

# JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION



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The *Journal of the American Scientific Affiliation* is published quarterly in March, June, September, and December by the American Scientific Affiliation. The subscription price is \$5.00 per year. Single copies may be purchased at \$1.25 each. Second class postage paid at Mankato, Minnesota.

Concerning subscriptions, changes of address, requests for back issues, and other business, address: Executive Secretary, The American Scientific Affiliation, 414 South Broad St., Mankato, Minnesota 56001.

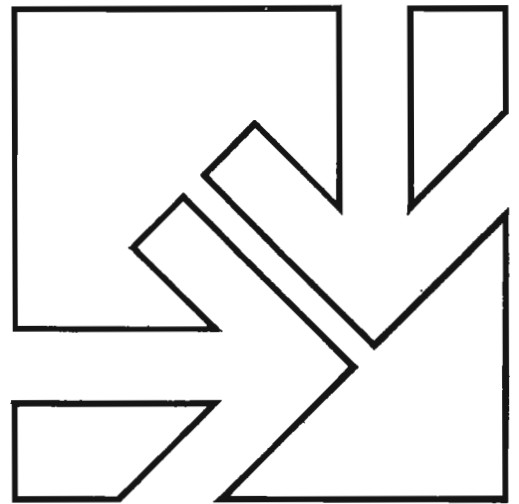
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The opinions and conclusions published in this *Journal* are those of the authors. The American Scientific Affiliation studies relationships between Christianity and science in the conviction that the frameworks of scientific knowledge and evangelical Christian faith are compatible. Open discussion is encouraged. Non-members as well as members are invited to submit manuscripts, letters, and brief contributions for consideration for publication. Instructions for contributors are published on page 2 of the March 1963 issue.

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

JOURNAL OF THE  
AMERICAN  
SCIENTIFIC  
AFFILIATION



Copyright 1964 by the  
American Scientific Affiliation

VOLUME 16 1964

Published Quarterly by the  
American Scientific Affiliation,  
414 South Broad St., Mankato, Minnesota 56001

Printed in the  
United States of America

EDITORIAL

# EXPANDING HORIZONS IN A SHRINKING WORLD

The above title was the theme of the 18th annual convention of the American Scientific Affiliation held August 19-23, 1963, in Santa Barbara, California, on the campus of Westmont College. The first of many papers from that convention are published in this issue. Others are being reviewed by competent critics or are in process of revision by the authors following suggestions from program discussions and editorial referees.

The theme is very appropriate. The world and all its nations, institutions, and people are rapidly changing. The ASA itself can be viewed as a product of change. As several of these papers indicate, its future is even more challenging than its past. The growth of the Affiliation to its present membership of about 1,300 persons is accompanied by expanding opportunities to serve the cause of Christ in intellectual areas which are directly and indirectly pertinent to science. Many theoretical, theological, philosophical, and practical problems which need exploration and action will not be resolved unless ASA members *work* at significant tasks which others are neither motivated nor qualified to undertake.

All of the work of the ASA and its members occurs within a framework of commitments—commitments to our self-images as Christians and scientists, commitments to employers and fellow-workers, commitments to our numerous churches and denominations, commitments to our families and friends, commitments to our respective nations (chiefly the United States and Canada), commitments even to such international organizations and agencies as the United Nations, WHO, and UNESCO.

Cutting across all of these commitments to people and organizations is an overarching set of moral, theoretical, philosophical, and religious perspectives to which we are also committed. These provide us with guiding principles which become a part of our world-view and which are at the very core of our personalities. They make certain of our formal and informal groups more important to us than others. They are the very essence of the self. They lead us to act as if in the presence of certain persons and groups even when we are far removed from them. They provide us with conceptions of ourselves.

These self-images of who and what we are in turn become a major orienting force which guides all of our conduct, scientific and otherwise. They reflect the reality and importance of reference groups and reference orientations to which we appeal in all our decision-making.

Commitments to people, organizations, and activities often clash with each other. Even as I write, I am conscious of conflicting pressures upon me related to my obligations as a college professor, father, husband, editor, churchman, denominational servant with a significant committee chairmanship, adviser of college students, scholar, and writer. Such role-conflicts are

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resolved by irrational emotional influences as well as by reasonable appeals to one's loyalties and commitments. If we consistently follow the implications of full and true Christian faith, our highest and ultimate commitments will have a controlling influence over all the others. We will be so filled with the Spirit of God and thus with works of righteousness that we will not be misled into the works of darkness. We will make the kingdom of God our chief reference orientation. His kingdom will, in this sense, indeed be within us. What this implies for scientific activity is intimated in several contributions in this issue.

Once we have publicly declared our position on a subject, we tend to pontificate about it in order to defend our publicly displayed self-image. As the world around us changes with new scientific and technological developments daily, we must strive to distinguish between our ultimate commitments and those which are derived or secondary. Among other things, we need to see clearly the difference between "what the Bible says" and "what I believe the Bible means when it says." All too often we dogmatically use the former expression when presenting interpretations of the Bible message.

The bounds of man's habitation are rapidly expanding in terms of knowledge as well as in terms of transportation, communication, space exploration, and the population of deserts, polar regions, and other wildernesses. Yet, paradoxically, the world is shrinking. People of all nations, tribes, and clans are brought ever nearer each other in time-distance. The consequences of one nation's atmospheric testing of nuclear devices fall out upon all nations. Just as no man lives to himself, no nation can live to itself. Mankind is one. All share a common human condition, however modified it is by the numerous environmental and cultural variations apparent even to the casual observer.

Language changes, science changes, the world changes. In the midst of this changing world there is but one changeless object of commitment which can provide an enduring foundation for all personal and social life: Jesus Christ, the same yesterday, today, and forever. It is to Him, the eternal Word of God who became flesh and dwelt among men, that the ASA gives its ultimate loyalty. Although this Word never changes, the practical implications and applications of commitment to Him must be adjusted continually to fit the changing conditions of expanding horizons in a shrinking world.

Commitment to Jesus Christ sets men free from their bondage to superstitions and traditions. It makes them free to grow in truth as well as in grace, free from shackles of enslaving traditions, free from absolute commitments to scholarly traditions doomed by the rapid pace of scientific development. Commitment to Him provides a stabilizing keel as well as a compass, map, and rudder for man's autonomous voyage through life.

Not everything labeled "commitment to Christ" is truly such. Pseudo-Christian commitment to an earthly organizational structure (however "heavenly" the name), a theological system, a legalistic moral code, or a narrow and specific interpretation of "science and the Scriptures" takes away the glorious liberty of the children of God, replacing the bondage of "non-religious" commitments with a new slavery.

Articles in this issue reflect the nature and implications of Christian commitment. They suggest numerous fruitful avenues of exploration and adventure for the ASA and its members. The new format of the *Journal* is a suitable reflection of renewed aspirations and visions of service.

THE NEW LOOK initiated with this issue will help, we trust, to meet many of the needs which some believed could be fulfilled best through a new name. The *Journal* name contest was won by Don Fair with the title *Science and Christian Faith*. The editorial board recommended that the name be changed to *Theos and Cosmos*, a title suggested prior to the contest. The Executive Council, however, felt that there were good reasons for retaining the present name. It is our hope that the distinctiveness of the *Journal* will be promoted by the new symbolic design on the cover (the work of Robert Friederichsen, the artist and layout man for our new printer) as well as by the nature and quality of its contents.

The symbol can be interpreted in many ways, but we see it primarily as a representation of the fact that two perspectives, two types of truth, two sources of knowledge, two commitments, confront each other and converge in the ASA. We aim to remain on the exciting frontier of the confrontation of Christianity and science.

The scattering of "News and Notes" and other changes of format should make the *Journal* more readable and indeed even more marketable! Non-scientists like college professors, pastors, high school instructors, adult Sunday school teachers, and other literate laymen can profit greatly from reading the *Journal*. Tell them about it! (Send all new and renewal subscriptions to the Mankato office!)

A NEW EDITOR will assume his duties with the September issue and undoubtedly will contribute new perspectives to the expansion of our horizons in a shrinking world. All correspondence after April 1, 1964 (except that which pertains to the June issue), should be addressed to him:

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# CRITICAL ISSUES MODERN SCIENCE POSES FOR THE CHRISTIAN CHURCH TODAY\*

HENRY WEAVER, Jr.\*\*

*Three types of issues critical to the Christian Church are problems that disturb or divide it, ideas that influence it, and conflicts between it and the non-Christian community. Today these include questions about the method of science, the purpose of scientific pursuits, the supernatural character of historic Christianity, the interpretation of the Bible at points where it seems to conflict with science, and the communication of Christian truth.*

## I. WHAT IS A CRITICAL ISSUE TO THE CHRISTIAN CHURCH?

Before beginning to list or categorize the issues that seem to me to be important, let us examine what makes an issue critical to the Church. There are at least three bases that might make a topic critical or worthy of the attention of such a group as the American Scientific Affiliation. All of these affect the life and work of the Church. That is, from the Christian perspective critical issues are not limited to fundamental philosophical assumptions; they include trivial matters that might affect the work of the Body of Christ. Three types of issues are these:

1) Problems or issues that disturb or divide members of the church are critical. This is true regardless of how small the issue itself is. It is not trivial to bring dissension into the Church; any issue that does this is worthy of some concern. For example, there are American churches of Germanic origin that have a major problem over the question of whether or not the German language should be used. From most perspectives this appears to be a trite matter, but for the group facing the issue it is important. Not only is the subject matter itself important, but the attitudes of people toward each other, regardless of what subject is immediately involved, are of fundamental importance in any Christian Brotherhood. An issue is important not only because of its effect on interpersonal relationships, but also because of its effect on the life and thinking of an individual. Regardless of how insignificant the rest of a community may judge an issue to be, if it constitutes a genuine problem to a given individual, it is critical to him. This is not to imply, however, that the rest of a community should spend a lot of time discussing the issue; it does mean they should take it seriously.

2) An idea or position may be critical if it has consequences that are likely to affect the Church. The slow erosion of a basic pillar of truth or the subtle change of assumptions may have logical consequences that are bound to be reaped at a later time. For example, Dr. Moberg has pointed out that the concept of "Social Determinism" has serious implications for the doctrine of "free will." (See his paper in this issue of the *Journal*.)

\* Slightly revised version of an address presented at the 18th annual convention of the ASA held at Westmont College, Santa Barbara, Calif., Aug. 19-23, 1963.

\*\* Dr. Weaver is Professor of Chemistry, Goshen College, Goshen, Indiana, and a past president of the ASA.

In a similar manner some issues will affect the Church, but are unnoticed by most or all who are in the Church. What I mean to suggest here is that we need to have humility about our ability to decide what is critical or relevant. In the light of history one can look back and decide that certain beliefs or actions had unfortunate consequences for the Church or some other group, but these may have gone unnoticed by those contemporary to the problem. For example, if the fall of Rome was really caused by internal moral decay, as some historians suggest, the moral decay was apparently unnoticed or at least not considered important by many involved in the decay. As a practical matter, therefore, we need to be open to the voice of the prophet who helps us see the importance of issues we face.

3) An issue is certainly important when it involves a conflict with the non-Christian community. This is obvious. In spite of the confusion on the attitude of the Church toward astronomical views in the day of Copernicus, it was a critical issue even though the problem was not primarily a difference between the viewpoints of the Church and Science.

To summarize, it seems to me that any issue that a given group of believers find themselves concerned about is in a sense "critical" and worthy of some discussion by that group, but it is also possible that there are equally vital issues which they do not recognize.

## II. WHAT ISSUES SEEM CRITICAL TODAY?

It would be presumptuous for any person to suggest that he knows all the critical issues of a group, so I shall present a composite of the thinking of a number of people. As was reported in the April 12, 1962, issue of the *ASA News Letter*, I wrote to a number of Christian leaders and asked them, "What is the most critical issue that modern science poses to the Christian Church today?" Drawing primarily from these responses, I suggest that five major areas of concern need further consideration. There undoubtedly are many more, but these rank high in my estimation.

1) I believe that the most important issue we face today has to do with the method of science. Much of this subject might be placed under the title of "scientism." Logical Positivists at least in some instances state explicitly that the only reality is empirically determined reality. The average working scientist is not as aware of his assumptions, but normally he relies on the same basic assumption. Here are the words of several respondents to my query:

*Carl F. H. Henry*, Editor of *Christianity Today*: "The most critical issue, as I see it, is this: Does the limited methodology on which modern science insists exclude knowledge of the ultimate real?"

*George K. Schweitzer*, Associate Professor of Chemistry, University of Tennessee: "The most critical issue that modern knowledge has posed to the Christian Faith is that of the validation of religious assertions. (The age-old question: How do you know?)"

*Ian G. Barbour*, Associate Professor of Religion and Physics, Carleton College; author of *Christianity and the Scientist*: "I think that among students and the more 'intellectual' portion of the country, the biggest challenge to religion today comes not from any questions of the *content* of either science or religion, but rather from questions about their *methods*—in particular, the assumption that the methods of science are the only road to knowledge."

*William G. Pollard*, Executive Director, Oak Ridge Institute of Nuclear Studies; author of *Chance and Providence* and *Physicist and Christian*: "I feel that the most critical issue posed by modern science for the Christian Church today is the strong bias against the apprehension of any transcendent or supernatural reality beyond the limits of space, time, and matter, which the study and pursuit of science engenders."

*Bernard Ramm*, Professor of Religion, Baylor University (now California Baptist Theological Seminary); author of *The Christian View of Science and Scriptures*, and other books: "If science shows us how sentences assert and how they are verified or falsified, how is it that theological sentences assert and how are they verified?"

*Robert M. Page*, Director of Research, U.S. Naval Research Laboratory: "I would say that the most critical issue posed by modern science is the denial of the supernatural, placing upon the Christian Church the burden of proof."

One might also include in the area of concern about methodology the problem or perhaps opportunity that is inherent in the rather recent wave of awareness in the writings of physical, biological and social scientists of a significant change in what they think they are doing. The concept of the "model" which is true if it is useful, and useful if it can predict, is certainly gaining prominence over the older concept of "finding reality." This change in mood completely removes some problems of the past, but it also bears discussion by concerned Christians.

2) A second area that urgently needs attention by Christians in science is the question of purpose in scientific pursuits. There is the obvious problem of the extent to which the scientist accepts moral responsibility for his work or the results of his work. This is a most acute problem to the man of pure research who frequently has not even an inkling of whether the fruits of his labor will more likely be used for the betterment or to the detriment of mankind, to use but one criterion. To those of us with utilitarian-oriented backgrounds there is always the question of the value of doing something for which we do not see usable results. To what extent is scientific endeavor a valid occupation for the Christian in a world with an abundance of scientists and a scarcity of Christian workers? In short, the scientist cannot escape the basic question faced by every Christian of the meaning and purpose of his vocation. Here are the comments of several others:

J. Lawrence Burkholder, Associate Prof. of Pastoral Theology, Harvard Divinity School: "It seems to me that the main problem has to do with the ultimate end or purpose of science. What are scientists doing? We are living, as you know, in a scientific world, that is, the world which is dominated in almost all areas by scientific achievement. The question is really a religious question insofar as it raises the question of final purpose."

William Hordern, Prof. of Systematic Theology, Garrett Biblical Institute; author of *A Layman's Guide to Protestant Theology*: "Modern science, having put into the hands of man unprecedented power for good or evil, while it is itself incapable of providing ethical direction or spiritual power for the use of its discoveries, has placed a new challenge to Christian ethics and Christian living."

C. A. Coulson, Rouse Ball Professor of Mathematics, Oxford University, author of *Science, Technology and the Christian*, and other publications: "The most important issue which science poses to the Christian Church today is an understanding of the purpose for which human beings exist, without which they cannot possibly make use of the new power which science provides."

3) A third area that could profitably receive the attention of scientists who are also Christians is the supernatural character of the historic Christian faith. In a sense, there is nothing new about the problems raised by the miracles or non-repetitive acts of God, but the very existence of such a term as "demythologize" indicates a pertinent problem for those concerned with the use of the Scriptures. Pollard in *Chance and Providence* spends considerable effort in discussing this topic. It is worthy of attention.

G. D. Yarnold, Warden, St. Deiniol's Library, Hawarden, author of *The Spiritual Crisis of the Scientific Age*, replied: "While the discoveries of the natural sciences, by widening the horizons of the human mind, must be reckoned among the blessings of Almighty God, it seems to me that the most critical issue, which the Church has to face, is that of taking the new knowledge into its own thinking in such a manner as to do full justice to the Supernatural Character of its historic faith."

Emile Cailliet, Prof. of Philosophy (retired), Princeton Theological Seminary, author of *The Recovery of Purpose* and other works: "While scientists solely ruled by their intellect submit to the factualness of events which seem to defy common sense, theologians too readily reduce the factualness of New Testament Christianity to the mythical—ultimately because their apprehensions of God's mysteries do not square with the anthropomorphic ways of imagination."

4) Perhaps not fundamentally different from the above concern is a fourth kind of issue, the problem of understanding the Word of God at those points where it

appears to be in conflict with current scientifically oriented thought. Even though some of the specific issues involved may seem to have been overworked in the past, and undoubtedly some of them have been the focus of attention until no further attention seems relevant, areas of concern here will continue to reappear with each new scholar on the scene. When any of us has received peace of mind with respect to specific problems in this area after deep spiritual and mental anguish, we are inclined to consider the issue to be no longer relevant or critical. We must not forget that each new scholar must face each issue in person. Here are some specific replies that were in this general area:

Gordon H. Clark, Professor of Philosophy, Butler University: "I might say that the one overwhelming issue is the truth of the Bible. However, I might give a more technical reply by quoting a bit of Ernest Nagel's presidential address to the American Philosophical Association:

"The occurrence of events, qualities, and processes, and the characteristic behaviors of various individuals, are contingent on the organization of spatio-temporally located bodies, whose internal structures and external relations determine and limit the appearance and disappearance of everything that happens . . . There is no place for the operation of disembodied forces, no place for an immaterial spirit directing the course of events, no place for the survival of personality after the corruption of the body which exhibits it."

J. Oliver Buswell, Jr., Dean of Graduate Study, Covenant College and Theological Seminary: "Inasmuch as Christianity is centered in the atonement of Christ, 'The most critical issue that modern science poses to the Christian Church today' is the relation of the sin of Adam to the atonement of Christ, as set forth in Romans 5:12-21, as this relationship may be affirmed, doubted, or denied by the theories of the origin of the human race."

H. J. Eckelmann, Research Associate, Cornell University, has more recently written Dr. Elving Anderson, "Answering your invitation to submit what we feel to be the most important question in the area of science and Christian faith I offer two. 1) What at the present are the best known evidences for the existence of God?, 2) What at the present are the best known evidences for the inspiration of the scriptures . . . ?"

Merrill C. Tenney, Dean of the Graduate School, Wheaton College: "I would say that perhaps the most critical question is the age of man and its relationship to the Biblical doctrine of creation."

David W. Kerr, Acting Dean, Gordon Divinity School: "In one sentence, I would say that to my mind the most critical issue that modern science poses to the Christian Church today is whether a belief in Divine creation can be reconciled to the idea of the origin of life from amino acids or other primitive protein substances."

5) Finally I would like to suggest that we should be concerned with the problem of communicating Chris-



tian truth in a world dominated by scientific vocabulary. The concern here is both for the problem of presenting the Gospel to the twentieth century man of science and the problem of sharing with others in the Christian community the insights and concerns we have mentioned in the first four areas, as well as other important findings and interpretations.

*Peter W. Stoner*, Prof. Emeritus of Physical Sciences, Westmont College, recently wrote: "After more than 50 years of dealing with the relation of science to the scriptures, I am convinced that the greatest need is with the high school and college students . . ."

Inasmuch as the above concerns come from a variety of persons within the Christian Church, I submit that they are worthy of our careful consideration.

#### A MATHEMATICIAN'S PRAYER

Our Father in heaven, we thank Thee for the orderly beauty of the nature which surrounds us—for the delicate symmetry of the snowflake; for the intriguing diversity of living forms; for the manifold patterns into which matter is organized; for the ever-fresh and vital urge of spring; for the spark of life within each cell.

We thank Thee that we live in a world, a nature, a universe that is ever progressing; that the laws which describe so many aspects of this progress are discoverable to us; that we need not live in a dark, chaotic, unpredictable, and frightening world of superstition and fear—but that we have been blessed with a capacity to analyze and understand a nature which is orderly and logical.

But we pray, O Father, that our little knowledge not make us arrogant or presumptuous. Help us to remember that our knowledge is, at best, superficial and limited. We discover the laws of matter—but we do not know what matter is. We study the steps by which evolution has proceeded—but we do not understand the essential urge that spurs evolution on. We analyze the behavior of living things—but do not know what life is. Help us to remember that deep within all these problems there remains a central core which our science does not penetrate. And help us humbly to recognize that this core, this living essence, this one central and remaining mystery, is in Thy divine keeping. Amen. —*Warren Weaver*, Ph.D., *Medicine At Work*, vol. 3, no. 12, Dec. 1963, p. 2 (c. 1963, Pharmaceutical Manufacturers Assn., used by permission).

#### PURITANISM AND SCIENCE

Does a religious or a secular society provide the best milieu for the flourishing of science? Seventy years ago a case was presented against the society dominated by theology in Andrew D. White's *History of the Warfare of Science and Theology in Christendom*. (See Bube's note, *JASA*, vol. 12, no. 2, pp. 24-25, June 1960.) Since then, however, Max Weber and his followers have taken the position that the flowering of modern science was helped by the spirit released by the Protestant Reformation.

In a recent book, Lewis S. Feuer has re-examined the question and reached conclusions similar to those of White although his analysis is distinctly more sophisticated. Feuer not only takes a position that deplors the effect of a Puritan society on the flourishing of science but goes further to espouse a "hedonist-libertarian ethic" as the basis for scientific progress. His thesis is, in his words:

In this study I shall try to show that the scientific intellectual was born from the hedonist-libertarian spirit which, spreading through Europe in the sixteenth and seventeenth centuries, directly nurtured the liberation of human curiosity. Not asceticism, but satisfaction; not guilt, but joy in the human status; not self-abnegation, but self-affirmation; not original sin, but original merit and worth; not gloom, but merriment; not contempt for one's body and one's senses, but delight in one's physical being; not the exaltation of pain, but the hymn to pleasure—this was the emotional basis of the scientific movement of the seventeenth century.

A most interesting review of Feuer's book (*The Scientific Intellectual: The Psychological and Sociological Origins of Modern Science*, Basic Books, Inc.) appeared in the August, 1963, issue of *Scientific American*. The reviewer, A. Rupert Hall, Professor of the History and Logic of Science at Indiana University, applauds the publication of a book which re-examines the relation of science to society, but he enters the reservation whether the right questions are being considered in Feuer's book. On the one hand, Feuer, with some justification, can write about the freedom of Benjamin Franklin's Philadelphia being "eclipsed by the gray fog of religious revival that closed in on the bright dawn of American genius." On the other hand, he ignores the decline of science in the Ottoman Empire where the libertarian philosophy was accepted in its entirety. Feuer also can point to the liberating spirit of the 17th century as supporting the tremendous attainments of the English science of that time; however, the even more hedonistic England of the 18th century produced little of scientific value.

As the reviewer emphasizes, the issues raised by Feuer are too complex to be understood on the basis of sociology or psychology alone. Certainly liberty and a feeling of optimism and expansiveness are helpful to the scientific enterprise. Nevertheless, it is clear that other factors must be considered if a satisfactory understanding of the health and growth of science is to be obtained. —*John A McIntyre*, Cyclotron Institute, Texas A & M University.

# CHRISTIAN COMMITMENT AND THE SCIENTIST\*

V. ELVING ANDERSON\*\*

*Objectivity and commitment are compatible attributes, and both are to be encouraged. The nature or pattern of commitment, however, may restrict one's openness to new facts or ideas.*

Objectivity and commitment are sometimes presented as opposing attributes. A person may ask, "How can you be intellectually honest and believe the Bible?" Science may be thought to represent the peak of objectivity, whereas religion stands for commitment. If these terms are indeed opposite in meaning, then direct conflict between science and religious faith appears inevitable.

In contrast to this point of view I wish to suggest that: (a) Objectivity and commitment are qualities of persons rather than of topics. Each person develops foci of commitment, and is more objective or less objective in different areas of life. (b) The person who is most deeply committed may be the one who is able to be the most objective. (c) It is the pattern of commitment (rather than its presence or absence) which conditions one's objectivity.

## OBJECTIVITY AND COMMITMENT

Huston Smith (1) points out that objectivity is not equivalent to impartiality or neutrality. Anyone active in research realizes the selective nature of his work. One is never able to study *all* the factors which might affect the problem under investigation; he is forced to select those thought most significant. The interpretation of results also involves the observer's personal sense of perspective. Complete impartiality

\* Based in part on a paper presented at the 18th annual convention of the ASA, Westmont College, Santa Barbara, California, Aug. 19-23, 1963.

\*\* Dr. Anderson is Assistant Director of the Dight Institute for Human Genetics, University of Minnesota, Minneapolis and president of the ASA.

would be possible only for an omniscient God. In a similar sense, complete neutrality is neither possible nor desirable. Neutrality may simply mask an inability to make decisions when they are needed.

It is more appropriate to think of objectivity as an individual's openness to new ideas or fairness to evidence. "This involves open-mindedness—the willingness, even eagerness, to entertain seriously every item of relevant evidence that has a bearing on the problem at hand. It involves maximum responsiveness to the facts, seeing each, insofar as possible, with discrimination and without distortion to the end that it may be assigned its appropriate and becoming weight." (1, p. 43)

Objectivity is thus not a passive attribute which is given as a prize for good behavior. It requires energy to maintain. It involves a willingness to listen and an attempt to understand, followed by an appraisal of significance.

Teachers soon learn that students differ in their abilities to tolerate new ideas. Some students appear to feel that new evidence may markedly alter their systems of thought. They consider new ideas as a personal threat and are unable, or unwilling, to spend the effort required for re-evaluation.

Scientists also can reveal a lack of objectivity. A vigorous defense of a particular hypothesis can be a very stimulating exercise if it leads to new tests of the idea. But such a discussion can degenerate into an emotion-filled defense of an hypothesis as though it were personal property to be protected against all invaders. It is tempting to confuse one's models or interpretations of reality with the reality they are intended to represent.

On the other hand, a successful research scientist is often a deeply committed person. He must devote time and energy to study, planning, testing, recording data, and interpreting results. Furthermore, he is committed to basic assumptions, such as the following: (a) If an experiment is carefully designed, executed, and reported, the results can be verified by someone else. (b) If a principle or generalization is proved to be inadequate, it will be replaced by another more adequate one. (c) A good hypothesis is measured, not by its "truth," but by its usefulness in stimulating relevant research. (d) There is a reality which corresponds to the data supplied by his senses in answer to a research question.

## COMMITMENT A BASIS FOR OBJECTIVITY

It would seem, then, that objectivity and commitment are not alternative but mutually supporting attributes. Each person (whether theologian or scientist) reveals a pattern of objectivity and a pattern of commitment. Smith (1, p. 46) suggests that it is possible to possess a basic faith or commitment which "provides that matrix of ultimate confidence toward life which can ac-

commodate the maximum open-mindedness . . . . We have now been brought to a paradox: the more faith a person has, the more open-minded he will be." Objectivity and commitment—both are essential.

What happens then if we examine those commitments we make as Christians who are also scientists? I am personally committed to the faith that the Bible is God's revelation and that Jesus is both Savior and Lord. These, in fact, are the basic tenets which bring us together in the ASA.

Some have urged strongly that we should add as additional criteria for ASA membership either specific interpretations of the Bible or specific ideas about the nature of science. The Executive Council has resisted these pressures from both directions, feeling that our present statement of faith is a sound basis for fellowship and that we must not restrict open discussion of differing points of view.

Nevertheless, it may be appropriate for us as individuals to put into writing our personal "commitment profiles." This may be the only way we can discover the reasons for our differing opinions. Further discussion can be directed to these basic differences rather than to more secondary matters. It is in this spirit that I present the following as issues on which I am willing to take a stand.

(a) The God who is my redeemer is also creator and sustainer of myself and of the universe. (b) In the world of nature about me I see evidences of His activity. These are *evidences* in the sense that they demand a decision about faith in God, but not *proofs* which would compel an affirmative answer. (c) God's activity is involved both in what I think I understand and in what I know I don't understand. (d) Research is an appropriate task for a Christian, not just for the useful results which may accrue, but as part of God's command to subdue the earth and have dominion over it. (e) My faith creates no barriers to research, no forbidden areas. The earth is the Lord's and the fullness thereof. Certain methods of investigation, however, would conflict with my concept of the nature of man. (f) Research indicates that space is more vast, time more extensive, and nature more complex than I could possibly have imagined, and thus enlarges my concept of God.

Thielicke (2) has described the difference between a "world picture" (the sum of scientific knowledge about the world) and a "world view" (which deals with the ultimate meaning of life and the world). God as creator is part of my "world view." I hope to grow in my comprehension of this idea and its relevance for me, but I do not expect to have my "world view" significantly altered by the results of research in any of the scientific disciplines. On the other hand, a good deal of my time and energy must be spent in trying to keep my "world picture" up to date. The rapid advances in molecular biology, for example, have

dramatically modified some of the questions we address to the world of life as well as the answers we obtain.

This distinction is important for discussions of "evolution." Some scientists are so deeply committed to evolution as a comprehensive explanation for the universe that any thought of God is rejected violently. Clearly evolution has become part of their world-view as a substitute for God as creator. But some Christians reject carefully documented data concerning natural selection or speciation in just as emotional a manner. These latter topics I would consider part of one's world picture. I do not feel that my commitment to God as creator (as a creationist, if you please) should restrict my interest in genetic similarities between species or in natural selection in man. If anything, my awareness of the problems of interpretation places me under some compulsion to become involved in this type of research.

#### THE PATTERN OF COMMITMENT

Thus far I have argued that commitment and objectivity are compatible and that both are to be encouraged. But it is essential to point out that one's *pattern* of commitment has an effect on one's objectivity. The Russian commitment to Communist dogma, for example, has severely limited freedom for research in genetics. A commitment to the "gap theory" (an original creation in Genesis 1:1 followed by a large span of time and a re-creation) limits one's objectivity in geology, even though some might hold this limitation to be desirable. A belief in vegetarianism would restrict openness to research in nutrition.

Furthermore, the pattern of commitment may be central or peripheral. That is, one's energies can be devoted to simplifying and consolidating commitment or to protecting and up-dating a large number of specific beliefs. In general, it would seem that a larger number of commitment foci would place greater restrictions on objectivity.

Finally, it may be necessary occasionally to distinguish commitment to God's word from commitment to traditional interpretations of the Bible. It would be presumptuous to claim that one has personally explored all facets of important questions and has arrived at independent conclusions. We must not discard the insights inherited from past centuries, but it is entirely possible that the Holy Spirit may yet have new lessons for us, if we will listen.

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# CHALLENGES BEFORE THE AMERICAN SCIENTIFIC AFFILIATION\*

F. ALTON EVEREST\*\*

*To develop its great potentialities, the ASA should (1) initiate explorations into the possibility of a federation of associations which bring the Christian witness to intellectuals, (2) publish a popular magazine relating Christian faith to science, (3) develop a Christian philosophy of science which is in keeping with Biblical revelation, and (4) sponsor an International Congress on Science and Christianity.*

The American Scientific Affiliation has obligations to the Christian community, to the scientific community, and to its own members. The first twenty-two years of the ASA have been largely characterized by family affairs—the gathering of a membership of qualified individuals and the tentative exploration of the vast and vital issues arising between science and the Christian faith. It would seem most desirable and tactically astute for the ASA to make definite plans toward developing greater outward look during the next five or ten years. A study of existing needs and opportunities has suggested four challenges which appear to be worthy of the consideration of members and officers of the ASA in developing this outward look.

## CHALLENGE I

As far as is known, the American Scientific Affiliation is the oldest organization on the North American Continent formed for the purpose of considering the interaction of science and the Christian faith. God has seen fit to preserve and prosper the ASA when such worthy organizations as The Religion and Science Association, The Kelvin Institute, The Creationist Society, The Society for Study of Deluge Geology, The Natural History Research Group, The Society for the Study of Natural Science and others have fallen into oblivion. On the other hand, a number of new organ-

izations founded along disciplinary lines have arisen which are growing in strength, such as the Christian Medical Society, Christian Association for Psychological Studies, and those loosely organized, but indomitable scholars who publish the valuable journal, *Practical Anthropology*.

The first challenge is simply this: that negotiations be initiated exploring the possibility of the banding together of these organizations into a loose federation that would present a united front for the greatest overall witness to the world. This larger organization might function along the lines of the American Association For the Advancement of Science. The idea would not be to usurp the authority of the disciplinary groups, but rather to augment and encourage them. Greater emphasis upon the several disciplines should better serve the specific needs and interests of the individual Christian man of science and thus lay a stronger foundation for a program of outreach.

The temptation to suggest that the ASA fulfill this function by swallowing up these other societies shall be pushed aside. Perhaps an entirely new organization is needed to carry out this larger task. It is true that the ASA has the broader interests as shown by the intense activity within the Psychology Commission, the Natural Science Commission, the Social Science Commission and the Philosophy of Science Commission. Such an organizational arrangement as proposed could be built up around this commission structure. Like *Science*, the organ of the AAAS, a journal dealing with inter-disciplinary matters would seem to be indicated to supplement the disciplinary publications.

Such a "shade-tree" type of organization would shelter the disciplinary groups beneath its branches. It would be controlled by representatives from all of the disciplines and would serve all, better rendering that most important service of broadening the viewpoint of the specialist. The shade-tree organization would present a more unified and effective testimony to intellectuals and would serve the Christian community with greater authority and effectiveness.

## CHALLENGE II

It is suggested that the American Scientific Affiliation consider seriously the eventual publication of a popular magazine designed to help the Christian layman in relating matters of his faith to science. Youth workers, students, teachers and alert parents are eager for help in evaluating controversies that appear to arise between traditional Christian concepts and modern science. They need help in developing from first principles a world view embracing knowledge from revelation in Scripture and revelation in nature. Controversies would not be treated as ends in themselves but as opportunities to establish an intellectual climate in which such controversies could not arise or long survive.

The question arises, what would be the content? There could be articles on current issues and topics, reviews of significant books and articles appearing elsewhere,

\* Slightly revised version of a paper presented at the 18th annual convention of the ASA held at Westmont College, Santa Barbara, Calif., Aug. 19-23, 1963.

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treatment of controversial issues on a pro-con basis and reprints of helpful articles from other sources. Picture interviews could communicate the vitality of the witness of Christians prominent on the current scientific scene. One of the great values of such a journal would be the assurance imparted by the general knowledge that there are many qualified, practicing scientists living fruitful lives of faith.

The *Journal of the American Scientific Affiliation* is a scholarly publication. The proposed magazine would supplement the Journal. In fact, the existence of a vital Journal would be a necessary foundation for such a magazine. Apart from the ASA, there is no other backlog of talent in our hemisphere upon which such a magazine could be operated on a continuing basis. This means that the ASA has a special responsibility in this regard.

Such a periodical was considered seriously by the Editorial Board and the Executive Council in 1962. It would take considerable money to launch such a magazine and it was judged unwise to proceed in this direction until certain other editorial projects of a more urgent nature were cared for. But this is something the entire membership of the ASA should ponder, for all are involved. Who knows? Perhaps some member of the ASA has the money such a project requires or knows someone else who has!

#### CHALLENGE III

Beside the individual and collective responsibility of effectively communicating the Christian message to the scientific community, there is the broader task of developing a philosophy of science in keeping with Biblical revelation, and the two are related. It is characteristic of our time that great minds interpret the universe mechanistically. ASA members generally feel that science needs the orientation of Biblical theism. In fact, science and theology are in need of each other if we are to avoid the evils of compartmentalization. Christian thinkers of all ages have applied themselves to aspects of this problem but only recently have appreciable attempts been made to formulate such a philosophy. The American Scientific Affiliation has had a part in this; with the Evangelical Theological Society, the ASA has a responsibility to the world to carry on this work with increased diligence. As the problems of the time shift and as God's revelation in nature unfolds, a neat static philosophy cannot be expected, but rather one which is temporal and continuing in nature. An evangelical philosophy of science, then, would be a consistent amalgamation of the data of revelation and the data of empirical science.

This is an area in which neither the Christian nor the non-Christian can prove that his view is right. Christians see God in nature because of their vantage point of faith. Faith does not come as a result of seeing God in nature. The Christian man of science must not expect to force his position on others through "irresistible intellectual argument." Developing and applying such a Christian philosophy of science would, however,

be an invaluable exercise for all and would provide a satisfaction to the intellectual aspect of the Christian life.

Thousands and thousands of scientists are immersed in research in their narrow specialties, giving little thought to anything but the immediate empirical aspects of their work. A few self-appointed scientist-philosophers, arising out of this great sea of researchers, account for much of the philosophical enunciation in science. Among them are very few men of Christian persuasion. What is enunciated is shaped by the personal philosophy of the individual. In this way the scientific edifice has been erected on philosophical foundations of atheistic materialism.

In the rebellion against religion among intellectuals, something has been lost to science. For one thing, scientists have been inclined to forget the limited sphere of science and the source of the orderliness of the universe which makes scientific investigation possible.

We should not expect wholesale acceptance of any Christian philosophy of science, but we have a right to hope that it might become an intellectually respectable alternative. It is suggested that the ASA has a definite responsibility to the scientific community in developing a Christian philosophy of science and that such activity should be officially encouraged. During the last ten years six major papers on this subject have appeared in the Journal of the ASA. This is a small, but valuable beginning.

#### CHALLENGE IV

While the success of the annual national conventions of the ASA is being questioned, it may seem foolhardy to propose a heroic dose of the same thing as a palliative or as a cure. But with the desire to inject a new dimension into the mission and work of the ASA, such a heroic measure is hereby proposed. The new dimension is one of dramatizing to the scientific community and to the world the complete relevance of Christian faith to this modern age and demonstrating to the Christian community that science is truly an ally of faith. The proposal is that ASA officials consider the possibility of planning, organizing and sponsoring an International Congress on Science and Christianity to take place about 1969 or 1970.

To be effective, a tremendous amount of planning, hard work, and expense would be involved. The program might well be built around the several commission areas. Cross-pollination between Christian men of science of many countries would permeate each of the subject areas. Such a congress would yield publishable material and attract the attention of prominent publishing houses, extending the influence of the congress even further.

Here, then, are four of many possible challenges which are placed before the ASA. May these and other such challenges provide purpose, motivation and justification for this society in the years to come.



# CONFLICTS BETWEEN CHRISTIANITY AND PHYSICAL SCIENCE

DAVID F. SIEMENS, JR.\*\*

*Examination of the statements of Paul, Tertullian and Augustine reveals that the common belief that there has always been antagonism between scientific thought and Christianity is fallacious. Scrutiny of the lives of Copernicus, Kepler, and Galileo similarly reveals the falsehood of the conclusion that they were persecuted by the Church for their scientific views. The much-touted conflict did not begin until the latter half of the nineteenth century. The real source of the problem resides in three naive assumptions.*

That there is a conflict between science and Christianity is accepted by many today. Indeed, one quite often hears that there has always been antagonism between science or protoscientific thought and religious thought. But specifically, we are faced with the relationship between science and Christianity. Some people trace the problem back to Galileo's time. Some go back to Copernicus and his theory of planetary motion. Others trace the attitude back to Augustine, Tertullian, or even the writings of the Apostle Paul. Let's go back to this beginning and see.

## THE PRESCIENTIFIC PERIOD

Paul wrote: ". . . the Lord knoweth the reasonings of the wise, that they are vain. Wherefore let no one glory in men." (I Cor. 3:20f.)<sup>1</sup> And again: "For it is written, I will destroy the wisdom of the wise, and the discernment of the discerning will I bring to naught. Where is the wise? where is the scribe? where is the disputer of this world? hath not God made foolish the wisdom of the world?" (I Cor. 1:19f. cf. 1:17-2:16; 3:18.) Further, the only occurrence of "philosophy" in the New Testament is derogatory (Col. 2:8).

This has been taken to indicate that Christianity is totally opposed to any human being thinking, and that it is specifically opposed to that type of thinking which later gave rise to the modern sciences. But is this true? No! What Paul was opposing was the pride of man, which sets itself up as the judge of all things, which would make that which man cannot discover—or has not discovered—the ultimate criterion of truth. Paul was not against knowledge; he merely wanted a proper recognition of its place and purpose. Man's knowledge is useful only for time; God's revelation offers eternal life. Man's discoveries leave untouched the most important and basic problem of existence, his relationship to God.

We need to remember that it was this same Paul who wrote: ". . . whatsoever things are true, whatsoever things are honorable, whatsoever things are just, whatsoever things are pure, whatsoever things are lovely,

\* Revised version of a paper presented at the 18th annual convention of the ASA held at Westmont College, Santa Barbara, Calif., Aug. 19-23, 1963.

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whatsoever things are of good report; if there be any virtue, and if there be any praise, think on these things." (Phil. 4:8) This was written in a pre-scientific era, so it does not use the terms which specifically characterize our current outlook. Yet the terminology clearly indicates that anything that is worthy of consideration is open to the Christian, provided its limitations are kept in mind. Thus one cannot trace back an anti-intellectual bias to Paul, even though some who are anti-intellectual have claimed Pauline authority.

Next stop is at Tertullian, that early apologete. He is reported to have said, "*Credo quia absurdum* (I believe because it is absurd)." This kind of attitude obviously cuts one off from the down-to-earth rational empiricism of the practicing scientist. This statement is supposed to show that Christianity is anti-rational and ridiculous. But Tertullian never said *credo quia absurdum*. What he did say, speaking of the death of the Son of God, was: "It is to be believed because it does not fit" (*ineptum*, not *absurdum*).<sup>2</sup> This is Tertullian's striking way of saying that the Gospel is such that it forces belief. A Greek might write that a god or goddess might have a son by a mortal. But he would be like Memnon, son of the goddess Eos or Aurora, a king and great warrior who, according to the legends, died gloriously in battle. But that a Jew would say that the Lord God had a Son, that this Son was a Galilean working man, that He died as a common criminal, this is so far from what men would consider a suitable career for a Son of God that such a tale would not have been invented.

True, the language that Tertullian used is extreme. But there is no evidence in this statement of Tertullian's that orthodox Christianity would oppose scientific thought.

What about Augustine, that giant of Christian thought, the one to whom both Luther and Calvin returned in their attempt to reform the church? It is possible to find passages in Augustine that attack the mathematicians and depreciate various secular studies.<sup>3</sup> Some people have seized the statements about the mathematicians as evidence that Augustine opposed rational thought. These people are ignorant of the situation Augustine attacked. The mathematicians of his day were astrologers, practitioners of a superstition which Augustine rightly opposed.<sup>4</sup>

As to Augustine's depreciation of secular studies, the passage in which this occurs is part of a lengthy discourse on the understanding of Scripture. He notes, for example, that the study of astronomy is no help to the study of Scripture because there are practically no references to heavenly phenomena in the Scriptures, and because "by engaging the attention unprofitably [it] is a hindrance" to the study of Scripture. Further, it is liable to lead into astrology.<sup>5</sup> This last was true in Augustine's time and many centuries later, as may be seen in the life of Kepler.

Almost immediately below, Augustine adds a note on the practical arts and sciences of his time, carpentry, medicine, agriculture and navigation. He says that the Christian needs only a superficial knowledge of them and then immediately says that he is speaking, not from the need of such arts, but only from the standpoint of understanding Scripture.<sup>6</sup> Augustine then commends the work of scholars.<sup>7</sup> It is true that he finally says that anything of value is to be found in Scripture.<sup>8</sup> But this extreme statement is contradicted in the discussion preceding. It appears that the preacher was carried away with the importance of his subject until he exaggerated it beyond proper bounds. Elsewhere he notes that he was saved from the Manichean heresy by his recollection of "scientific" knowledge.<sup>9</sup>

It may further be noted that speculation and study had not, in Augustine's time, given rise to the advances which we today recognize. We have come to recognize, as Augustine could not, that any type of scientific study may pay practical dividends. So we cannot castigate Augustine for not recognizing the benefits of science not yet born. Still, it is instructive to note that Galileo, the founder of modern science, turned to the thought of Augustine and other "Platonists" for inspiration and defense of the scientific approach to the universe.<sup>10</sup> And some of the things that Augustine said sound more modern than some ideas propounded during the last century.

#### THE ERA OF SCIENTIFIC BEGINNINGS

What has been said thus far for the most part goes back beyond the beginnings of modern science. It is not until we come up to the time of Copernicus (1473-1543), Kepler (1571-1630) and Galileo (1564-1642) that we find the beginnings of physical science—in the modern sense of the term—and the possibility of a conflict between physical science and Christianity. At this point we are told that these three men were persecuted because of their scientific views. Specifically, it is stated that Copernicus was persecuted by Bishop Dantiscus, his immediate ecclesiastical superior, and that he refused to publish for some thirty-six years because of his fear of additional persecution.<sup>11</sup> The fact of the matter is that pope, cardinals and bishops urged Copernicus to publish. Even Dantiscus, when he heard that Copernicus was ready to publish, far from persecuting him, sent him a friendly letter, with a poem to be used as prologue. Copernicus did not use the poem. Certainly, Luther growled that "the fool would upset the whole science of astronomy," which Luther conceived as being taught in Scripture. But *De Revolutionibus Orbium Coelestium* was published in the Lutheran city of Nuremberg. There was no persecution of Rheticus for his part in seeing the book through the press, nor of Maestlin, professor at the Lutheran University of Tuebingen, who taught the Copernican Theory to Kepler.<sup>12</sup>

Kepler was persecuted. But the persecution came as a result of his religious views, not because of his scientific views. As a matter of fact, the Jesuits were influential in having Kepler reinstated as professor at the University of Graz after all Protestants had been ordered out of the area. Further, although it was well known that he was a Copernican and a Protestant, he was offered the chair of mathematics at the University of Bologna.

What actually was going on at this time was a confrontation between astronomers and theologians who favored the Copernican Theory, the Tychonic Theory and the Ptolemaic Theory. It was into this discussion that Galileo leaped with a cudgel. His telescopic observations of the moons of Jupiter showed the untenability of the Ptolemaic-Aristotelian system. As a direct result, there was the refusal of Cremonini, the aging Aristotelian philosopher, even to look through the telescope, for it might upset his philosophy. Actually, Cremonini was not being obstinate but merely being human. He was nearly convinced of the error of Aristotelianism, and he did not want to be faced with that final bit of proof which would destroy the system to which he had devoted a lifetime. But it should be noted, to give Cremonini his due, that the old man later abandoned Ptolemy; his integrity overcame his reluctance.

Other Aristotelians were not so honest. They hated Galileo for showing them up, for writing acidulous verse and caustic rebuttals. They were joined by others whom Galileo had offended by his gratuitous insolence and intellectual dishonesty. When Galileo finally alienated the pope, he was doomed. The arrest, trial and condemnation of Galileo came, not because Galileo and Copernicus came into conflict with Christianity, but because Galileo was arrogantly egotistical and libelously insolent.<sup>13</sup> Unfortunately, the power of the church was used to pay back old scores with usurious interest, thereby clouding the actual issues. The examination and proof of these statements would take too much space here, but they can be documented.<sup>14</sup> Sir Francis Bacon, a contemporary of Galileo, saw no conflict between Christianity and science.<sup>15</sup> But he was convinced that Aristotelian philosophy was a brake on scientific advance.<sup>16</sup> In this he was probably correct, for Aquinas, who gave the standard interpretation of Aristotle for practically all Christians, said that "... knowledge is in inverse ratio to materiality."<sup>17</sup> Further, it is a matter of record that the group which is fundamentally Aristotelian has produced relatively few scientists compared to the number produced by the non-Aristotelians.

During "The Century of Genius" (the seventeenth), Newton, Boyle, Hooke, Descartes, Borelli, Halley, Cassini, Grimaldi, Huygens, Gassendi, Fermat and Leibnitz were all active. Of this amazing group of scientists and mathematicians only one, Huygens, was not religious.<sup>18</sup> This means that they apparently believed

that there is no conflict between physical science and Christianity. In other words, apart from the unfortunate identification of Aristotelian philosophy with Christian truth, there was no general feeling of conflict.

#### DEVELOPMENTS SINCE 1850

More recently, however, there has been a general feeling of conflict. Where did it arise, and how? To seek to answer this question fully would take us into another lengthy topic. However, I must note that John William Draper, *History of the Conflict Between Religion and Science*, and Andrew D. White, *A History of the Warfare of Science with Theology in Christendom*, were first published in 1874 and 1895, respectively. They could not have been published much earlier.<sup>19</sup> These books reflected the attitudes of their times back into the earlier period, when the conflict did not exist. Even as they were writing their books, the spaciousness of their claims was recognized:

The antagonism between science and religion, about which we hear so much, appears to me to be purely factitious—fabricated, on the one hand, by short-sighted religious people . . . and on the other, by short-sighted scientific people.

That statement was made in 1885 by Thomas Henry Huxley.<sup>20</sup> That was his belief, though he certainly was no Christian.

This is not to say that there have been no Christians who have not opposed scientific discovery. But opposition was not general until the latter part of the nineteenth century. The opposition of the Deists to Christianity, for example, was not derived from scientific considerations as much as from philosophical considerations. Today, opposition more generally claims scientific backing. But what is the real source of the problem? Huxley said that it is shortsightedness. I would suggest rather that the source of the problem is threefold:

1. The naive assumption that what one thinks Scripture says is the only possible meaning. This can be illustrated by the recent statement that anyone who does not believe in the universality of the flood is denying the truth of Scripture.<sup>21</sup>
2. The naive belief that a scientific explanation excludes the creative and providential acts of God. This would make God limited by human ignorance, a ridiculous situation for the Infinite One, yet it is put forward by philosophers.<sup>22</sup>
3. The naive insistence that science is materialistic or (philosophically) naturalistic.<sup>23</sup>

These three views are as common among religious people as among the non-religious. Although they are so naive as to be ridiculous, they unfortunately are very common.

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16. Bacon, *Novum Organum*, I, 63 (*Great Books*, 30:113f); I, 54 and 67 (30:111, 115); *Advancement of Learning*, II, vii, 7 (30:45). Bacon was opposed to other philosophies as well, but he kept his strongest statements for Aristotle. See for example his *Cogitata et Visa* (*Works*, Spedding edition, 7:115f) and *Temporis Partus Masculus*, II (7:18-20). These are translated in Basil Montagu, ed., *The Works of Francis Bacon, Lord Chancellor of England* (Philadelphia: Carey and Hart, 1844). 1:426f; 2:545-547.

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23. See, for example, Elder, *op. cit.*, pp. 5f, 9. The problem is discussed by Carl F. H. Henry, *Remaking the Modern Mind* (Grand Rapids, Mich.: Wm. B. Eerdmans Publishing Co., 1946), p. 89, n. 19; p. 95.

## SPIRITUAL DIZZINESS

The Word of God tells us that at the "time of the end: many shall run to and fro, and knowledge shall be increased" (Dan. 12:4). That many are running "to and fro," no one can deny, and knowledge in every field is so increased that we scarcely know where to begin to disburse it or to assimilate it. The field of Christian thought is no exception—there are volumes and volumes filled with terms so new that they are not in our dictionaries, and words so formidable sounding that one wonders if the theologians can define them. In the midst of all this stands the thinking Christian . . . wondering where to plunge in.

All was well when there were, roughly speaking, two main streams of thought—orthodox and liberal. One chose this stream, jumped in, and found himself carried along in the stream by the thinking of his associates, quite able to stay afloat, and even sometimes making a bit of progress upstream. Today Christian thinking is one great whirlpool, and quite a bit of it is very muddy. One jumps into the swirling currents, and even though he is an orthodox Christian, well supported by his God-given faith in the infallibility of the Word of God, he finds himself suffering from a severe case of vertigo . . . This dizziness may even be accompanied by frequent touches of nausea and occasional sinking sensations.

Is there a cure for those troublesome symptoms? Yes, the cure for "spiritual dizziness" is: one pure and unadulterated dose of the Word of God, taken as needed. (Please note: the dose may be repeated as frequently as desired, with only beneficial results.) Each Christian stands alone with his God in this matter . . . The light comes only as each Christian opens the Word, and lets the Lord Jesus open his eyes and his mind, as the risen Lord did for the two disciples on the road to Emmaus . . . —Miriam Cadman in *The Sunday School Times*, 105: 930, Dec. 21, 1963 (c. 1963 by The Sunday School Times; used by permission).

# THE PUBLISHING PROBLEM AND THE CHRISTIAN

RUSSELL W. MAATMAN\*

*Some ethical questions concerning the publication of research articles are discussed. (1) In determining when one should publish scientific results, publication should be considered a part of the age-old philosophers' conversation. Editors' decisions concerning what is and what is not published ought not to depend (even in the present period of rapid growth in scientific output) upon space availability and cost of publishing. (2) Criticisms concerning the anonymity of referees seem to have some merit. (3) Ideally the Christian should carry out scientific work because God commands him to, and not for scientific advancement. Therefore, he ought not to be anxious about the amount of credit he receives for his work.*

One of the growing pains attending the rapid expansion of science in this century is the "publishing problem." The situation is more correctly defined as a series of problems caused by the very large increase in the number of scientific articles written in recent years. Some questions related to publishing in any period, regardless of the total number of articles written, are ethical questions of special interest to the Christian. These questions are of acute interest in this present rapid growth period. Probably there will be trouble if good answers are not given. I would like to suggest answers to three of these questions.

## WHEN SHOULD ONE PUBLISH?

Someone said that every time a philosopher speaks he enters into a conversation which has continued for millenia. Our sciences are branches on the philosophical tree, so in a very real sense scientific publications are parts of this philosophical conversation, even though it now has so many sub-conversations that participants can understand only a very small percentage of the contributions of others.

The problem of when to publish is no different from other conversations: one should say something when he has something worth saying. What of the person who divides his work into small pieces in order that he obtain a larger number of publications? This policy does not make for smooth, sensible conversation. Perhaps the piecemeal author is a little too proud. I

believe, however—after surveying the chemical literature of a generation ago—that this problem is no larger now than it was before the period of extremely rapid growth began.

Nor is it very helpful for those listening to this philosophical conversation if the worker is pontifically deliberate, refusing to speak until the project is complete in every imaginable sense of the word. Helpfulness is a Christian virtue, and the Christian ought to want to tell others what he has discovered at the earliest possible time, enabling them to build upon his work. Much of the very long lag between discovery and publication is not the fault of the individual worker; he ought not to be even partially the cause of the lag problem.

When to publish depends upon the motives of the individual. If he enjoys working with what God has created, he wants to tell others about his findings. Is this his primary motivation, or is he motivated by possible advancement in position, prestige, and financial status? If there is a tougher ethical problem facing the scientist, I would like to know what it is. But if the scientist really has a Christian world-and-life view and has overcome the temptation of working for advancement, then he will naturally do the right thing about the twin evils of publication multiplication and publication postponement.

Some of these bad practices are the very ones which some use as excuses for investigating nothing of what God has created. How many times have we heard of someone who didn't want to engage in research because many articles are trivial or incomplete or because many publish merely to get ahead? Perhaps these are excuses for laziness.

## HOW DECIDE WHAT TO PUBLISH?

Here feelings run high. Who is to play God? Who is to determine whether or not a manuscript should be allowed to contribute to the age-old conversation? If there is any subject about which scientists are emotional, it is this.

Before we can say *who* will judge, we ought to know what criteria the judges should use. I think that many associated with publishing are not clear on this point. Isn't it true that there is only one good criterion the judges should use? Isn't it a necessary and sufficient condition that a piece of work add to scientific knowledge?

Yet there are journals that admit that year after year they reject many articles which do add to scientific knowledge, but for which no space is available. I would rather see a journal be mimeographed, and containing all articles submitted which add to scientific knowledge, than see it appear in a relatively expensive format, but omitting some positive contributions. Should not scientists be insistent on this point? Article content is infinitely more important than journal format. Christians ought not to confuse a principle, the principle that all good work (and good work is sacred) *must* be published, with the practical problem of what

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method of duplication the printer is to use. One of the more foolish things our civilized society can do is to allow journal format to be a rate-determining factor in the growth of science.

When put that way, of course, we realize that the format really need not suffer. There is no intrinsic reason why the cost (in real dollars) of publication of a scientific article in 1964 should be more than, say, in 1930. Of course, a library which attempts to be complete in its coverage of, for example, organic chemistry, may need to buy fifty articles in 1964 instead of a single one in 1930. Presumably such a library will serve more organic chemists now; but at any rate this particular problem is the user's, not the publisher's.

I wonder if much of the unrest over what is to be published would not be eliminated if it were agreed once and for all that the only good criterion for publication is whether or not an article adds to scientific knowledge. Perhaps it is characteristic of our age to confuse principles with the means of implementing them. The scientist who is a Christian ought, I believe, to consider addition to scientific knowledge immensely important and not a matter to be confused with the practical means of disseminating knowledge. There is a real problem in disseminating knowledge when the number of qualified articles submitted increases rapidly, but such a problem ought to be solved in a way helping scientific progress in months, not decades. What would happen on election day if a polling place closed early because the voting machine could handle only three digit numbers and the 999th person had just voted?

Who is to decide what is an addition to scientific knowledge and what is not? Is the referee system a good one? Surely we cannot quarrel with the idea that specialists chosen by an editor pass on a manuscript. Without some check, the philosopher's conversation would become babble. Yet the precise way in which referees are used has been criticized widely, and President Henry Eyring of the American Chemical Society in a presidential address agreed with many of the critics. He said that an editor "can't publish even all the acceptable papers that are submitted" and that he is therefore tempted "to send the paper to the severest critic on his staff of reviewers." He said that intemperate criticism is possible and that even Newton delayed publication because of it. He continued, "For the sensitive beginner caustic reviews can do real harm. There are too many potentially competent investigators who shy away from the ordeal of running the gauntlet of overzealous reviewers and either needlessly delay publication or, worse still, cut down on their research productivity." (*Chem. and Eng. News*, Sept. 30, 1963, p. 56).

If Eyring is correct—and I think it is fair to say that most chemists would accept his statement—then the work of chemists and perhaps other scientists (work dignified by God's command to carry it out) is often hurt by fellow-scientists. Eyring puts part of the blame

on the referee system. He said, "If reviewers were given more recognition by urging them to sign their reviews, it would give the author the opportunity to acknowledge his indebtedness for constructive suggestions and *it would encourage the reviewer to be more constructive in his approach to a difficult but valuable task.*" (Italics mine).

I think the question of referee anonymity is related to natural human tendencies. I believe Scripture teaches men are not innately good. When men assume that neither man nor God knows what they are doing, they are at their worst. They are almost as bad when they know about God but conveniently forget Him. They are somewhat better when only a few people know what they do. They usually act much more respectably when their deeds are public knowledge. Many of us have seen first-class pieces of work by anonymous referees. Haven't we been a little surprised at the work being first-class *in spite* of its anonymity?

I know that I tire of paper work piled high on my desk. It is a real achievement to get everything into the "Out" box. If one can dispose of one of these items of paper work *anonymously*, disposal is easier. Why do we tolerate the idea of anonymity in such a strange place?

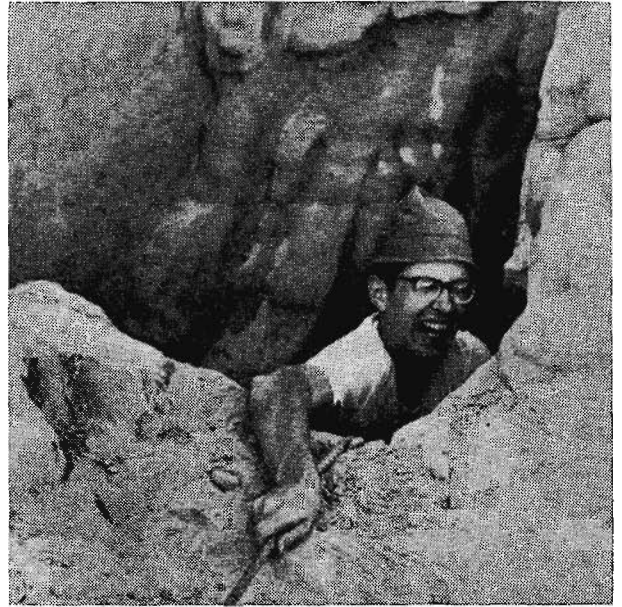
#### WHO SHALL RECEIVE CREDIT FOR RESEARCH?

If the Christian works for God and not for honor, he ought not to be very sensitive about the credit he receives. Yet he can be solicitous of the welfare of others in this matter. Some are not given proper credit for their achievements. Some are greedy and attempt to receive credit for what they have not done.

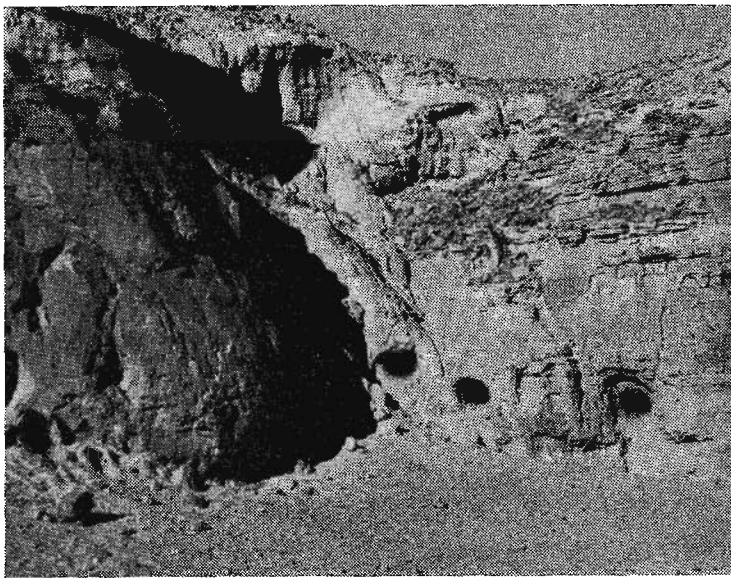
A research worker—let us call him A—told me of his troubles. He had carried out almost all the experimental work on a project. However, there had been a personality conflict with the research director (B), and at the eleventh hour B moved A's name from first to last in the list of authors. What was worse, thought A, was the simultaneous addition of the name of C, with C's knowledge, even though C had contributed very little. Isn't this the story of much of our scientific lives? Were any of these three exhibiting the Christian virtues of humility and generosity?

Perhaps chemistry and other young disciplines are too young to have well worked-out ethical principles which will give one good guide lines in solving these very practical problems. Even though scientific articles are part of the ancient philosophical conversation, these practical problems concerning the assignment of credit are in a certain way characteristically modern. Who should receive credit, in what order names should appear, and similar questions are not small, but many of us can be small as we give selfish answers.

In summary, it seems to me that ethical questions such as those mentioned are at present not answered by the objective methods scientists ought to use, but by the same sin-tainted methods the world uses to solve all ethical problems.



Halvor Ronning entering an ancient cistern.



Wady Timnah, the site of ancient Israel's copper mines.

# KING SOLOMON'S MINES

ANSON F. RAINEY\*

*This brief article clarifies the copper mining enterprise of ancient Israel and describes the intriguing plates and enigmatic cisterns at the mining locations.*

Wady Timna is the scene of ancient Israel's copper mining (Fig. 1). The Bible, legend, and folk tales refer to its mining activities. This "wady" is actually a wide canyon several miles north of the Gulf of Aqabah, which opens on to the "Arabah" (southern end of the Jordan rift) via three creek beds. At the southern end of Wady Timna stands modern Israel's copper mining establishment which produces copper-ore for local use and overseas shipment. (Further south in the Wady Arabah is Eilat, Israel's seaport on the Gulf of Aqabah. East of Eilat, in the modern "no-man's land" is Ezion Geber, which as a result of

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Dr. Nelson Glueck's studies has been labeled the archaeological remains of King Solomon's smelters. Farther east is the town of Aqabah, Jordan's port on the Gulf of Aqabah.)

An extensive survey was carried out in Wady Timna during the spring of 1959 and detailed results have been published in the *Palestine Exploration Quarterly*, January-June, 1962. It seems to be well established now that the ancient Solomonic mining operations were not continued there beyond the 10th century B. C. (Other copper mining installations have been found at various locations along the Arabah; doubtless some of them date from the later centuries of Judean history.) Apparently the workers came seasonally, during the cooler winter months and for only a few years in succession, to extract copper from Wady Timna. Perhaps it was a "crash program" to provide copper for Solomon's great palace and temple.

Visitors to the site can see where small nuggets of ore are imbedded in the canyon walls among the roots of petrified trees. The ancient workmen gouged it out, smashed the pieces into smaller chunks to eliminate the petrified wood and sandstone, and carried them to smelting sites near the mouth of the canyon. This ore has been tested and proven to be malachite with a copper content of up to 40 per cent. The modern plant extracts its copper from an ore of only about 1 to 1.5 per cent, a feat far too difficult for ancient methods of smelting. This is what led the explorers to delve farther into the canyon until they found the ancient Israelite mining areas.

Clustered around the mining sites are dozens of circular "plates" (Fig. 2), areas of a yard or two in diameter from which the rocks have been neatly cleared away and sometimes piled around the circumference to form a protecting wall. The leader of the survey, Benno Rothenberg, a well-known Israeli photographer, believes that the partially cleaned ore was stacked on these "plates" prior to being carried to the smelting sites.

At the smelting centers the ore was crushed and mixed with a finely-ground flux and some charcoal. Small bits of iron ore, dug out with the copper, were also added. The mixture thus prepared was slowly dispersed over open fires that blazed forth from specially made pits. Under the intense heat the iron was able to replace the copper, which was freed from its original state and flowed to the bottom of the cavity to form a flat ingot. Afterwards the copper was removed and other pellets remaining in the slag were knocked out and collected. Pottery fragments found near the smelting camps and among the piles of slag seem to resemble the bottom of a bottle, except that they have holes in the center. They were probably nozzles for bellows used to increase the heat of the fires. The sherds were burnt on the outside, never on the inside. Other structures within the canyon represent living quarters and some defensive towers which apparently

guarded a "stockade." Mr. Rothenberg doubts that slaves were kept in this latter enclosure. He suggests that they were places of refuge for the workmen in case of an attack by desert marauders. High up on a rocky outcropping, which served both as a defense post and smelting site, traces of a ritual "high place" are plainly visible. The household pottery from all of these sites has been duly examined by experts who agree that it must be dated to the 10th century B. C., the age of Solomon.

Agreement is not uniform, however, about the purpose of those strange "plates" nor about the numerous "cisterns" (Fig. 3) found near the mining operations. Some of the latter are as much as 17 meters deep. Mr. Rothenberg insists that they were used for water storage. Others suggest that one would not need to dig down 17 meters to store water which drained into them merely from the canyon walls, and then only during the limited rainy season. The sole evidence of previous exploration in these "cisterns" is an oral report circulating in modern Eilat that two Israeli bus drivers had climbed to the bottom of one of them in the dark. There are footholds gouged one above the other like an improvised set of steps in most of these so-called wells, so one may descend without much difficulty with the aid of a sturdy rope. The drivers reported finding horizontal tunnels that led away from the bottom of their cistern; however, they did not try to crawl through them and determine their purpose or destination.

Since the cisterns are cut into shelves of rock around which copper ore has been discovered along the exposed sides and close to the valley floor, some have suggested that the wells were dug in order to extract more ore than was available from the creek beds and gullies outside. As yet, no conclusive proof has been obtained to settle the issue.

In November 1962 the area was explored by students of the American Institute of Holy Land Studies (formerly the Israel-American Institute) under supervision of the author, the Institute's instructor in Holy Land geography. The group visited the stockades and camps of Wady Timna and the mining sites near the canyon walls. They came prepared to explore the "cisterns" also. Using a rope of suitable length and strength two cisterns were explored to their bottom by Bruce Crapuchettes, George Blankenbaker and Halvor Ronning. While down below each looked carefully for connecting tunnels, but none were found. That does not mean, however, that they may not exist in some of the other cisterns nearby.

Although they were unable to solve this enigma, the explorations did add a few items to the sum of knowledge accumulating about the "cisterns" of King Solomon's mines. The explorers will long treasure memories of stark desert landscapes, abandoned encampments of Biblical lore 3000 years old, and the awesome and still present mystery of King Solomon's mines.

# EMPIRICAL SOCIAL SCIENCE AND CHRISTIAN FAITH\*

DAVID O. MOBERG\*\*

*Science is, above all else, an empirical method; the social sciences use that method. The Christian who is a social scientist must see both his science and his religion in proper perspective. Resources in the Christian's faith ideally aid much of his scientific work, but scientific biases may result from incomplete assimilation of them.*

*The Christian social scientist is confronted by such problems as the imperfect agreement of Christian life with Christian ideals, philosophical-theoretical problems related to social determinism, and the evolution of man. Solutions to these and improved scientific understanding of social processes and structures can help Christians serve God and man more effectively. Empirical social science and Christian faith thus can be partners.*

Both empirical social science and Christian faith have rapidly expanding horizons in a world that, from most perspectives of human understanding, is steadily shrinking. We have entered an era of history in which the social sciences are growing at a nearly explosive rate, and their growth is contributing to ever closer relationships between persons and groups in all parts of the world. Concurrently, thoughtful Christians are becoming increasingly aware of the relevance of personal faith to every detail of life, including scientific endeavor, and are increasingly convinced of the essential oneness of all men that dwell upon the face of the earth. Scientific and Christian horizons are expanding while the surrounding world seems to be shrinking.

Mankind has a host of problems. All of them are at least in some respect social, and many are primarily social. Relationships between man and the so-called natural environment are but one focus of attention of the biological and physical sciences; the social sciences are concerned more directly with man's activities and interrelationships. Their domain is the problems of communication, social control, leadership, production, distribution, social relations, social change, human organization, and many other types of interpersonal and intergroup relationships. These subjects are concerned with men's intimate personal experience, so most people have developed or accepted many preconceptions and prejudices about them. When research findings and theoretical implications of the sciences of anthropology, economics, history, political science, social psychology, and sociology or their numerous sub-disciplines and closely-related fields indicate that traditional answers to men's problems are

\*Revision of a paper presented at the 18th annual convention of the ASA held at Westmont College, Santa Barbara, Calif., Aug. 19-23, 1963. Major portions of this paper were presented at the 1961 meeting of the Minnesota Conference on Christianity in Higher Education under the title, "Christian Faith and Empirical Method in the Social Sciences." Participants in both programs, colleagues, and friends have contributed to further development of the author's thoughts.

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insufficient to meet the complex demands accompanying expanding horizons in a shrinking world, opposition to the social sciences readily develops.

To give a complete survey of all the social sciences, their basic tools and techniques, the challenges confronting them, and their achievements and limitations is obviously impossible here. Little more will be attempted than to sketch briefly the empirical nature of social science, some reciprocal relationships between Christian faith and social science, and ensuing problems and benefits linked with those relationships. In this process implicit answers to such questions as the following will be given: Are the social sciences worthy of the name, *science*? Can a Christian be a true scientist? (Must he ever be merely a pseudo-scientist? Do his religious biases prevent him from doing validly scientific work?) What additional problems confront the Christian social scientist?

The terms "Christian" and "Christian faith" as used here go beyond mere intellectual acceptance of the historic doctrines of Christianity; they incorporate both personal trust in its tenets and a complete commitment of life to God through Jesus Christ. Much of what is stated hence does not necessarily apply to every "Christian" nor to all of Christendom.

#### SCIENCE—THE EMPIRICAL METHOD

There are, as you well know, numerous definitions of science. One category of definitions refers to the subject matter studied and the body of conclusions reached by scientists. These assume that subjects which are "natural" are the proper domain of science, while those which are "spiritual," "mental," or "subjective," including the social sciences which deal with man, cannot be science but must fall instead into the category of the humanities. Although man in certain respects is indeed different from the organic and inorganic subject matter of the biologist, physicist, chemist, archaeologist, geologist, and astronomer, this distinction is not wholly justifiable.

How can one draw a dividing line between that which is and is not "natural" in *any* discipline? If human behavior is not natural, is it artificial? or unnatural? or synthetic? or supernatural? (Even in daily speech we refer to people's behavior as "natural" for those in certain circumstances, and our Scriptures refer in several passages to man's "nature.") Although he is uniquely distinct from the rest of creation, man is a part of nature.

As long as the term "natural science" is not extrapolated into a denial of the supernatural and a complete rejection of man's autonomy as a creature of God who has been given a "free will," it can be applied as appropriately to social science as to the physical and biological sciences, for the subject matter of all the sciences is "natural" (cf. 5, Chap. 3). All seek principles and laws that describe "natural" characteristics which are empirically observable rather than those which are imaginary, unique, nonrepetitive, or super-

natural. The social sciences are less highly developed along empirical lines than physics and chemistry, but it is evident from their findings that much of man's behavior is repetitive, uniform, and, within limits built into the conclusions, predictable. Hence man's social life is a suitable subject for scientific investigation.

Another category of definitions refers to science in terms of fields of knowledge carved out by scientists. As an outgrowth of the medieval heritage, these also emphasize the physical and biological sciences and leave the social sciences to the limbo of philosophical disciplines which are presumed to be speculative, conjectural, and metaphysical, hence non-scientific. A major difficulty of this approach lies in its use of tradition to determine which new areas of knowledge are to be labeled as scientific or not. What is shared by the astronomer studying the atmosphere of a distant planet, the paleobotanist analyzing fossilized plant life in a stratum of coal, and the biochemist investigating the chemotaxis of a cell which justifies calling all of them scientists? Are there not at least as great differences between the analysis of radioactive decay in U-238 and the study of genetic mutations among *Drosophila* fruitflies as there are between analysis of human systems of social organization, ecological study of the distribution of a particular tribe of people, and sociometric investigation of attraction-repulsion patterns in a group of school children? Different instruments are used by the various scientific disciplines in their observation and analysis, but they are not defined as science or not-science solely on the basis of the specific microscopes or telescopes, micrometers or odometers, balance scales or sociometric scales, odontographs or bar graphs which are used in their research.

In essence these first two types of definitions of "science" rest ultimately upon a third. Science is essentially a method—a method which is empirical. Only on the basis of whether that method is used can a body of knowledge or a scholarly discipline be classified as a science.

Science as a method has been described in various ways. Some emphasize its three, four, or five basic steps of scientific research procedure, while others use definitions that are less operational. Basically, however, science rests upon observation. Scientific observation can be made only through man's senses, which may be aided and extended by scientific implements to increase their acuity and precision. With a body of verifiable knowledge as its goal, science is concerned primarily with that which is repetitive in the universe and aims at generalization (laws, theories, principles) which apply to a large number of phenomena rather than to unique events. It is not simply a body of systematized knowledge, nor is it merely a branch of knowledge concerned with classification of facts and ideas, for all scholarly disciplines do this.

The application of empirical methods of investigation to the study of man is the essence of social science.



Although its tools and techniques differ from most of those used in the biological and physical sciences, the same basic scientific method is applied.

Science is largely limited to observations based upon use of the known and recognized senses. Yet these senses are influenced by internal nonsensory experiences. Conclusions based upon various forms of extra-sensory personal encounters and perceptions may become a part of science as the relevant experiences are shared with others through communication, for at least the communications are empirically observable. Furthermore, man is both the object and the subject of social science research; the scientist studying social structures and processes is himself engaged in them. Hence there is a place in the sciences of man for consideration of internal experiences interpreted through introspection, intuitive insight, and sympathetic or empathetic understanding, as well as for that which can be externally, independently, immediately, and directly observed by two or more persons (12). Of course, conclusions based upon these subjective sources must be carefully validated as "spirit bears witness with spirit"; they must be only tentative until more solid evidence brings them into the sphere of scientific truth.

Logical and rational elements are also as significant in the social sciences as in the others. It is particularly difficult to draw a sharp distinction between social science, social philosophy (evaluative interpretation of social phenomena), and social engineering (application of social science to practical problems), for empirical observations must be interpreted by logical reasoning, value judgments on many topics are unavoidable because of the scientist's peculiar involvement with the total human race, and an implicit practical goal stands behind all of science. This definition of science as a method is not narrowly positivistic, although it undoubtedly is modified by neopositivism," for it acknowledges the scientific role of interpretative understanding (*Verstehen*). Certain aspects of positivism are often distorted or misrepresented by its critics. For instance, sociological positivism is not necessarily logical positivism. Logical positivists hold that only that which is empirically observable is true or real; numerous sociological positivists would disagree with that proposition, saying that only that which is empirically observed can be a part of *scientific* knowledge, but acknowledging that there also are other kinds of knowledge which are a product of deductive reasoning, intuition, revelation, sympathetic insight, and the like. A sociological positivist is in essence one who believes that the viewpoint and methodology of the natural sciences may be applied to the study of man's social relations and society. As a movement to discredit idle speculation, mystical contemplation, illogical reasoning, armchair theorizing, and vague generalizations in social science, positivism has made a significant contribution. If, however, it be assumed that positivism requires a belief that only that which can be operationally defined, objectively measured, inductively ana-

lyzed, and empirically observed is real, true, ontological, or factual, then positivistic science must be rejected by the Christian as being inconsistent with both the revelation upon which his faith is based and with his own subjective transcendental experiences with God.

Recognizing science to be primarily a method resolves many so-called conflicts between science and religion. It frees one of some of the dangers of scientism which would, in effect, deify science by making it a "sacred cow." As a method, science is a tool or instrument which can be used by men toward the achievement of their goals. It is not a pseudo-religion. It is instrumental, not an end in itself.

It is simple to assume from this definition of science that there are two major realms of truth, the scientific and the non-scientific; that which cannot be relegated justifiably to the domain of science must be subsumed under the heading of philosophy, religion, commonsense knowledge, or other metaphysical or speculative category. In practice, however, science and religion are not so clearly distinguishable. The Christian must see both in proper perspective. The two overlap in the everyday life of the scientist as well as of the non-scientist; Christian faith demands that everything be kept in subjection to the lordship of Jesus Christ.

#### CHRISTIAN "BIASES" IN SCIENTIFIC ENDEAVOR

Does such subjection of scientific activity to Christ mean that one's scientific work must be so biased that it is non-reliable and non-scientific? Not necessarily, for the scientific method makes demands upon its practitioners which, when rightly understood, are strengthened, not weakened, by Christian commitment. Science involves a search for truth, whether the truth be pleasant or painful. It demands of the scientist rigorous honesty, love of truth, self-discipline, and a humility which recognizes the ever-imperfect nature of scientific knowledge. Far from being inconsistent with Christianity, these virtues are at the core of Christian morality. The Christian in science therefore ought to be a better scientist than he himself would be if he did not share the motivating force of Christian ethics to buttress his scientific morality. A major difference between the Christian and the non-Christian in science, and hence a major source of "bias" in interpretations of observed phenomena, lies in the values which undergird the activities of the Christian.

POSTULATES OF SCIENCE. Science rests upon a series of presuppositions which are unproved, if not unprovable (2; 3, p. 20; 5, pp. 8-9; 7, pp. 11, 332-333). These assumptions include the assertions that the universe exists, that it is orderly, that knowledge about it is desirable, that man is capable of knowing it objectively, that he can know it adequately through his senses which provide a channel for the acquisition of knowledge about it, that language symbols (including logical and mathematical notations and other symbols

as well as words) adequately represent the responses of men's senses and are sufficiently communicable to make possible the sharing of their understanding of the universe, that phenomena in the universe are causally or at least sequentially related in time and in space, and, in the social sciences, that all of mankind share a common "human nature" which eventually can be described by scientific laws and principles.

To the postulates which undergird all science the Christian adds certain assumptions which grow out of his experiential faith and especially out of what he believes to be God's revelation, the Bible (11, pp. 1-4). These Christian postulates include the belief that God is; that He is the Creator and Sustainer of the universe, the great First Cause, and the Father of all mankind; that man has an eternal soul and an eternal destiny; that man is endowed by his Creator with a free will, is morally responsible to Him, and may choose to accept or reject God's will for his life as he understands it; that each man is a steward under God personally accountable for his use of the time and possessions entrusted to him and for those aspects of the welfare of his fellowmen over which he has some direct or indirect control ("the brotherhood of man"); that man fails to achieve God's ideal of perfection (he sins) and hence needs to be redeemed in order to have "eternal life"; that God made provision for that redemption through Jesus Christ, and that God has revealed Himself and His will to man through the natural universe, the Bible, the person of Jesus Christ, and the still small "voice" of the Holy Spirit. (Interpretations of these as well as of additional presuppositions of Christians vary somewhat from one theological circle to another.)

**IMPLICATIONS OF CHRISTIAN VALUES.** The interaction of a Christian's faith with the postulates of science should make him a more dependable scholar than he himself would be as a non-Christian with only the mores of science and society to guide him and with no external sanctions beyond those of his immediate discipline and culture. The Christian believes he is responsible to an Eternal God. Ideally, he lives his life in the present with reference to a transcendent Judge who will not merely reflect a specific cultural situation but will be far beyond and above it. If a man believes himself to be merely a product of chance, a result of biological and cultural forces which happened to result in his emergence, will he see any ultimate purpose and responsibility other than to glorify his social group or magnify himself? In contrast, if he truly operates upon Christian perspectives believing himself to be created by and eternally responsible to God, should he not sense a higher destiny of pleasing God, supporting the welfare of others, and advancing God's Kingdom in all that he does, including his scientific work? Should he not be less apt to become involved in bestial, inhumane activities like some that emerged from the Nazi "scientists?" Is not the man

who recognizes a higher morality than that which immediately advances personal, self-seeking ends usually more to be trusted in scientific as well as in other endeavors than the one who is solely self-centered? Recognizing man to be more than a product of chance evolution, relating oneself through personal faith to the Creator of the universe, and transcending limitations of time and place to whatever degree this is possible by seeing oneself in relation to eternity and to the whole universe introduces sanctions for ethical values which the non-believing scientist is likely to lack or to possess only in attenuated degree.

The Christian is less likely than the worldly-oriented man to be certain that mere intellectual knowledge and the spread of education and science will lead to utopian conditions among mankind. He knows that "all have sinned and fall short of the glory of God" (Rom. 3:23, RSV). His optimism for the future hence rests in God's purposes and God's redeeming grace rather than in man's own qualities and achievements.

The Christian social scientist ideally realizes that he, like all other men, is lured by "the lust of the flesh and the lust of the eyes and the pride of life" (I John 2:16, RSV) and may succumb to the temptation in his science, as well as in his religion, to find support for vested interests and fond ideas through biased observation, erroneous interpretation, and fallacious hermeneutics. He knows that he is a sinner, albeit a sinner redeemed by God's grace. He therefore seeks God's help in attempting to avoid the barriers of sin to truth, and he maintains a spirit of humility and of openness to other evidences rather than one of ill-founded pride or self-righteousness.

If he fully implements his Christian values, his attitudes toward himself, science, his fellowmen, and the universe and his scientific activities will be different at points from those of non-Christian colleagues. In his selection of research topics or projects he will be motivated by a desire to "do all to the glory of God." His work will not be determined by a search for fame or status-seeking nor even by desires to secure the greatest research grants. He will be motivated by Christian aspects of the "Puritan ethic" believed by Robert K. Merton (6, pp. 574-606) and others to have been linked with the progress of western science, for he will do his daily tasks in a consciousness that they must be kept in proper relationship to eternal verities. He will not see his human subjects as mere dehumanized objects of study but will be their "keeper," protecting them from any harm that might otherwise result from the research process.

The Christian in the social sciences has an organizing principle around which all of his life can be oriented. At his best he realizes that to make his home, church, science, pleasures, scholarship, research, or any other activity or institution an end in itself is a form of idolatry, putting other gods before the one and only true God.

The resulting self-concept of the truly Christian scientist hence determines his daily actions. He has great freedom in his choices, but these choices are made with a conscious recognition of overarching goals that go beyond the temporal values of this life; they grow out of a conscious search for the guidance of the Holy Spirit who dwells within to guide him into all truth.

In summary, the Christian social scientist uses the same basic research tools and techniques as the non-Christian, but his religious commitment adds checks and balances upon his work and influences his application of scientific procedures, especially interpretative conclusions and suggested inferences for action emerging from his research.

**VICES OF CHRISTIAN BIAS.** Personal faith can produce bias in scientific research. It can tempt the scientist to observe whatever his intuition or preconceptions tell him "ought" to be true or to promote the goals of his denominational subculture and turn to theologians for "scientific" truth. It is especially difficult to control these religious biases when one's fellow scientists, faculty colleagues, students, college administration, and supporting constituency are all sympathetic to the same theological and metaphysical viewpoints and, in some cases, demand unquestioning adherence to traditional dogma in defiance of contrary empirical evidence. Hence those who are in church-related institutions must face this problem all the more frankly and openly, seeking constantly to see "the other side" and at times playing the role of the devil's advocate. They must control the evils of bias by conscientious awareness of this tendency, by cautious efforts to see all sides of the subjects they study, by mastery of the tools and techniques of observation and analysis which are the essence of scientific methodology, and by consistent efforts to apply the teaching, "Judge not lest ye be judged," whenever judgment should be left in the hands of God alone.

Writing reports of research for presentation at scientific meetings and in professional journals often produces a rigor otherwise not present. Upon writing for skeptical colleagues of diverse backgrounds, one usually finds minor and sometimes major flaws, imprecise details, and poorly established conclusions which have been glossed over in the initial analysis. Preparedness to interpret possible findings, which at first glance might appear contrary to the tenets of one's faith, in a manner compatible with it also helps remove blinders that might hinder objective observation because of subconscious fears of departing from the faith. For example, in a major study relating personal adjustment in old age to religious faith and activities (9) I was prepared to argue on religious grounds in favor of whatever finding might emerge. If poor adjustment were connected with religiosity, this could be due to otherworldliness in Christians' orientations for the future; if good adjustment were linked with religiosity (as in

fact proved to be the case), this could result from the "abundant life" promised by Christ to His disciples.

While I use this illustration commendably, let me also add that it can be taken as an illustration of what may be an all-too-common fallacy among evangelical Christians. We are tempted to go to the Bible to discover "social science principles," which we then test as scientific hypotheses. In the selection of these principles we may misinterpret the Bible, and in our observation of data to "test" these hypotheses, we may be so blinded by preconceptions that we fail to observe evidence which could lead to rejection of the hypotheses. We also may "glean from the Bible" principles which are really from the social sciences through the use of devious interpretative approaches that read into the Bible that which is not really in it. To help us avoid such errors, we need the correctives of scientific methodology and sound theology, especially hermeneutics. We also need complete and true Christian commitment.

Too many Christians suffer from the malady of "fractional conversion." They have committed their eternal destiny to Jesus Christ but have failed to see the full implications of Christian faith for their daily round of activities (7, pp. 383-393). The more legalistic their religion is, the less prone they are to see its implications for acts not directly mentioned in their lists of right and wrong. As "babes in Christ," the scientists among them may fail to discern the all-encompassing role of Christian faith, to which reference already has been made, and lapse into pseudo-scientific and non-Christian fallacies of the types alluded to above.

Some Christians in science act in an anti-Christian as well as a non-scientific manner even when they ostensibly are defending Christian faith, organizations, and movements. The narrower their scientific education and the more provincial their religious experience, the more prone they are to fall prey to such hazards.

The Christian who has attained the wisdom of intellectual and spiritual maturity senses an eternal personal responsibility to God and to all of mankind, not just to his own nation or his own religious group. His ultimate commitment helps him qualify his generalizations and provides normative standards that sit in judgment over the ethics of his methods and conclusions. To the extent to which he permits Christian virtues to reign in his life, his formulations of reality and of truth are superior to those he would develop were he to ignore or renounce those resources.

#### PROBLEM AREAS FOR THE CHRISTIAN SOCIAL SCIENTIST

I acknowledge the most weighty problem implicit in the preceding discussion: the above is an idealized picture of the Christian scientist. In practice, Christians seldom live fully in accord with the ideal. Not only is their knowledge of Scriptural values imperfect, but the biases of selfishness and other sins often intrude to make them less than Christ-like in scientific and

other conduct. The earthly rather than the heavenly orientation of their dual citizenship tends to take precedence and they become like ordinary men of the world. Dual commitments also may prevent them from being "men of science" in the fullest sense of that term, if being such necessitates taking a completely detached view and letting only empirical evidence reign in every sphere of life.

SOCIAL DETERMINISM is a philosophic viewpoint commonly held by social scientists. To oversimplify, it is the doctrine that men as well as institutions are what their surrounding circumstances have made them to be. To a certain extent it is a postulate of all the sciences that, at least to some degree, an event is explicable in terms of its antecedents. It is assumed that, given complete knowledge of antecedent conditions, one could have complete knowledge of what will follow, including how a person or group will and indeed must act. (Contemporary social science determinists typically go beyond the boundaries of *social* determinism per se, with its stress upon the social and cultural environment; they include a recognition of the biological inheritance. They hold that, given complete information about the biological heredity and environmental surroundings of a person from the time of his conception, scientists ultimately will know infallibly what that person will do and become.)

The goal of social science research may be viewed as that of complete understanding of social structures and processes which enables perfect predictions of social acts and events. The Christian must have certain reservations about this, for if his postulates are valid, man is an autonomous being with a "free will" and is therefore morally responsible for his deeds. God has given him the opportunity to make choices between alternatives; if complete determinism prevailed in the universe, there could be no such choices. While one certainly is not free to choose to ride a ricksha to work if none is accessible in his culture nor to do other things impossible because of limitations in either his social milieu or personal abilities, numerous choices are before him every day of his life. Many of these can be predicted or are potentially predictable, but the Christian must always leave room for his omnipotent God to break through or transcend the natural order, working in a miraculous manner if He sees fit to circumvent natural circumstances and to cause the unexpected to occur. (It is my personal belief that God usually works through rather than outside of the natural events and processes of man's social life. To whatever extent scientific laws are a discovery of "natural law" in the universe, they reflect principles and relationships established by God. To understand certain aspects of how God ordinarily works is not to explain Him away.)

Christians are not compelled to choose, in other words, between self-determination and social determinism. They may accept elements of both, recognizing the qualifications each imposes on the other, just as they

believe in both individual autonomy and God's foreknowledge of the choices made by exercise of man's "free will." (See 1, pp. 187-207, and 4.)

OTHER SKIRMISHES occur when contradictions emerge between accepted interpretations of the Scriptures and the conclusions of social science research. Whenever this happens, examination of both the limitations of the research and the nature of the interpretations usually reveals that the research findings rest upon shaky grounds in the tentativeness of science and cannot yet be accepted as final scientific truth (indeed, there is no such thing!), or else that there is too narrow a view of God's working among men, a fallacious understanding of Scripture passages and their contexts, or erroneous interpretations of them. Cautious adaptations of both scientific and theological conclusions thus provide a basis for reconciling contradictions. The American Scientific Affiliation (ASA) can be of inestimable help on matters of these kinds as relevant resources from science and theology are brought to our attention by other members who share our faith in Jesus Christ.

I personally am not disturbed, as some of my fundamentalist friends are, by the increasing evidence from the physical and biological sciences that the earth *may* be extremely old, that biological species *may* be linked in a chain of progressive development, and that the human organism *may* have evolved gradually to its present biological form. I have a great God, an infinite God who is far more than the "god of scientific gaps." If He chose to create man's body by a progressive process, at some point in which He made man "a living soul," let us praise Him for it! If even today He is continuing a gradual process of evolving different, perhaps higher forms of human life, who am I to say that, if He works in a way I cannot understand or cannot accept emotionally, He must be rejected entirely? After all, He has told us,

*For my thoughts are not your thoughts,  
neither are your ways my ways,  
says the Lord.*

*For as the heavens are higher than the earth,  
so are my ways higher than your ways  
and my thoughts than your thoughts. (Isa. 55:8-9,  
RSV)*

Many other topics need the special attention of Christian social scientists. These include the question of cultural and ethical relativity in contrast to the ethical norms of Scripture (8), Christian ethics in research, naturalistic conceptions of man and the universe, and the doctrine of the perfectibility of man (1). Fellowmen who are confronted with analogous quandaries can help us directly and indirectly toward reaching a theological-philosophical-theoretical solution which is consistent with both Christian and scientific values. Some of these problems already have been attacked in the ASA; others provide a fertile field for future ASA activities. Increased knowledge of social pro-

cesses and structures helps us to understand more clearly the ways in which we can serve and glorify God and to appreciate more fully the manner in which He makes even ungodly men and movements contribute to the praise of His glory.

#### CONCLUSION

All in all, Christian faith has much to contribute to empirical social science. It helps the scientist see his life and actions in broader perspective than the immediate here and now. It gives him a goal or purpose around which to integrate all of his life, including his scientific work. It provides motivations which help him to further that goal. To some degree it helps him transcend the limited social organizations which have helped to make both him and the culture which binds and limits him. When he does research on religion, personal experiences of trusting God, believing in Jesus Christ, and being led by the Holy Spirit furnish insights into religious behavior that he otherwise would lack. His faith helps him see how the methods and findings of social science research can be applied to the work of the church in its endeavors to carry out the will of God (10). Scientific values which stress objectivity, demand verifiable evidence, insist on crucial tests of hypotheses, and emphasize valid reasoning strengthen Christian ethical behavior and are linked with it. Some of the logic and all of the honest seeking of science must also be applied in religion.

Empirical social science and Christian faith are partners. Each has its own special sphere of thought and action; yet paradoxically each cuts across, checks up on, and to some extent includes and modifies the other. Neither can be divorced from the other in the mind of the believing social scientist. Of the two, Christian faith is the broader. Science is only one area or part of life; the scientific role is one that periodically is taken on and shed. But one's role as a Christian is on a higher level which encompasses all other roles and ideally is never cast off. Christianity is an all-embracing reference group, while one's scientific role reflects but one of many membership groups (cf. 6, pp. 225-386).

In scriptural terms, Christ in the Christian is his "hope of glory" (Col. 1:27), his life (Col. 3:4), his all (Col. 3:11). The eternal Christ abiding within the believer, with all that this implies, is the distinguishing characteristic of the Christian in contrast to the non-Christian social scientist. Living by faith in constant awareness of Christ's presence is, after all, what God has revealed to be His will for all Christians.

*For although there may be so-called gods in heaven or on earth—as indeed there are many "gods" and many "lords"—yet for us there is one God, the Father, from whom are all things and for whom we exist, and one Lord, Jesus Christ, through whom are all things and through whom we exist (I Cor. 8:5-6, RSV).*

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#### 1964 CONVENTION

The 19th annual convention of the American Scientific Affiliation will be held August 24-27, 1964, on the campus of John Brown University, Siloam Springs, Arkansas.

The Natural Science Commission of the ASA under the chairmanship of Dr. Wayne U. Ault, Senior Research Scientist at Isotopes, Inc., is in charge of program planning. Although most sessions will be devoted to the natural sciences, papers on the philosophy of science, psychology, the social sciences, and general themes pertinent to Christianity and science will also be presented. Dr. Irwin A. Wills, Chairman of the Division of Natural Sciences at John Brown University, is chairman of the local arrangements committee.

Copies of the program and other information about the convention may be obtained from the national office of the ASA, 414 South Broad St., Mankato, Minnesota. (ASA members will receive them automatically.)



# BOOK REVIEWS

In this issue we begin our treatment of a controversial book, *The Genesis Flood*, by publishing two reviews presented and discussed at the November 1963 meeting of the New York Metropolitan Section of the ASA. One is by a theologically trained Christian educator "outside the camp of professional geologists" and the other by a Christian who is a contributor to geochronology, a geochemist on the staff of the first commercial laboratory in the world to provide radiocarbon and tritium dating as a service and now covering the full range of dating methods, including K-Ar, Rb-Sr, and U-Th-Pb.

Both of these reviews have been edited extensively, partly to eliminate duplication between them and partly to tone them down a bit. There can be no doubt that the polemic style of the book under consideration is such as to evoke extreme reaction from any reader seriously concerned about both Genesis and geology: one tends to be either exhilarated or infuriated by the authors' treatment. It is doubtful that Dr. Morris and Dr. Whitcomb will appreciate the following reviews even in their edited form; when their book received a mild but negative review by Donald Boardman, Professor of Geology at Wheaton College, in *Christianity Today* (Sept. 11, 1961), they replied in a letter to the editor (*Ibid.*, Nov. 10, 1961) that the review presents "a highly biased and misleading picture of the book's content and significance."

Readers of these reviews who have not read the book may not realize that its authors argue not only for the Noahic flood as being responsible for essentially all stratigraphy observable today, but also for the recent creation of a "full-grown" earth with an *apparent* great age, and for the role of the Edenic curse on Adam as the explanation for the origin of *all* fossils. Having concluded that Romans 5:12 means that death and violence in the animal kingdom could not have existed before the appearance of man on the earth, the authors reason that fossil-bearing strata, filled with evidences of violent death, must have been laid down *since* Adam. Thus the authors have no interest in merely criticizing the time-table established by paleontology, stratigraphy, and radioisotopic dating in order to revise it or improve it; they must reject it *in toto*.

In the light of their position, it is not completely clear to the book review editor why Morris and Whitcomb go to the trouble to quibble so extensively with the accuracy of dating methods. Why not assume that the methods are essentially reliable for determining the *apparent* age which God structured into the rocks on the particular 24-hour day of their creation? This position would be logically unassailable, as pointed out by Martin Gardner (*Fads and Fallacies in the Name of Science*, Dover, 1957) in his discussion of zoologist Philip Gosse's 19th century book, *Omphalos*. That book was named for the Greek word for navel because Gosse thought that Adam was created as a full-grown man with a navel—a relic of a birth that had never

occurred—just as the entire earth was created with all the fossil relics of a past which had existed only in the mind of God. With such a position it is not necessary to restructure geological science but merely to reject the idea that it tells us anything about the *true* age of the earth, which must be revealed to us, as Morris and Whitcomb say, by God in the Bible. However, with the same reasoning, as Gosse realized, we might even suppose that God created the earth only a few minutes ago, complete with memories in the minds of men, records of apparent history, scientific methods of apparent accuracy, and a Biblical record consistent with all this—all for some purpose of His own which He has not yet revealed to us. In Gardner's words, "There is no logical way to refute this as a possible theory."

Science probably appeals to most of us in the ASA as an imperfect but *valid* method for getting at a true picture of what God has actually done in His universe. Although each of us knows best the established principles and inherent limitations of the area of science in which we ourselves work, none of us should be too proud to listen to criticism of our field from those with a broader, or at least a different, perspective. Those who dwell inside the house of geological science have been in the process of remodeling it continuously ever since it was built. Now Henry Morris and John Whitcomb have come along insisting in the name of the Master Architect that the whole thing is on a shaky foundation and must be bulldozed to the ground. Detailed plans for the fine new edifice which should be built in its place, they claim, were found by them in the pages of the family Bible.

—W.R.H.

THE GENESIS FLOOD, by Henry M. Morris and John C. Whitcomb, Jr. Presbyterian and Reformed Publishing Co., Philadelphia, 1961, 525 pp., \$6.95.\*

Most geologists would be amazed to learn that a book had been published so recently which attempts to explain the stratigraphy and morphology of the crust of the earth in terms of the Biblical flood. Their amazement would not stem so much from a philosophy of unbelief in the Bible as from the idea of trying to fit the facts of geology into a flood of a year's duration. A hundred years ago Lyell wrote, "When geology was first cultivated, it was the general belief that . . . marine shells and other fossils were the effects and proofs of the deluge of Noah; but all who have carefully investigated the phenomena have long rejected this doctrine." (*Elements of Geology*, 1865, p. 4) Revival of these ideas goes back to George McCready Price, who began publishing around 1920. Since then a succession of books—none written by a geologist—has contended that the flood of Noah was responsible for the stratified layers of the earth's crust. The con-

\* Copies are available at the special authors' price of \$4.25 postpaid from Dr. John Whitcomb, Grace Theological Seminary, Winona Lake, Indiana.

cept that the laws of physics of the universe remain unchanged with time is challenged as unbiblical. We are told that the Biblical flood was of tremendous geological potency and are then left with the vivid alternative:

Either the Biblical record of the Flood is false and must be rejected or else the system of historical geology which has seemed to discredit it is wrong and must be changed. The latter alternative would seem to be the only one which a Biblically and scientifically instructed Christian could honestly take. (p.118)

The person who is just as committed to the inerrancy of Scripture, but who disagrees with the Morris-Whitcomb system, thus brands himself as both Biblically and scientifically uninstructed!

The authors suggest that Christians should "restudy and rethink the great mass of geologic and paleontologic data" in order to develop "a new scheme of historical geology," admitting that this will not be easy and will have to be done largely by men "outside the camp of professional geologists." (pp. 119-120) The authors feel it unlikely that a student majoring in geology could "survive several years of intensive indoctrination in the uniformitarian interpretation of geology without becoming immune to any other interpretation."

Could a person possibly believe in a uniformitarian view of nature without indoctrination? I, personally, came to my present uniformitarian views of geology years before ever having had any course whatever in geology, having studied the Scripture in the original languages and having read several books of various opinions. It may be that this "rethinking" will have to be done by men "outside the camp" primarily because professional geologists have so much good evidence in support of their uniformitarian view. The approach suggested seems to place a premium on ignorance of the subject under consideration.

In several specific areas the arguments of the book fall short. First of all, a false definition of uniformitarianism is set up as a "straw-man." In the discussion of the doctrine of uniformity it is stated: "Thus it is now believed that the present-day geomorphic processes, acting essentially in the same manner and at the same rates as at the present, can suffice to account for all the earth's physiographic features." (p. 137) Much of the book is occupied in demonstrating that this could not be so, thus destroying the doctrine of uniformity. The fact of the matter is that geologists hold that the laws of physics and chemistry remain unchanged with time, but that the rates of geomorphic processes have varied and do vary widely. This is particularly well recognized today in tectonics and paleontology. Interestingly the authors contradict themselves later by saying:

Further study has convinced even uniformitarian geologists [what other kind is there?] that this extreme form of the doctrine could not be valid. Too much evidence exists that the earth's formations cannot possibly be explained entirely in terms of present rates of these processes. (p. 200)

The authors often seem to take unfair advantage of the process of scientific inquiry, jumping in on technical discussions in the literature to pit one author against another in an attempt to invalidate the entire science. The method is like that of the liberal who shows that the entire Bible is false by noting the dialog between premillennialists and amillennialists.

Geologists are accused of circular reasoning. (pp. 131-135) It is assumed that the ages of fossils are determined from evolutionary considerations: the more advanced and specialized, the more recent the fossil. Then as the fossils are found in the rocks, they are used to assign ages to the rocks. Thus evolution dates the fossils; the fossils date the rocks; and the rocks are used as proof of evolution. This is circular reasoning and so the whole procedure is false. But evolution does not determine the ages of fossils: the stratigraphic sequence determines the relative age. One must keep in mind that Lyell and others worked out the whole story of historical geology thirty years before Darwin, assuming successive divine creations!

Some information in the book is actually incorrect. In one place it is stated that mountain-making processes, with their associated phenomena of faults, folds, rifts, thrusts, etc., "are not active now, at least not measurably so!" (p. 142) Many studies with measurements are being conducted at the present time, such as those at the well-known San Andreas fault in California where the displacement has been considerable within the recorded history of the past 150 years. We are also told (p. 171) that "formations are often found actually in reverse order, with the presumed older rocks lying on top of younger rocks." This statement gives an utterly false impression of stratigraphy. The few cases in which it is true are in areas where folding and faulting of the rocks are in evidence, where it may be seen that processes subsequent to deposition of the fossils have changed the relative positions of the rocks. There are no *undisturbed* areas in which it is true.

Aside from innumerable forced interpretations both of the Bible and of scientific evidence, it seems to me that there are at least two major problems which "flood geology" completely fails to solve. The first of these is the extremely widespread existence of parallel stratigraphy. Water-deposited sediments usually maintain layers whose thicknesses vary significantly only as one moves many miles in various directions. A flood of the kind called for in the book must have been violent and catastrophic to explain some phenomena, yet extremely quiet to deposit the shales and limestones so widely observed.

The second problem is that of the source of the sediments. Sedimentary rock, which is very widespread, is usually deep—up to many miles deep. Where did these sediments come from? "Flood geology" will not permit the erosion of a slowly rising mountain range. The swirling waters of the flood would have to erode

many thousands of cubic miles of rock, hold the material in suspension, and gradually deposit it as alternate layers of sandstones, shales, and limestones in various sequences. The theory simply does not give an adequate explanation of what we actually see.

In conclusion it should be pointed out that it is possible to believe in a universal flood which destroyed all of mankind without holding the Morris-Whitcomb theory. It is also possible to hold a uniformitarian geology without believing in the theory of organic evolution. On the other hand it should be recognized that one can hold the local flood view without denying the inspiration of the Scriptures and that one can believe in some evolution of animals without believing in an animal ancestry of man.

—Reviewed by Frank H. Roberts, Head, Science Dept., Delaware County Christian School, Newton Square, Penna.

The authors of *The Genesis Flood* make the erroneous assumption that belief in uniformitarianism is an incompatible alternative to belief in the Biblical record. In reality, it is incompatible only with the Price-Morris-Whitcomb catastrophic geology.

Christian men in professional geological research of every kind are convinced of the validity of the principles and results of stratigraphy, paleontology, and geochronology. As a Christian, this reviewer believes in the verbal inspiration of the Scriptures, their accuracy and complete trustworthiness, and in miracles as acts of the Supernatural. But to me as a professional geoscientist the Bible does not teach catastrophism. Biblical miracles were Supernatural events and have never been made non-miraculous by explanations of modern science. The greatest miracle of all time, the Incarnation, was not a catastrophe. God could have worked with catastrophe; He could have done anything in keeping with His attributes. The question is not what *could* He do; but rather, what *did* He do, and are there any evidences?

It is very significant that Christian geologists have not praised *The Genesis Flood* as have other Christians. Even in the Foreword we read: "From the writer's viewpoint, as a professional geologist, these explanations and contentions are difficult to accept . . . I would hope that some other means of harmonization of religion and geology, which retains the essential structure of modern historical geology, could be found."

In their efforts to invalidate modern geology and to establish their particular views, the authors appear to have combed the scientific literature on geochronology for statements which could be interpreted as being critical of the whole state of the science or as casting doubt on the accuracy of particular data. These statements invariably were lifted out of context and misapplied. Typical examples follow.

On p. 334 Dr. Tom Aldrich is made to appear to confirm that most of the lead ages obtained before 1950 were "quite misleading." In fact, the continuing development of techniques has led chiefly to refinement of the earlier data with the result that, as Dr. Aldrich writes, the "order of magnitude of the time scale remained unchanged . . ." (L. T. Aldrich and G. W. Wetherill, *Geochronology by Radioactive Decay*, in *Ann. Rev. of Nuclear Science*, 8: 257, 1958). Most improvements or refinements in radioisotope dating techniques, which get us closer to the true age, have resulted in somewhat older dates.

On p. 211 the authors misuse a quotation of Prof. Edmund M. Spieker and see him as "exposing the weakness of basic geological theory" in order to deny "that any revolutions or other geologic events of worldwide significance ever occurred and, therefore, that the boundaries between the various systems are meaningless. That is, he insists that there is no actually identifiable boundary between the Cretaceous and Tertiary, for example, or between any . . . two supposedly adjacent systems." A lack of understanding of the simplest principles of stratigraphy is apparent here. For example, millions of tons of sediment are being carried into the Gulf of Mexico where they have deposited thousands of feet of sediments adjacent to the changing shoreline. At the same time the Appalachian and Rocky Mountains are being eroded away. Thus, for a given geologic period, a stratigraphic column will be present in one area and missing in another. One would go to the Gulf of Alaska or the Black Sea or the Sea of Japan to find sediments contemporary with those in the Gulf of Mexico today.

The paper by Dr. Spieker, far from being an admitted exposure of weakness in basic geologic theory, is a discussion of principles of determination and interpretation of originic dates and of the basic nature of the time scale. He points out that the Cretaceous type-section of the geologic column was described from stratigraphy in the Paris Basin. If strata from this period in geologic time had been first described elsewhere, another name might have been applied; in fact, a continuous type-section might have been described with the Jurassic and Cretaceous or parts of both lumped under one name. Dr. Spieker goes on to say "if the question is raised as to what the terms Cretaceous and Tertiary actually mean, . . . it is evident that they have come to stand essentially for times in the geologic past when more or less characteristic organisms lived."

Dr. J. A. Jeletzky, geologist with the Geological Survey of Canada, is represented as saying that the absence of fossils in pre-Cambrian strata has prevented any time sequence from being worked out for them and as emphasizing that even the various radioactivity methods of geologic dating have not provided, and cannot provide, a geologic time criterion of equal valid-

ity or usefulness with the fossils (p. 205). If one looks up the paper in question, he will see that Dr. Jeletzky divides physical phenomena into two groups. The first group is "fossils and radioactive processes, which represent irreversible, rectilinearly progressing processes providing us with useful sets of time marks." The phenomena of the second group (lithological similarity of rocks, their petrofabrics, stratification planes, relationship to adjacent strata, electric properties of rocks, thermoluminescence, etc.) "do not show any general and easily recognizable relationship with the geologic time planes." This terminology explains his statements that physical-stratigraphy (the second group) "criteria are only locally stratigraphically valuable and devoid of any geologic time sequence," and that "the geochronological use of fossils and radioactive processes form the subject of geochronology . . . and should not be confused with stratigraphy proper."

From this and the whole of the article it is evident that Dr. Jeletzky *uses* rather than rejects the established methods of geochronology. And, for anyone familiar with the applications of radioactive dating, it is obvious why for sedimentary rocks he said, "consequently, paleontology is, for the time being, the only basis for practical everyday geochronology." Since his article was written, however, radioactive dating techniques have been successfully applied to ocean bottom sediments from the present back hundreds of thousands of years. (J. N. Rosholt, *et. al.*, Pa<sup>231</sup>/Th<sup>230</sup> Dating and O<sup>18</sup>/O<sup>16</sup> Temperature Analysis of Core A254-BR-C, *Jour. Geophys. Res.*, 67; 2907, 1962.) Also, glauconite from sandstone and shales is gaining widespread acceptance as giving consistent results on the sedimentary rock strata.

Morris and Whitcomb feel that establishment of the linear geologic time scale involves circular reasoning. Other writers (notably C. E. Barber, *Fossils and Their Occurrence*, in *Evolution and Christian Thought Today*, Eerdmans, 1959) have lucidly shown that this is simply not the situation. Suffice it to say that over a century ago the sequence of fossils was established on the simple basis of their consistent sequential occurrence in successive strata. Their actual age was not known until the radioactive methods of dating were discovered a few decades ago and refined within the last fifteen years. The geologic time scale, or more properly the time sequence of the stratigraphic column, has undeniably been confirmed—and hence the sequence of fossils validate. Clearly, these are independent phenomena. Furthermore, those with fossil phobia should have little trouble with the Precambrian which is about eight-ninths of the whole time scale. For three-fourths of this great period of earth's history we can now begin to draw maps indicating areas of similar age dating successively from recent to very ancient basement rock over three billion years old.

It seems to bother the authors that the age of ancient rock formations cannot be determined as accurately as

recent written history. If radioactive measurements indicate that the Vishnu schist at the bottom of the Grand Canyon Gorge is 1.4 billion years old, this is very significant information. Even if the uncertainty of the measurement should be  $\pm 0.1$  (about 8%), the age of the rock would still be considered well known. But laboratory techniques for established radioactive dating methods today can give data to  $\pm 2\%$  on suitable rock samples. There are at least six independent geochronometric methods that can be applied to the oldest rocks, and the potassium-argon method has been extended with fair success down to and overlapping with a portion of the radio-carbon range.

The geologic literature is full of consistent data with many concordant ages, i.e., excellent agreement of results obtained by two or more independent methods. On the other hand, discordance in the results on a given rock or mineral, instead of invalidating the methods, has often provided the clue for discovering orogenic events to which the rock has been subjected since its formation. For example, argon loss from a mineral such as biotite, as confirmed by laboratory experiments, will provide evidence that the mineral has been subjected to metamorphism since its formation. Determination of the extent and magnitude of this effect throughout a region can indicate the geographic extent and degree of metamorphism. Thus complex problems when solved have often yielded greater information than if the situation had been simple.

One significant point that should be mentioned is that in most situations the radioactive dating methods indicate a *minimum* age for the rock. The actual age, the time of crystallization or formation, is usually somewhat older.

It simply is not true, as the authors write on p. 341, that "most age measurements have been found hopelessly discrepant and have been rejected." It is most pathetic that the non-geologist would obtain from Chapter VII a completely erroneous impression of the state of the art of geochronometry. Those who are interested in this field can find good technical information in two recent volumes: (1) *Geochronology of Rock Systems*, J. L. Kulp, Ed., *Ann. N. Y. Acad. Sci.*, v. 91, Art. 2, pp. 159-594, 1961; (2) *Radioactive Dating*, Internatl. Atomic Energy Agency, Vienna, 1963.

As far as the scientific secular world is concerned, *The Genesis Flood* will likely pass quite unnoticed. At most it may be taken as a poignant example of someone from another discipline attempting to plunge into the multiple disciplines of geological science and come up with a new scheme that agrees with certain select preconceptions. On the evangelical Christian world the book, regrettably, may have more of an impact; it could lead to the unfortunate result of retarding the development of true Christian scholarship in the younger generation. The book has an appeal to Christians because the authors begin by claiming a new interpre-

tation of historical geology which is Scripturally tenable. They claim further that any scientific objections can easily be refuted. But it will be most unfortunate if this book is accepted uncritically by Bible scholars and teachers.

One can hope that students, teachers, pastors, and laymen using the book will look up the references cited to see what the quoted works really say instead of relying on what the authors make them appear to say; that they will look for unlabeled assumptions which the authors make and present as fact; that they will earnestly seek to find logic in the arguments advanced and valid deductive reasons for discarding reasonably established phenomena. If anyone accepts what appeals to him rather than what logically appears to be truth, then there is a great fault.

—Reviewed by Wayne U. Ault, *Geochemist, Isotopes, Incorporated, Westwood, N. J.*

#### CLARIFICATION

In my review of *Religion and the Scientific Outlook* by T. R. Miles (June 1963), the implication seems to be made that I believe the King James Version of the Bible shows a fallible Jesus. Miles does not believe in my review of *Religion and the Scientific Outlook* by original choice of words was poor. —Irving W. Knobloch.

#### NORTH CENTRAL SECTION MEETING

"A Scientific and Christian Appraisal of Ethical Values" is the theme of the spring meeting of the North Central Section of the ASA to be held at 1:30 - 5:00 p.m. April 11, 1964, at Northwestern College, 50 Willow Street, Minneapolis, Minnesota. Papers will be presented by Vernon Sommerdorf, M.D., and Robert Sandin, Ph.D. Discussants of the papers are sociologist David O. Moberg and theologian Robert Mounce. For further information, contact Dr. Robert L. Bohon, President of the Section, at St. Paul telephone number 776-5274.

# LETTERS TO THE EDITOR

## THE ROLE OF THE ASA

I hope that the atmosphere and publications of *The American Scientific Affiliation* won't be watered down because of criticism, or the impact of ASA will be nullified. Our young scholars and more mature Christian colleagues today are looking for ways to reconcile Christianity with *new ideas*.

It seems to me that there is a great need for an organization like ASA if we will continually keep before us *new* responsibilities and opportunities, but if we settle back into a rut, then it will become just another organization; none of us has time for that.

Two avenues of service I see are young graduate students and foreign scholars. A British physicist and a Chinese engineer were at the 1963 ASA convention in Santa Barbara. Unfortunately, they misunderstood and thought that only the last day pertained to their interests. We could be better hosts to such persons who need Christian fellowship in a scientific atmosphere.

Mary Key, Ph.D.  
(Mrs. Harold Key)  
Wycliffe Bible Translators  
Santa Ana, California

## THE BIBLE AND SCIENCE

As I read the ASA for September, 1963, I noted that it is somewhat difficult for the various authors to believe that the Bible is also a book on science. As you may have surmised, I am one who believes that it is. Some of the writers, as they commented on the theory of evolution, may have been unduly influenced by the phrase "the God of the gaps." God may have purposefully been the God of gradual changes and *also* the God of the gaps.

In Richard H. Bube's splendid article, he at one point quoted a portion of Psalm 93:1, "the world also is established that it cannot be moved." He therefore believed that that statement ruled out any astronomical significance.

But when I looked up this Hebrew word for "moved," I found the definition, "waver or be out of course." So this comment by David is really a scientific statement because it states, "That it is established that the earth will not wander off its course" (about the sun).

Anton Kronstedt  
Minneapolis, Minn.

## THE POLITICS OF SCIENCE

I should like to direct attention to *The American Behavioral Scientist*, September 1963. The entire issue is devoted to the "Politics of Science and Dr. Velikovsky" and includes three papers. The first, by Ralph Jurgens, recounts the story of Dr. Velikovsky from the beginning to the present day. The second, by Livio Stecchini, analyzes the roots of the controversy in the history of science. The third, by Alfred DeGrazia, publisher and editor of the journal, searches out the means by which new science is brought into the corpus of science and offers suggestions for reforms.

I believe that Dr. Velikovsky's work and the issues presented in this particular issue of the *Journal* are of immense importance to the Christian scholar and the social scientist. Inadvertently, Dr. Velikovsky has probably done more to provide a rational basis for the connection between Old Testament phenomena and science than any modern day author. His major works, *Worlds in Collision* and *Ages in Chaos*, need be analyzed carefully by the physical scientist, social scientist, and theologian.

Of particular interest to me as a social scientist is the interesting and well-documented thesis that the natural sciences, claiming themselves to be the only objective sciences, in fact are not so, but are agitated and strongly influenced by clique behavior, power networks, ideologies, public opinion, social controls and professional sanctions.

I trust that in some way this controversy might be made known in the *Journal of the American Scientific Affiliation* in the near future.

Ronald Stuckey  
N. Y. State Research Foundation  
Children's Hospital, Buffalo, N. Y.

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION



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

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