OF MAN

In the March 12, 1965, issue of "Christianity Today" Mr. Buswell of St. Louis reaffirmed the stand that he took in *Evolution and Christian Thought Today* that Christian anthropology has no quarrel with an historical Adam. The thought is that no matter where anthropology dates the emergence of man, there will be no conflict with Genesis since the genealogies of Genesis do not supply a reliable means of dating Adam. This position rests mainly on B.B. Warfield's paper, "On the Antiquity and Unity of the Human Race".

As many conservative theologians also rest heavily on this paper, it seems imperative that if any advance is to be made, someone must point out that Warfield's paper is intrinsically bound up with the science of his day and that since science has changed, there is a need for a change in the conclusions of the paper.

Warfield came to believe that as the theologian looked on the merely scientific debate as to the antiquity of man

> he can scarcely fail to take away as the result of his observations two well grounded convictions. The first is that science has as yet in its hands no solid data for a definite estimate of the time during which the human race has existed on earth. The second is that the tremendous drafts on time which were accustomed to be made by the geologists . . . have been definitely set aside, and it is becoming very generally understood that man cannot have existed on the earth more than some ten thousand to twenty thousand years.1

He also says, "The past glacial period, which will roughly estimate the age of man . . ." and "If man is of post-glacial origin, then his advent need not be dated more than five or six thousand years ago."2

These statements reflect the state of science in Warfield's day, and had he written today he might have been less liberal in giving to science any amount of time they might ask for. As is seen in his article, he does, in fact, contend against scientists who asked for too immense lengths of time; and, he puts these men down as "speculative" and as passing away. He felt that the brand of science which was on the right track did "not demand an inordinate period for the life of human beings on earth."3

Had Warfield been confronted with modern means of dating the past by stratigraphic, archaeological, and paleontological correlations along with radioactive and other chemical means of dating in corroboration with each other—"solid data for a definite estimate of the time during which the human race has existed on earth"—he might have looked a little longer at the Biblical data. Had he met with a consistent wave of

geologists and anthropologists asking for a period of time in excess of 500,000 years for the existence of man on earth, he might have looked a little harder at the Biblical data.

In any case, Warfield, not seeing that the question of the unity of the human race was integrally related to the question of the antiquity of man and following Green closely, did not fully consult the context of the genealogies in Genesis 5 and 11. He only considered the genealogies *per se* and established that their purpose was not chronology and that they did often have gaps. He says,

> There is no reason inherent in the nature of the Scriptural genealogies why a genealogy of ten recorded links, as each of those in Genesis 5 and 11 is, may not represent an actual descent of a hundred or a thousand or ten thousand links.4

> So far as the Scripture assertions are concerned, we may suppose any length of time to have intervened between these events (creation, deluge, and the call of Abraham) which may otherwise seem reasonable.5

But, it is a question whether or not the genealogies of Genesis 5 and 11 can bear the weight of 500,000 years. When they are seen in their context, do they lead one to believe that they are able to distribute 500,000 years across their frames? The crucial genealogy is Genesis 5, for few would wish to date the flood before 10-15,000 B.C., the time of the last glacial retreat.

In the first place, of the nine links in Genesis 5, three are bridged by direct father-son relationships, *viz* Adam and Seth (cf. 4:25), Seth and Enoch (cf. 4:26), and Lamech and Noah (cf. 5:29). With this context having been given, who would think to conclude that the other six links bear nearly 100,000 years apiece? Even with the gaps in Matthew in mind, this can scarcely bear the name of responsible exegesis.

Secondly, in Genesis 4:17-24 where the parallel genealogy of Cain is given, the seventh member (out of eight) can clearly recall the tradition about Cain—probably an oral tradition. So, with Lamech of the Seth genealogy who knows the tradition about Adam (Genesis 5:29). So, with the genealogy itself as known by Moses. Is it likely that they stayed intact over a period of 500,000 years?

Thirdly, Genesis 4:25, 26 resumes the narrative from 4:16 in such a nonchalant way that it is hard to believe that the intervening verses 17-24 cover a period of 500,000 years. Other parts of Scripture also leave time gaps silently, even between verses, but none with a gap of this magnitude or anything even remotely related.

In other words, although no black and white case can be made, the tendency of the genealogy in context is contrary to a faith that it may cover 500,000 years. As Unger wrote in his Bible dictionary,

> The appearance of man upon the earth is set forth as the result of a direct creative act of God, which took place at least over 4000 years B.C., and perhaps as early as seven or ten thousand years B.C. "which is more in the spirit of the Biblical record than either Ussher's compressed chronology or the evolutionist's greatly expanded ages" (Laird Harris . . .).

It is to be noted that this is the same order of magnitude for the period of man's existence on earth which Warfield thought science was teaching in his day.

I would say then that Warfield's exegesis of the genealogies was good as far as it went, but it did not go far enough. The context of Genesis 4 gives data relevant to the exegesis of Genesis 5 and as will be seen, far more data than Warfield even began to consider. In a word, contrary to Warfield, the Scriptural data do not leave us "wholly without guidance in estimating the time which elapsed between the creation of the world (I would say Adam) and the deluge."

Warfield also wrote that the span of time before Abraham could only be calculated on the basis of the genealogies in Genesis 5 and 11. If they "supply no solid basis for chronological inferences, it is clear that we are left without Scriptural data for forming an estimate of the duration of these ages."6

However, as is well known, an archaeologist is not left to the mercy of epigraphic material for the dating of his finds. It has been found, for example, in the Near East that particular styles of pottery are found in particular time zones; so that as a general rule a find can be dated by the type of pottery associated with the find.

The same technique in effect can be applied to Genesis 3-5. In particular, what does chapter 4 reveal about the associated culture of the people in the period of time covered by the genealogy of Genesis 5? It is plain that Cain and Abel lived a settled existence with domesticated animals and the sowing and reaping of settled farming (Genesis 4:2,12). To this picture of settled living may be added the city of building of Cain (Genesis 4:17). This I would take to refer to some kind of settled housing probably within walls. This economy is in contrast to the nomad life suggested in verse 20. As time went by, both musical instruments and metallurgy were introduced to this pre-diluvial culture (Genesis 4:21,22).

As with pottery, we may ask concerning these cultural characteristics, "When in other sites, do these cultural modes appear?" The answer is generally given as c. 9000 B.C. So, the dating of Adam and his descendants of Genesis 5 who had this Neolithic (or Mesolithic) culture is easily reduced to a span of time of approximately 9000 years. Since Abraham is dated at c. 2000 B.C., the genealogies of Genesis 5 and 11 can only cover a span of time of c. 7000 years. This is the usual picture as given by archaeologists and anthropologists.

Yet, the anthropologists are asking for a million years for the "Oldest tool-making Hominidae ('men')", half a million years for the "Oldest homines (large brained men)", and 40,000 years for the "Oldest examples of modern man".7 The professional, Christian anthropologists basically concur but would perhaps question calling the first group of Hominidae even "men".

But, if this anthropological dating of Adam and of the

contrasting emergence of man is allowed to stand, the unity of the descent of the human race falls. The question of the antiquity of man is then not a separate, merely scientific question as Warfield thought.

It is interesting that besides the Bible, Warfield appealed to four areas of extra-Biblical proof for the unity of the human race, namely, physiological, psychological, philological, and historical. For the first three proofs, he as much as admits that they only prove unity of kind, not of the line of descent from Adam which is thought crucial to orthodox theology. Unfortunately, the historical proof which he adduced as powerfully supporting the Biblical doctrine (as understood by Warfield) of the unity of man has capsized like a canoe and proves the disunity of the descent of the human race.

The original historical argument which Warfield gave was that,

> The possession of common traditions by numerous widely separated peoples is only a single one of many indications of a historical intercommunion between the several peoples through which this essential unity is evidenced, and by which the Biblical account of the origination of the various families of man in a single center from which they have spread out in all directions is powerfully supported.8

Now, "traditions" as Warfield here uses the word is plainly interchangeable with "cultural characteristics" or "cultural artifacts". But, suppose these "cultural" are greatly dissimilar. Then "the Biblical account of characteristics and artifacts" are not in "common" but the origination of the various families of man in a single center from which they have spread out in all directions is just as "powerfully" *un*-supported as it was supposed to be supported, and is even disproved.

As it stands, in fact, the "cultural characteristics and artifacts" of Paleolithic man are greatly dissimilar from the Neolithic culture of Adam; hence, the orthodox doctrine is powerfully disproved.

Even supposing for a moment that the genealogy of Genesis 5 allows us to place Adam prior to 500,000 B.C., the culture which he had in Mesopotamia is still greatly dissimilar from that which his supposed children had in Palestine and Egypt and the West or in China and the East in Paleolithic times. The culture which Adam knew is described in Genesis 4 as being refined until the time of the Flood. This Neolithic culture would be handed down from generation to generation both in Cain's line and in Seth's line, growing and being improved up till the discovery of metallurgy (Genesis 4:22). I assume that metallurgy would be, as it is in the text, one of the last things to be developed before the Flood. In this case it is incredible that the culture would not spread with the dispersing children. So, even in this supposed case of Adam predating Paleolithic men in both West and East, the historical argument powerfully disproves the "orthodox" teaching.

On the above supposition, if one wishes to avoid the implications, one must not only believe that all of Adam's children who left home did not take their culture with them, but also that the Flood when it did come obliterated every piece of evidence of this Neolithic culture in Mesopotamia, which had been developing for over 500,000 years. But, if exegesis brings one to these conclusions, why exegete at all?[9]

It appears then that Christian anthropology cannot simply assert that she believes both her story of the origin of man and the theologian's story as well. The Scriptural data cannot be put into a pigeon hole separate from the anthropological data, because they have a fundamental bearing the one upon the other.

I can only chalk it up to the power of dogmatic theology that Dr. Buswell and his colleagues "find no contradiction".[10] But it appears to me that the theologian must be reminded at this point that he cannot lawfully speak *ex cathedra*. Theology depends upon an extra-Biblical knowledge of grammar and history and culture. History and culture depend in this area in particular upon anthropology. Theologians and anthropologists must work in close cooperation on the problem of the antiquity and unity of the human race with neither group having to distort its data in order to reach the truth.

There needs to be more creative thinking in future attempts to correlate the Scriptures with anthropology, and theologians and anthropologists ought to quit trying to hide behind Warfield's paper. This may be the time to remind theologians that when they tried to ignore or suppress astronomy they only brought a bad name on theology. This ought to serve as a warning not to attempt to suppress anthropology, but to seek a lawful change in the interpretation of one or both sets of data.

It appears to me that we have open only two roads: literalism with "catastrophism" or figurative language with "scientific creationism". But, in any case, there must be a fresh start on the problem and a more thorough-going correlation of the two sets of data.

REFERENCES

1. B. B. Warfield, "On the Antiquity and Unity of the Human Race". *Theological Studies* (1932) p. 245.
2. *Ibid.*, pp. 249, 250.
3. *Ibid.*, p. 236.
4. *Ibid.*, p. 238.
5. *Ibid.*, p. 244.
6. *Ibid.*, p. 237.
7. Kenneth P. Oakley, "Dating the Emergence of Man". *Advancement of Science*, January, 1962, p. 425.
8. Warfield, op. cit. p. 256.
9. Byron Nelson's idea that all discovered human fossils are post-diluvial not only gives an untenable date for the Flood (in excess of 500,000 years B.C.), but also simply gives the same problem of cultural discontinuity to Noah instead of to Adam and permits Genesis 11 instead of Genesis 5 to bear the 500,000 years.
Another "exegetical possibility" is to assume that Genesis 4 is only parallel to Genesis 5:1-8 and that an unnamed disaster destroyed all that had been developed before anyone left Mesopotamia and before 5:9-32 takes place. In other words, we go back to a Gap theory, but this time without even a hint from the text or context.
If a date for the emergence of man is used which is later than 500,000 B.C., the arguments of this paper are virtually unaffected. I have used the date 500,000 B.C. because it is the date usually given for the emergence of man and because the

evidence of the Australopithecines may eventually push the date even earlier.

10. Mr. Buswell and others have occasionally acknowledged the problem of cultural discontinuity between Adam and Paleolithic man, but they have all too often made it a problematic appendage to their discussion. It seems apparent to me, however, that this problem is crucial and cannot be relegated to a subordinate position. Until a good reason can be given for dating a man with a Neolithic culture before Neolithic times, there is little value in appealing to Warfield.

The editor regrets that he has lost the author's name. Will he please reveal himself so credit may be given to him.

CIVILIZATION IN ANCIENT MESOPOTAMIA

I would like to make a few comments in relationship to Stanley D. Walters' article, "The Development of Civilization in Ancient Mesopotamia" in the September issue of *JASA*. His conclusions that the events mentioned in the beginning parts of Genesis perhaps reflect the beginnings of civilization are interesting to note.

Over the past two years I have begun to emphasize that the Genesis account from chapters 2 through 11, which reflects beginnings to the mind of the ancient Hebrews, portrays in Mesopotamian fashion the start of civilization. As one studies the Akkadian epics of creation and the flood and the Sumerian version of the deluge, it becomes somewhat apparent, in spite of the differences, that all of these literary avenues including the inspired Old Testament account came from a common oral source. This is not difficult to understand since Abraham's roots were in Mesopotamia. The Hebrews under the inspiration of God delivered in written Semetic style these events uncluttered by the Polytheism of Mesopotamia.

When one attempts to relate Adam with Cro-Magnon, Neanderthal, Peking, or any other example of ancient man then the problems begin. Could it be that when God "breathed into his nostrils the breath of life; and man became a living being" that this was the point in time when man became unique and in the image of God unlike the other animals? Then one could easily agree with Walters' thesis that the events presented from Genesis two on need not go back previous to 5,000 B.C.

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I would like to express my appreciation for the article, "The Development of Civilization in Ancient Mesopotamia" by Stanley D. Walters in the *Journal* for September, 1965. I would also like to add the following comments:

1) Two works on *religious beliefs* during the Stone Age that may be of interest are: G. Rachel Levy, *Religious Conceptions of the Stone Age* (New York: Harper Torchbooks, 1963); and Beatrice L. Goff, *Symbols of Prehistoric Mesopotamia* (New Haven: Yale University Press, 1963). The latter work deals in part with magic amulets. Iron objects made by hammering meteoric iron come from early third millennium sites in Egypt and Mesopotamia. [See Jacquetta Hawkes and Leonard Wooley, *Prehistory: The Beginnings of Civilization* (New York: Harper and Row, 1962), pp. 56-65.]

2) The change from a "food-gathering" stage to a "food-producing" stage, commonly called the "Neolithic Revolution," cannot be adequately discussed without reference to Jericho—the earliest Neolithic site in the world, dated c. 7000 B.C. Jarmo, even by Braidwood's estimate, dates back to 6500 B.C.; the radio-carbon dates would indicate an even later date. See Kathleen Kenyon, *Digging Up Jericho* (New York: Frederick A. Praeger, 1957); Robert Braidwood, "Jericho and its Setting in Near Eastern History," *Antiquity*, 31 (1957), 73-81; and Kathleen Kenyon, "Reply to Professor Braidwood," *Ibid.*, pp. 82-84.

3) Neolithic sites are being excavated in such a manner that it is difficult to keep up with them. Three recent sites of importance are:

a) Robert Braidwood's excavation at Canyonu in southeastern Turkey. [See *Newsweek* (Nov. 2, 1964), p. 66.] The chronological data in the news article are not precise. But the site dates back between 6-7000 B.C. "Cold hammered" copper found there, the earliest example yet, seems to be dated about the middle of the 6th millennium. The earliest examples heretofore had come from Mersin XXIII in southeastern Turkey and from Sialk in Iran from the 5th millenninm.

b) James Mellaart's excavation at Catal Hüyük in south central Turkey. [See *Time* (January 1, 1965), p. 61.] Radio-carbon dates range from 6500-5700 B.C. For further bibliography see, Machteld Mellink, "Archaeology in Asia Minor," *American Journal of Archaeology*, 69 (1965), 133-49.

c) The excavation of Nea Nikomedeia in Macedonia by Robert Rodden and David Clarke—the earliest Neolithic site in Europe with a radio-carbon date of 6220 B.C. [See Robert Rodden's article in *The Scientific American* (April, 1965).]

4) I would disagree with the author's emphasis on the supposed discontinuity of the Neolithic revolution. It is not such a revolution that would constitute man's humanity.

a) There are reasonable ecological changes that can explain the transition, whether one accepts Kenyon's "oasis" hypothesis or Braidwood's "grassy steppe" hypothesis.

b) The change was not as "sudden" as the author implies. In the earliest Natufian phase at Eynan in Palestine numerous animal bones indicate that hunting continued to be a prime source of food along with the development of agriculture.

c) There are still groups today that have not learned to practice agriculture, e.g. the Australian aborigines, who gather seeds, roots, insects, and hunt kangaroos

for their food. Are they less than "human?" They do have languages; translators from the Summer Institute of Linguistics are working with them. And they certainly have religious beliefs, e.g. their totemism.

5) The author dates the earliest working of iron after 1500 B.C. (p. 72). The earliest iron blade, known to this writer, dates from 2300 B.C. It was found in the royal tomb at Alaca Hüyük in north central Tunrkey. [See Seton Lloyd, "The Early Settlement of Anatolia," in *The Dawn of Civilization,* ed. by Stuart Piggott (New York: McGraw-Hill, 1961), p. 186.]

6) One final and minor note: the author cites V. Gordon Childe's *New Light on the Most Ancient East,* 4th edition, n.d. but about 1950. This work was first published in 1928 as *The Most Ancient East;* reprinted in 1929; revised as *New Light on the Most Ancient East* in 1934; reprinted with some corrections in 1935; revised in 1952; reprinted with some corrections in 1954; reprinted in 1958 and in 1964.

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THE GENESIS FLOOD

The recent letter by Dr. Roy M. Allen (June, 1965) contained a suggestion that "*nothing* more need be said on this phase (scientific aspects) of the subject" discussed in Morris and Whitcomb's book (emphasis added). However, under close scrutiny, part of one of the reviews (March, 1964) of this book may be called into question on the grounds of "scientific aspects", i.e., correct use of scientific references.

Geochemist Wayne U. Ault closed his review of Morris and Whitcomb's *The Genesis Flood* by urging *ASA Journal* readers to "look up references cited to see what the quoted works really say." I have checked many of their references. Therefore, I wish to share with other readers, even at this late date, some clear and honest remarks directed at two paragraphs of the Ault review.

I will discuss what Ault called typical examples of statements "lifted out of context and misapplied" by Morris and Whitcomb. Reference is made to an article by Prof. Edmund M. Spieker, "Mountain-Building Chronology and Nature of Geologic Time-Scale," *Bulletin American Association of Petroleum Geologists,* Vol. 40, August, 1956, pp. 1769-1815.

In one paragraph, Ault asserted that the authors misused a quote from Dr. Spieker because they referred to him as one who exposed weakness in the "basic geological theory." Ault was quite in error in his claim of misuse, and the authors were clearly correct. After saying that the time-scale is the ultimate framework of the science of geology (p. 1800), Spieker expended about one-third of his paper in discussion of critical problems of the time-scale.

In point of fact, a close reading of Spieker gives one ample reason to know that Morris and Whitcomb represented him properly when they said Spieker "insists that there is no actually identifiable boundary between the Cretaceous and Tertiary" (p. 211). Actually Spieker has given considerable attention in his publications to criticism of boundaries of time-scale divisions.

In the above mentioned article, Spieker said variously: ". . . there is no logical reason why the two [Cretaceous and Tertiary] should be separated by a break" (p. 1800); "Many of the physically placed boundaries in our sections may not mean a thing as regards the actual time-scale." (p. 1806); ". . . boundary disputes . . . have invested every juncture in the whole column" (p. 1807); "The doctrine that . . . regional interruptions separate the important divisions . . . is sheer dogma" (p. 1810); and ". . . the pictures of great revolutions, critical periods, uniform breaks, and generally rhythmic performance by the earth . . . [are] not really supported by the facts." (p. 1812).

Further, in point of fact, after admitting that subdivision of the time-scale rests on fossils, Spieker noted continued problems in the use of fossils because "prominent changes, extinctions, sudden new appearances", though commonly used as criteria, are each a very poor basis for decisions (p. 1812). Spieker referred to his 1946 article ("Late Mesozoic and Early Cenozoic History of Central Utah", *U.S. Geological Survey, Professional Paper,* No. 205, pp. 117-161, with many supporting references) in which he discussed the "Cretaceous-Tertiary Boundary Problem" and concluded:

> The boundary between Cretaceous and Tertiary placed on the basis of any sort of pronounced change in the fossil succession cannot escape real possibility of fallacy, and it might perhaps best be regarded frankly as an arbitrary device, founded as far as possible on phenomena of natural significance but hardly expressive of any comprehensive principle. (p. 149)

In a second paragraph relevant to Spieker, Ault quoted the geologist on the meaning of the terms Cretaceous and Tertiary, but failed to give *his* readers the necessary context (p. 1806) in which Spieker considered the physical evidence as "chaff", which does not support any general statement about the boundary between Cretaceous and Tertiary. And again, when Ault wrote that Spieker's 1956 paper was not an "admitted exposure of weakness in basic geologic theory", Ault ignored apparently Spieker's repeated criticism of circular reasoning (pp. 1780, 1781, 1811) and unjustifiable reasoning by geologists (p. 1795). Exposure of weakness in basic geologic theory (i.e. time-scale) was an admitted role by Spieker when he wrote in closing his 1956 article, ". . . it may appear that I am mainly an iconoclast— . . . Yes, much of what I have said is destructive, but if I have tried to smash any idols they are wicked idols and ought to be smashed" (p. 1813).

This corrective communication could be continued

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