Journal

of the

American Scientific Affiliation

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

December, 1961

Vol. 13

No. 4

The American Scientific Affiliation

(Incorporated)

The American Scientific Affiliation was organized in 1941 by a group of Christian men of science. The purpose of the organization is to study those topics germane to the conviction that the frameworks of scientific knowledge and a conservative Christian faith are compatible. Since open discussion is encouraged, opinions and conclusions are to be considered those of the authors and not necessarily held by others in the organization.

PUBLICATIONS

The Journal of the American Scientific Affiliation is issued quarterly. Its contents include primarily subjects both directly and indirectly related to the purpose of the organization, news of current trends in science (including sociology and anthropology), and book reviews.

Modern Science and Christian Faith is a 316-page book containing ten chapters on nine fields of science, each written by a person or persons versed in that field.

Evolution and Christian Thought Today is a 221-page symposium by thirteen authors, expressing the attitudes of Christians on this subject a century after Darwin's writings.

EXECUTIVE COUNCIL

The Journal of the

American Scientific Affiliation

Table of Contents

Vol. 13 December, 1961 No. 4

The Journal of the American Scientific Affiliation is published quarterly, March, June, September, and December by the American Scientific Affiliation. The publication office is located at 414 South Broad Street, Mankato, Minnesota. The subscription price is $3.00 per year. Single copies may be obtained at a price of 75c each. Copies of back issues may be obtained at the price of $2.00 per volume. Send all communications regarding editorial matters to the editor, Delbert N. Eggenberger, 620 Lincoln Street, Downers Grove, Illinois. Second-class postage paid at Mankato, Minnesota.

Printed in U.S.A.

Twenty Years with the American Scientific Affiliation *

I. A. COWPERTHWAITE**

The Historical Committee
I. A. Cowperthwaite, Chairman
F. Alton Everest
Russell L. Mixter
Marion D. Barnes
H. Harold Hartzler

The events and circumstances leading up to the founding of the American Scientific Affiliation have been well presented by Dr. F. Alton Everest in his paper entitled: "The American Scientific Affiliation—The First Decade," which appeared in The Journal of the American Scientific Affiliation Vol. 3, No. 3, September, 1951. It is neither necessary nor advisable to repeat this story in detail at this time. However, a brief outline of these events will, perhaps, be of value as a background for the story to follow.

The concept of an organization of Christian men of science started as a wistful dream of Dr. Irwin A. Moon of the Extension Department of the Moody Bible Institute, later Director of the Moody Institute of Science. At the time in question, the period leading up to 1941, Mr. Moon was personally traveling throughout the country with a truck-load of scientific equipment giving his series of lectures and demonstrations known as "Sermons from Science." While he presented these sermons with their experimental demonstrations in the great metropolitan centers, he also sought opportunities to present them on college and university campuses. The students found these novel sermons from science to be very interesting and stimulating, and, at the conclusions of these presentations, they frequently flocked around Mr. Moon for a period of questions and discussions. Many of these students were scarcely able to cope with the pervading materialistic philosophy of collegiate science and were eager for reassurance that modern scientific knowledge does not rule out faith.

Mr. Moon, of course, knew that competence in science and Christian faith were perfectly compatible. He also knew that there were a number of reputable men of science who were devout Christians; but:—how many were there, who were they, where were they? Such considerations and questions doubtless led to the concept of the desirability of an organization of Christian men of science; men representing all branches of science brought together by the unifying factor of a common Christian faith. He felt that the very existence of such an organization would be a source of reassurance to perplexed and confused students.

He discussed his concept of a distinctively Christian organization of qualified scientists with Dr. Houghton who at that time was president of the Moody Bible Institute. Dr. Houghton apparently concurred in the desirability and value of such a group and plans began to be formulated to bring together a nucleous of selected men who could be expected to be sympathetic to the idea and interested in its realization.

The first contact in the interests of the proposed group was made in November of 1940 with Prof. F. Alton Everest of Oregon State College. In the months that followed, Prof. Everest was able to make some preliminary investigations into organizational forms and procedures in preparation for the projected meeting of a representative group of Christian men of science to be convened in the near future. Invitations to this meeting were sent out by Dr. Houghton in June of the following year, 1941. The text of the letter of invitation has subsequently been published in Dr. Wilbur M. Smith's biography of Dr. Will H. Houghton entitled "A Watchman on the Wall" published by Wm. B. Eerdman's Publishing Company, Grand Rapids, Michigan, 1951. Dr. Smith has aptly called this letter "The Birth Certificate of the American Scientific Affiliation." The letter contained an invitation to come to Chicago, with expenses paid, for the period of September 2 to 5, 1941, in order to explore the possibility and desirability of forming an organization of Christian men of science. The particular time designated for the meeting was chosen to coincide with Mr. Moon's presentation of his series of sermons from science at the Moody Memorial Church so that he would be in Chicago and able to meet with the group and impart his vision of opportunities and services to them. However, the letter was very explicit that neither the Moody Bible Institute nor the persons sponsoring the invitation had any desire to dominate the group or define its sphere. The group was to be entirely free to make its own plans. These assurances of freedom from pressure or direction were literally adhered to.

The number of letters of invitation that were sent out is not known. However, five men accepted the invitations and came to Chicago in the interests of forming a new organization of Christian men of science. Those who responded and met together were: F. Alton Everest, Peter W. Stoner, Russell D. Sturgis, John P. VanHaitsma, and Irving A. Cowperthwaite. From time to time Mr. Moon, Dr. Houghton, and Mr. H. Coleman Crowell, Vice-President of the Moody Bible Institute, conferred with the group, but, true to the stipulation of the letter of invitation, no effort was made to dominate or give direction to the group.

At this organizing meeting held twenty years ago, those participating could recognize a number of needs that could be met by an organization of Christian men

*Paper presented at the Sixteenth Annual Convention of the American Scientific Affiliation held at Houghton, New York, August, 1961.

**Dr. Cowperthwaite is Chief Engineer with the Thomson Wire Company of Boston, Massachusetts.

of science and, also, a number of unique services that such a group could perform.

The objectives visualized for the proposed organization may be subdivided under the headings of services to the anticipated membership and services to others outside of the membership. The latter may be further subdivided into a deep concern for the spiritual welfare of Christian students in secular colleges and universities, and into services that the organization could render to pastors, evangelists, writers, and other Christian workers.

In considering the needs of Christian men of science scattered throughout our country, and beyond our borders, it was felt that a distinctively Christian-oriented organization had much to offer. There were already an abundance of technical and scientific societies operating within the different fields of scientific disciplines. These, however, were, and still are, largely dominated by a materialistic philosophy of science. It seemed that there must be many Christians on the faculties of colleges and universities, on the staffs of research organizations, in industrial laboratories, or in private practice who yearned for Christian fellowship with others in similar or comparable fields of work. There was no thought that the proposed organization would supplant the established technical and scientific societies in the work and loyalty of the anticipated members. Such societies are good and valuable and are important to all scientists, Christian and non-Christian alike. However, it was felt that such societies could profitably be supplemented by a new society presenting a Christian philosophy of science where Christian men of science could meet in an atmosphere of worship and fellowship in Christ.

Let us now consider the services which the proposed organization could render to others outside of the membership. From the very beginning, there was a deep concern for the plight of Christian students. It was known that many such students were shocked and bewildered when exposed to college level courses of science that were presented from a strictly materialistic point of view. There was also the distressing knowledge that many were unable to cope with the situation and lost their Christian faith. As a result of this concern, the very first major project considered for the proposed organization was the publishing of a students' handbook presenting a Christian philosophy of science and a Christian interpretation of each of the various fields of science. Then, too, it was felt that the very existence of an organization of Christian men of science, the mere fact that there were enough such men to organize for a united testimony, would comfort and encourage such wavering students. And, finally, it was thought that the group could strengthen and uphold such Christian teachers as it might be the good fortune of the students to have.

Under the heading of services to pastors, evangelists, writers, and other Christian workers, programs of publications and editorial services were visualized. It was anticipated that members of the proposed organization would be encouraged to prepare scientifically sound and accurate papers in the field of the harmony of science and the Scriptures for publication in the several Christian periodicals where they could be read and be available to these Christian workers. In addition, it was thought that the time would come when the group would be able to issue its own publications.

There appeared to be a wide sphere of service in the field of editorial assistance. Many Christian speakers and writers at that time liked to use illustrations from the realm of science, but, unfortunately, their illustrations were not always technically accurate. In many cases the impact of an excellent message or publication was lost on some wise student who detected a relatively trivial error in a scientific illustration. It was felt that an organization of dedicated Christian men of science could offer their services to such speakers and writers and work with them to eliminate the technical errors that could alienate some smart listeners or readers. The group could be anticipated to have specialists in all fields to whom the various problems could be submitted for editing.

Also, it was felt that the organization could compile a list of dedicated Christian speakers who were specialists in the different fields of science. The projected list was expected to have the names of suitable speakers located in the various sections of the country, who would be available and willing to assist pastors, evangelists, and other Christian workers in their campaigns.

All of these and other similar considerations lead the five who participated in the preliminary meeting in Chicago to conclude that there was a real need for an organization of Christian men of science and that such an organization should be formed. Then there was the problem of a suitable name for the group. After many suggestions and much discussion, the name American Scientific Affiliation was selected. The pertinence of the chosen name has been questioned from time to time, so it might be well to explain that it has no subtle or mysterious significance. It was simply selected in an effort to formulate a name that would be brief, euphonious, and distinctive.

Then followed such routine, but tedious, organizational activities as the preparation and adoption of a constitution and set of by-laws and election of the first officers. F. Alton Everest was elected as the first president and I. A. Cowperthwaite the first secretary-treasurer and the new-born organization was in business. Subsequently, the American Scientific Affiliation was incorporated as a non-profit organization under the laws of the state of California.

The growth of the ASA has probably followed a typical pattern characterized by a rate of growth that was quite slow at first, but which built up at an accelerating rate as the years passed and the organization became bigger and more widely known. To begin with, there were only five members in 1941, and, of these five, one had to withdraw during the first year because of health.

From many points of view, the Affiliation was launched at a most inopportune moment. It was organized in early September 1941, and precisely three months later, on December 7, 1941, the United States was attacked at Pearl Harbor and we were involved in World War II. Immediately, everybody was busy and preoccupied with the war effort in one way or another and wartime restrictions soon made civilian travel virtually impossible.

However, "God moves in a mysterious way, His wonders to perform." While civilian travel was virtually impossible as previously stated, our president, F. Alton Everest, was not only able, but was actually forced to do considerable traveling all over the United States in the interests of his wartime work. Everywhere he went, he found time to seek out Christian men of science to whom he told the story of ASA and its vision of Christian service. Interested men were invited to join the new organization. This was a period of slow, but sound, growth.

As the number of members increased, there were more to tell the story to others and invite them to join. So the rate of growth increased rapidly. This growth is illustrated by the following figures:

Growth of ASA

Year	No. of members
1941	5
1946	73
1951	220
1961	860

The war effort, which bore so heavily on scientific personnel and which made unessential travel so difficult, made annual meetings of the newly organized ASA impractical for the duration. Annual meetings of the organization had been an important part of the plans formulated by the founders. However, circumstances made such meetings out of the question for several years. In retrospect, perhaps it was just as well that circumstances prevented the holding of annual meetings in the early years until the membership had built up to a point that made support of such meetings possible. Meetings in the first few years might have been discouragingly weak.

However, the war finally came to an end and there was a relaxation of the tremendously engrossing war effort and the strain upon transportation was eased so that travel was again feasible. Therefore, the original plans for annual meetings could at last be carried out and the first such meeting was scheduled to be held at Wheaton College, August 28, 29, and 30, 1946. It was not a big meeting numerically, but it was intellectually stimulating and pervaded by a fine spirit of Christian fellowship. The annual meetings of the ASA were off to an auspicious start and they have been held yearly from that time on.

It would be tedious to review each of the succeeding annual conventions in this brief historical sketch and it is doubtful if any useful purpose would be served by such a review. Therefore, only trends in the developing pattern of the conventions will be noted.

From the very beginning, the meetings have been open to interested visitors. Many such visitors found the program, fellowship, and objectives of the organization to be attractive and became members. Also, it has been the practice from the start to have at least one evening session to which the general public is invited. These open public meetings were designed to give an inspirational Christian message with a scientific orientation, using either a suitable speaker or a Moody Science Film. These meetings served to get the ASA and its objectives more widely known among the Christian public.

The technical sessions of the early conventions were largely made up of more or less random papers. As the organization grew and more talent was available for program planning, a trend toward grouping of papers into symposia in specific fields developed. This trend went full course in the sixteenth annual convention in 1961 when the entire convention was given over to the study of a single field: "The Christian's Responsibility toward the Increasing Population."

Another distinctive development in convention programs involves field trips. The programs of the first two annual meetings consisted entirely in the presentation and discussion of papers. However, at the third convention held September 1-3, 1948, at Calvin College, there was the move in the direction of a field trip as a part of the convention program. This first scheduled trip was a visit to the Christian Psychopathic Hospital operated by the Christian Reformed Church. The following year at the convention held at The Bible Institute of Los Angeles the trend to field trips came to full flower with trips to Mt. Wilson, Mt. Palomar, La-Brea Tar Pits, and the Los Angeles County Museum. Following this impressive start, subsequent meetings have featured many notable field trips conducted by skilled guides that have been enriching experiences.

Through the years, a pattern has emerged in the matter of the geographical location of the annual conventions. It has become customary to have the meetings in the mid-west on alternate years. Then on one of the odd years the meeting would be located in the west followed by an eastern meeting two years later.

Therefore, in a four year cycle, there would be a meeting in the mid-west, followed by one in the far-west, then another in the mid-west, completing the cycle with one in the east. There have been exceptions, but, in general, this pattern is followed.

The annual conventions are a very important activity of the Affiliation. It is at these meetings that members get to know each other. They afford a wonderful opportunity for Christian men of science from many scattered points to become acquainted and enjoy fellowship in Christ. Also at these meetings members present papers embodying years of mature meditation in the field of science and the Scriptures that are both stimulating and inspiring.

However, many members do not attend these conventions and thus miss the very considerable benefits available. To partially remedy this situation, a number of local sections have been formed where members in a given area can meet periodically for fellowship, presentation of papers, and discussion. This is a very important development that should be encouraged and enlarged.

In addition to the meetings, both annual and local, another very important activity of the Affiliation is in the field of publications. These publications may be conveniently divided into two groups: those primarily directed to readers outside of the membership, and those primarily for the members.

The first group of publications aimed at a broad market includes the books, tracts, and monographs produced by the ASA. As mentioned earlier in this review, the very first project accepted by the group at its organization was the preparation of a students' handbook written at college level and presenting a Christian philosophy of science and a Christian interpretation of each of the various fields of science. This project was directed by Dr. Everest who assigned the different chapters to suitable authors and acted as editor. After several years of work in extremely difficult times, the handbook appeared in 1948 under the title of "Modern Science and Christian Faith." This book has gone through two editions and many printings and a third edition is under consideration.

In 1959 the Affiliation published a second book entitled: *Evolution and Christian Thought Today.* This volume was planned to give a Christian interpretation of the impact of the theory of evolution on science and on Christian thought. It was planned for publication in 1959, on the 100th anniversary of the publication of Darwin's *The Origin of Species.* As in the case of the former book, this was a cooperative project. In this case, Dr. Mixter was appointed as director and editor-in-chief to coordinate and expedite the work. Authors were selected for the various chapters and several years of writing and editing followed before the volume was finally published on the centenary of Darwin's work. It represents a solid contribution by ASA in a highly controversial and emotionally charged field.

Other publications of ASA for wide distribution include three monographs and a tract. The monographs are as follows: No. 1, "Christian Theism and the Empirical Sciences" by Cornelius Jaarsma; No. 2, "Creation and Evolution" by Russell L. Mixter; and No. 3, "The Eye as an Optical Instrument" by Frank Allen. The tract referred to above is entitled: "Ten Scientists Look at Life" and was edited by Alfred Eckert.

The second group of publications of the Affiliation was described as publications aimed primarily at the membership, although it is to be hoped that their circulation and influence extends far beyond such limitations. The first item of this group, in fact the very first piece put out by the Affiliation, was entitled "American Scientific Affiliation" and was a pamphlet prepared for members to distribute to prospects. It described the origin and aims of the organization and invited qualified and interested persons to join. After several reissues, this pamphlet has recently been completely rewritten and modernized and is currently available in an attractive up-to-date form for the same old purpose of making the organization known to prospective members.

Very early in the history of the Affiliation it was realized that a periodical was needed to keep the scattered membership informed and to maintain their interest. This posed a serious problem. The membership was small and needed the unifying influence of a periodical, but a periodical needs a large membership for support. However, in time a start was made and from simple beginnings the Journal as it is known today was developed. In 1948, two mimeographed publications were issued and distributed to the membership; one was entitled "A Symposium on the Age of the Earth," and the other "The Yearbook of American Scientific Affiliation." The following year, 1949, saw the beginning of regular publication with the appearance of three numbers of "The American Scientific Affiliation Bulletin." The next year, 1950, the name of the publication was changed to *Journal of the American Scientific Affiliation,* the name which is still used. Four numbers were issued in 1950 and it has appeared quarterly since that time. The Journal for the years 1950 and 1951 appeared in the form of mimeographed sheets bound into printed covers. Beginning in 1952, the Journal was printed in essentially the present form. The content and purpose of the Journal are too well known to readers of this review to require explanation at this time.

The most recent publication of the ASA for distribution to its membership is the "News" edited by F. Alton Everest. This delightfully written news sheet is justly popular with the membership.

The organizational structure of the Affiliation has gone through a number of changes during the past

twenty years. In 1941 there were only five members and, by a strange coincidence, it was decided that the affairs of the Affiliation should be managed by an executive council of five members. The original constitution of the Affiliation provides that a member was to be elected to the executive council each year for a term of five years. This meant that the original five members had to establish an order of retirement from the council in order to make room for newly elected members while maintaining a council of five members. The order of retirement was determined by drawing lots with the following results: John P. VanHaitsma to retire in 1942, Irving A. Cowperthwaite in 1943, Russell D. Sturgis in 1944, Peter W. Stoner in 1945, and F. Alton Everest in 1946.

The constitution also specified that the officers of the Affiliation should be elected annually by the members of the executive council from their own ranks. Traditionally, members of the council serve only one term, although there is no constitutional barrier to more than one term. This tradition has been broken three times in the cases of three members who were serving the Affiiliation with unusual dedication and devotion. These three were F. Alton Everest who served on the council from 1941 to 1951, Russell L. Mixter from 1944 to 1954, and H. Harold Hartzler from 1950 to 1960.

At first there was only one class of membership in the Affiliation. However, about 1950 a new constitution was adopted with two classes of members: Members and Fellows. According to this second constitution, only fellows could vote in the election of council members. Another provision of this constitution was two doctrinal statements: a briefer statement to be subscribed to by the members, and a fuller statement to be subscribed to by the fellows. The fuller statement was in eight parts and was quite long (389 words) and involved. It is difficult to write such a long and involved doctrinal statement that will satisfy everybody, and so it is not surprising that this statement came under considerable criticism. Also, the members showed signs of dissatisfaction with their disenfranchisement.

These dissatisfactions finally led to the adoption of still a third constitution in 1959. This third constitution made provision for four classes of membership: Honorary Fellow, Fellow, Member, and Associate. The specific points of dissatisfaction with the second constitution were removed: voting was put in the hands of Members and Fellows, and a single brief doctrinal statement was formulated to which all classes of members must subscribe. This third constitution is currently in effect and can readily be consulted for details so that no further discussion is warranted in this review.

Now at the Affiliation's twentieth anniversary, it might be an appropriate time to take stock and try to determine to what extent the dreams of twenty years ago have been realized. In the early part of this historical review, the visualized objectives were divided for purposes of convenience into two parts: services to members, and services to others outside of the membership.

There is ample basis for claiming that the ASA has developed a good program of services to its members. However, even a good program requires participation before it can be effective in the case of an individual member. Those who have participated by attending annual and local meetings have had their lives enriched by friendships with choice Christian men in the various fields of science. Friendships which, but for ASA, probably would never have been made. In this connection, a quotation from Dr. Everest's paper of ten years ago would be in order: "One of the greatest experiences in the life of the writer has been the thrill of working side by side with men of the ASA — men whose faith has been tried in the crucible of spiritually sterile scientific criticism, men who have devoted their lives to the study of God's handiwork in nature and who see there the infinite resources of the One in Whom we live and move and have our being." Many in ASA can say a hearty amen to these sentiments. Those who have attended meetings and made friendships with the members, then find pleasant reminders of personal friends in the columns of the Journal and the News.

How well the ASA has achieved its objectives of service to others is more difficult to evaluate. The students' handbook, the first major project of the ASA, was published as soon as practicable and has enjoyed a substantial sale. Many teachers have been encouraged and strengthened through fellowship in the ASA. How big an impact this has had upon students cannot be known. However, many encouraging reports have been received which indicate that the work has been meaningful and worthwhile.

The objective of encouraging members to write for the various religious periodicals has evidently been fruitful as is apparent from the number of articles that have appeared and continue to appear in these periodicals.

Many publishers and authors have gratefully availed themselves of the editorial and reviewing services of the Affiliation.

In conclusion, it may be stated that the Affiliation has made progress in its fields of Christian services, but the work is never completed. Perhaps the next twenty years can be faced in the spirit of Philippians 3:12-14: "Not as though I had already attained, either were already perfect: but I follow after, if that I may apprehend that for which also I am apprehended of Christ Jesus. Brethren, I count not myself to have apprehended, but this one thing I do, forgetting those things which are behind, and reaching forth unto those things which are before, I press toward the mark for the prize of the high calling of God in Christ Jesus."

*Admonitions of a Physician**

JOHN S. HYDE, M. D. **

We have been concerned at this conference with approaches that should allow science and theology to become mutually respecting and mutually reinforcing partners.

Why does science command the prestige which it obviously possesses?

What are some of the limitations of science today?

Has the work of science undermined in a more profound way the once dominant position of religion?

Scientists and non-scientists have been deluded by external appearances and by partial understanding into thinking of science as a relentless all-conquering intellectual force, armed with finality and perfection. We are, in the modern world, completely surrounded by science and by the technological achievements which science makes possible. By this powerful partnership we are warmed and cooled, clothed and fed, protected, cured, transported, and entertained.

Science has never really been blocked, it seems, no matter in what direction it seeks to move into the wilderness of ignorance. Its remarkable success in dealing with inanimate nature—the physical universe—and the promising advances it has already made in controlling vital phenomena have brought science great prestige and respect. Often this prestige and respect rest on quite wrong evidence—on relatively trivial matters, or on advances which are essentially technological rather than basically scientific in character.

Scientists belong seemingly to an undefeated, presumably all-powerful group of wise and clever men. No wonder the non-scientist resents, fears, and opposes this so-called superbreed. Perhaps we should turn the world over to them. Perhaps they could, if properly supported, really liberated and put in charge—perhaps they could solve all problems of human relations, of economic stability, of international peace, of the good life. Perhaps they should design not only the churches, but the creeds also. Perhaps the best music and poetry will, in a short time, come out of a machine.

The sad fact is that some scientists themselves appear to believe precisely this. This attitude has tended to separate scientific thought from general learning. Thirty years ago the literary intellectuals and the scientists "had long ceased to speak to each other; but at least they managed a kind of frozen smile across the gulf. Now the politeness is gone, and they just make faces." (C. P. Snow)

*Paper presented at the Fourth Biennial Joint Meeting of the American Scientific Affiliation and the Evangelical Theological Society held at Goshen, Indiana, June 1961.

**Dr. Hyde is a Practicing Physician in Oak Park, Illinois.

The favorable part of the present reputation of science is often significantly misunderstood and the unfavorable part is largely, if not wholly, false. Is there a more balanced view of science which puts its power and its limitations into a clearer focus?

When scientific man confronts any object, any natural phenomenon, what does he wish to do? He does not elect to disregard, he dislikes being mystified, he is not willing to fear. On the contrary, he has a deep craving to understand. The difference between the state of not understanding and of understanding takes a depth and subtlety which deserves a far more competent summary than I can give.

Scientists and non-scientists use a sort of understanding known as the useful analogy. For example, a person doesn't understand genetics at all. He is told, "Well, a chromosome is sort of like a string of beads (in every cell of your body). Each bead is a gene. Each gene determines, or helps determine, one of your characteristics, such as your blue eyes, hair color, or your sex." The person may like this curiously comfortable and useful description of the unfamiliar phenomenon in terms of its similarity to a familiar phenomenon. This procedure is misleading because, if one examines the situation honestly and in detail, the familiar is itself simply not understood. It has been familiar long enough so that curiosity concerning it has disappeared; but that is all.

The modern scientist likes a good theory. It might be a small and neat black box which works for a wide range of problems, which has external dials which can be set. It is a theory which is general and elegant or compact, which puts us in control of the phenomena in question, and which can predict. This abstract procedure makes no pretense of explaining phenomena. The triumph for a theory is that it deals successfully with phenomena.

Science does not furnish any really ultimate or satisfying explanation. There are four other imperfections of science, or rather imperfections in the views that are held by some concerning science.

Scientists do not, and apparently cannot, agree about certain of the deepest and most central aspects of science. Instead of a monolithic enterprise, science exhibits the same lively diversity which one finds in non-scientific fields.

Further, there is a statistical limitation. The ultimate individual decisions of a person are not predictable although large-scale phenomena are nevertheless dependable. Does this make one admire science the less? Can

you conceive of wanting to marry a woman who is completely perfect and totally predictable?

Science is more strictly logical than any other field of intellectual activity. Deductive logic has vital and built-in limitations based as it is on assumptions and its essential incompleteness. Inductive reasoning cannot lead invariably to distinctions between lawlike and unlawlike conclusions. Dr. Charles F. Kettering characteristically warned, "Beware of logic. It is an organized way of going wrong with confidence."

The supposed objectivity of science may not be so sacrosanct. In his book, *Personal Knowledge,* Michael Polanyi totally rejects the ideal of scientific detachment. He does not believe that knowledge is, or can be impersonal, universally established, objective. Even in the exact science "knowing" is an art, of which the skill of the knower, guided by his passionate sense of increasing contact with reality, is a logically necessary part.

We have spoken thus far of five imperfect aspects of science. The view necessitated by these points has been summarized by Warren Weaver. "Science has, as a tool for dealing with nature, proved to be superbly succesful. With respect to physical nature, and to all moderate scales of space and time—say larger than an atom and smaller than a galaxy, say more persistent than 10^{-10} seconds and less than a billion years—science has a difficult time. It is by no means clear that our present concepts or even our existing language is suitable for these ranges. In the realm of animate matter, science has made wonderful, but more limited, progress. This adds up to a very great intellectual achievement." (Weaver, W.: The Imperfections of Science, *Proc. Amer. Philosop. Soc. 104: No. 5, 1960.*)

We must, however, bring science back into life as a human and spiritual enterprise, an enterprise that has at its core the uncertainty, the flexibility, the subjectivity, the dependence upon creativity and faith which permit it, when properly understood, to take its place as a friendly and understanding companion to the rest of life.

Why does modern man look increasingly to science while organized religion is pushed steadily to the periphery of his concern?

I believe that it is wherever religion is satisfied to hold out to man the comfort and security of a static set of answers to all our questions about life and wherever its chief concern is to provide a set of rules by which to regulate our living. Where religious faith consists only of an intellectual belief in a set of doctrines or teachings, science soon exposes error. Where religious faith is conceived of as a lead from insufficient evidence into the security of a closed system to the security of mental and social conformity, the scientific attitude challenges us to dare to question. For by questioning and testing we prove that which is true, we overthrow that which is false. And this challenge to the church is healthy for it is a mighty flood that shakes the very foundations. And whatsoever house is built upon the sand must perish, but whatsoever house is built upon a rock will stand.

The challenge of science is an opportunity for true religion. For it is not the challenge of evil but the relentless quest for truth that dares to question its most cherished notions in order to insure that they are rock and not sand. It is important to distinguish between the questioning of a scientist—this is the legitimate and necessary questioning of every inquiring mind—and the questioning of the skeptic and the cynic. The skeptic or cynic has been disillusioned, has experienced the shattering of an idol to which he once looked for security and he is no longer capable of faith. The scientist like the Christian, dares to question precisely because he has a *deep abiding faith.* He questions in order to build, whereas the cynic questions in order to destroy. The scientist like the Christian questions that his house may be built on God's rock and not on the sand of some false idol.

What then are the *characteristics* of Christian faith, of *scientific faith?* There are two sides of this faith. There is the call and the response.

The call is an inner voice. It is an inner vision. Now here are many voices that speak to a man's soul. There are the clamoring voices of the self-life, the whimper of fear, the trumpets of prejudice, the whisper of pride, the shout of lust, the command of ambition.

And there are voices from the outside: there are the threats of the powerful, the bribing promises of privilege, the chances for security. How many are the voices that drown out the still small voice of God! Yet *creative faith* cannot be born without the discernment in your soul of the voice of God.

Now, the voice of God has an unmistakable quality. Even if we dare not to believe that it is of God, the secret recesses of our being confirm its origin. Since the dawn of recorded history man has been witnessing to a divine voice that speaks to him. Therefore, search not for the voice of God to speak to you out of lightning and thunder. The spectacle, the novelty, is never His mouth. He speaks in the stillness of a quiet soul. That declares Him. That is His mouth which fulfills His promises of old. Jesus has been criticized because He brought no new doctrine. But His uniqueness lies not in His teaching but in the fact that He fulfills the old; that He fulfills the law and the prophets. It is for this reason that we encounter the voice of God supremely in the person of Jesus Christ.

John says, "No man has seen God at any time; the only begotten son which is in the bosom of the father, He hath declared Him." The voice of God never bribes

the self-life within us. Rather, its very quality commands our allegiance and creates a desire within us to follow Him. And the knowledge of this truth changes us so that we can never be the same again, whether we honor this knowledge with the love and devotion of our hearts, or whether we trample it under our feet. And so it is symbolized as a two-edged sword for it brings with it both mercy and judgment. It brings mercy to those who receive it gladly. "But as many as received Him, to them gave He power to become the sons of God." To those who reject Him, it brings judgment. "And this is the condemnation, that light is come into the world, and men love darkness rather than light, because their deeds were evil."

The vital task of education, the vital task of the church, is to help bring to pass that mysterious event whereby we suddenly stand still to discern the still, small voice and know that it is God. The essential authority of the Scriptures, the essential authority of the person of Jesus Christ, the essential authority of the fellowship of the saints lies in this: they each partake of the spirit of God and therefore may at any moment become transparent to the light of God. If we want to develop a scientist we bring the aspirant into first-hand contact with science in the making. He thus captures the secret spirit of science by participating in the scientific process, by exposure to the minds that are seeing and creating, rather than predigested treatises about science. Even so, we bring the aspirant of the Christian experience into participation of the Christian life through worship, the sacrament, through the fellowship of saints, through sharing in the struggle to relate the principles of our Christian experience to our daily living.

It is my conviction that at the center of every creative life stands a divine call and that the measure of a man's greatness is the totality of a man's response to that call. In this age of propaganda it is necessary to distinguish between the great and the notorious, between the great and the famous. Greatness has nothing to do with publicity. It is the fruit of a profound relationship with a divine call.

Dr. John Goodenough, Research Physicist at M.I.T. states, "I fear that our universities sometimes fail to communicate to the students the centrality of an inner call. Great scholars, who have been awakened by some inner voice, whose lives are motivated by it, and dedicated to it, are usually reluctant to share the fact of its existence, beckoning them ever onward they know not whither. This is their private affair. They prefer only to expose their preoccupation with the essential tasks of obtaining information and developing their analytical skills to the purpose of finding pattern and order within this information although facts and analysis are not the only aspects of scholarly judgment. They bow before that shrine of that elusive concept: objectivity. And they pretend that this is so. For it is the final formulation of an idea not the tortuous route to its conception which alone can be thrown out to ones' peers for judgment."

When we leave the restricted realm of quantitative relationship of numbers to concern ourselves with relationships of quality, with relationships in ethics, in form and in beauty, we walk not only by the light of our intellect but also by the light of our spiritual apprehension. Judgments of quality are made in terms of the illumination within us and illumination that emanates from inner voices. It is no wonder Jesus warned us, "If therefore the light that is in thee be darkness, how great is that darkness!"

I repeat, therefore, that the vital task of the church, the vital task of education is not accomplished whenever opinions and solutions are given without first confronting the inquirer with the great problems and questions to which they are addressed. For the formulation of the problem may of itself be the avenue of a divine illumination. The ferment of intellectual and spiritual life comes from the probing questions that echo and re-echo down the corridors of our souls.

The shield of faith is f o r g e d and tempered in a knowledge of love that cannot be assailed by reason. The battleground of faith is our whole person: will, intellect, and emotions. First there is the battle of the will to put forth the effort to wait upon God—to struggle for understanding with both mind and spirit until illumination is given. Then there is the struggle to remain faithful to the illumination that is given—when the cost involves being misunderstood by our friends, even by our families, and the risk of a new way of life. If faith is born of a voice, it is created only as we commit ourselves, our soul and bodies to that voice. That is why the quality of a man's life is the only mark of his relationship to the inner voices, and the fruit of our life is nourished by what we honor, by what we cherish.

Therefore, victorious faith depends upon our response as well as upon the call. The vision, the call of God, is a precious gift that must be held sacred and inviolate if we are to maintain our essential integrity. Whatever else a man does he must be true to this. To betray this gift is to do violence to our soul. Such a betrayal is, I believe, what Jesus referred to as the sin against the Holy Ghost. Every man: scientist, scholar, Christian, who follows his inner voice is led out into a lonely road. Though struggling and suffering may attend his steps, so also creativity follows a faith that ventures into the unknown. Our faith is not a static stronghold of security. It is a dynamic force through which the grace of God transforms the world.

Yet how often we are paralyzed, either through laziness or by fear, into inaction. There are many who are drawn to Christ precisely because they discern within Him, the call of holiness, yet they fail to follow, they fail to grow in knowledge because they are bound—

bound to habit, to a relationship, to an ambition, to a pretense with which they cannot part. They stand at the threshold of salvation, but they will not let go of their securities in this world. Therefore, they know not true freedom, freedom to serve that which they see to be holy, freedom to do their duty as their conscience dictates without catering either to threats from outside or to fear within.

Surely, we all stood on this threshold and cried out as did Moses of old: "Who am I that I should go?" It is just here that the triumphal song of the saints should swell the heavens with the joyous testimony of the faithfulness of God's reply: "Certainly, I will be with thee." "Wherefore, seeing we also are compassed about by so great a cloud of witnesses, let us lay aside every weight and the sin which doth so easily b e s e t us, and let us run with patience the race that is set before us, looking unto Jesus the author and the finisher of our faith."

And so, brothers of mine, stand firm! Let nothing move you as you busy yourselves in the Lord's work. Be sure that nothing you do for Him is ever lost or ever wasted.

Implications of Christian Education In Theology and Science *

WOODROW GOODMAN**

We are concerned today with the system of education commonly called Christian Education as distinguished from other education commonly called secular education. The very word secular in its first meaning is "of or pertaining to this world or the present life."[1] Hence its usage is sometimes applied as "not concerned with religion"[2] and is used in contrast to that which is religious or spiritual. The use of the term Christian Education refers primarily to the philosophy of education in the teacher-pupil relationship. The form of that expression in school organization is secondary.

The first premise in any educational system rests upon an assumption or a set of assumptions. These statements of truth accepted without proof shape the conclusions that the system produces. Our common body of knowledge, therefore, is dependent upon the common denominator of accepted fundamental truths and the rules of inference that are applied to these truths. Whenever a person or a group changes its accepted first premise or body of assumptions or changes the rules of inference the conclusions will be affected.

Immediately it is perceived that the first premise of secular education limits itself to matters pertaining to human observations in our physical world, social development, and such like. To this mass of observable and experimental matter, human reasoning is applied and the result is a body of knowledge that is a mixture of theory and facts, truth and error, constantly subject to revision and possessing differing degrees of acceptability.

In this world of expanding knowledge religion with its concerns for a life hereafter, a holy God, and similar subjects is brushed aside by science as irrelevant. A religious person engaged in a secular study becomes a dichotomy with a soul concerned with the supernatural which phenomena the intellect thrusts aside as though it did not exist.

Christian education on the other hand has its first implication of difference from secularism in the fact that it holds some axioms or first truths that secularism either ignores or denies. These first truths of knowledge have relevancy to all branches of learning in Christian Education. Science confronts a Force other than of this world and must relate its findings to that Force. Philosophy has a confrontation with Revelation that drastically affects its viewpoint concerning the meaning of things. The Humanities must face the record of an intervention into history and the affairs of men from an outside source. In the Fine Arts, Music and Art find an object of portrayal which transcends the realm of matter and concerns itself with things of the spirit. Likewise the Literature of men gives rise to its noblest expression when its concerns are of another world. Christian Education brings the focus of eternity into time and the mark of infinity into the realm of finiteness. A true Christian Education does not deny a truth or fact of secular education, but rather frames that fact in a larger area of relevancy. Nevertheless, Christian Education may frequently find objection to the theories of secularism because of the ignoring or denial of things Christian Education holds to be relevant.

Let us consider a few basic first-truths in Christian Education and their implications to Theology and Science.

Our first axiom is, "There is a God." Beyond this body that each of us calls "myself" and beyond the mountains and oceans of this planet there exists, God. To the Christian, God is relevant to creation, to the mystery of life, to the innermost spiritual nature of man, to the laws of nature, to the unfolding of history both personally and nationally, to the death of the individual as well as to the end of the age, and to all other knowledge of man.

The assumption of the existence of God affects Theology in its most vital function for its very name suggests the science or knowledge of God. And yet, strange as it may seem, some theology virtually denies the existence of God. Nevertheless, it seems to the writer that the pendulum of Theological thought will need to swing away from all forms of nebulous, impersonal, and pantheistic expression to the definite, the personal, and the transcendent God.

As man learns more of the secrets of the natural world, the vistas of knowledge increase. Already small compartments of knowledge require a lifetime of study for a single man to understand. How then can such wonderful order be logically attributed to a force or being less than man? Our alternative is to reach out into the direction of that which is greater than man. As man faces the understanding of nature in its most elemental form with the attendant power of man to destroy the world as we know it and of the possibilities of reshaping by men of things to come, the impending crisis will be so great, frightening, and awesome that only the concepts of a definite, personal, and transcendent God will, in the opinion of the writer, give meaning and relevancy to the events of our time.

*Paper presented at the Fourth Biennial Joint Meeting of the American Scientific Affiliation and the Evangelical Theological Society at Goshen, Indiana, June, 1961.

**Dr. Goodman is President of Marion College, Marion, Indiana.

At this hour in history the Christian assumption, "There is a God," gives us hope for the future. Without a concept of Someone transcending man in his ascendency over the inanimate powers of nature, the picture is most bleak. Man's selfishness and love of power are hurling the world civilizations in a collision path and possible human annihilation. Only a God transcendent in power and authority over His creation can either alter the course of self-destruction or bring salvation to the human race in a life beyond death, in eternity beyond time, and in a realm beyond this world. The acceptance of the simple four word sentence, "There is a God," transforms the interpretation of the course of events in our day. Science without Theology spreads fear and gloom. Theology coupled to Science gives confidence and hope in the ultimate triumph of right over wrong. And so the first of Christianity's axioms has implications of the highest order in the day in which we live.

A second assumption of Christian Education is "God reveals Himself." The idea of a Supreme Being out of communication with the lower orders of His creation leads to a world concept equally devoid of understanding of things supernatural as the atheistic assumption, "There is no God." To the Christian, God not only exists, but He reveals Himself to man. This revelation is of a two-fold nature, through natural revelation in the world of creation and through special revelation by the Word manifest in Christ and the Scriptures.

Natural revelation is the subject matter of Science. A dissection of the wonders of nature brings men to the threshold of faith in One who creates, designs, and provides. A shepherd lad accustomed to gazing at the stars and studying the hills burst forth with this classical statement, "The heavens declare the glory of God; and the firmament sheweth his handiwork. Day unto day uttereth speech, and night unto night sheweth knowledge. There is no speech nor language, where their voice is not heard" (Psalm 19:1-3).

Modern scientists pride themselves on a relentless search for truth. Without question Truth is the goal of vast efforts in research. From this searching there is a multiplicity of facts to increase our body of knowledge. Their search is in an empirical world, bounded by the physical senses of man—a world that is becoming increasingly vast, profound, and complex; nevertheless our common depository of knowledge is growing. This world of the scientist is the world of natural revelation.

Theologians possess through special revelation a Truth to be declared to the world. From the world beyond the empirical knowledge of man comes a revelation of the Truth which man seeks. "But as it is written, Eye hath not seen, nor ear heard, neither have entered into the heart of man, the things which God hath prepared for them that love Him. But God hath revealed them unto us by His Spirit: for the Spirit searcheth all things, yea the deep things of God" (I Corinthians 2:9-10).

Out of this wealth of revelation a few things stand out and should be considered. The first of these is that God is True. "He that hath received His testimony hath set to His seal that God is true" (John 3:33). Also the writer of Hebrews declared, "It is impossible for God to lie" (Hebrews 6:18). We can expect then that in God we will find truth unmixed with error. A second revelation concerning truth is that Christ is the Truth and the way of Truth. The Beloved Apostle John quotes Jesus as saying, "I am the way, the truth, and the life: no man cometh unto the Father, but by me" (John 14:6). Our route to God the Father, the Truth is through Jesus who Himself is Truth. Then in a third point of revelation we understand Christ to be the depository of all knowledge. In his famous sermon on Mars Hill, Paul pointed out concerning Christ, "For in Him we live, and move, and have our being; . . . " (Acts 17:28). Thus the very world of our physical life, the empirical world of the scientist is attributed to Christ. Perhaps this truth is expressed more clearly in the Colossian passages referring to Christ. "And He is before all things, and by Him all things consist" (Col. 1:17). Also, "In Whom are hid all the treasures of wisdom and knowledge" (Col. 2:3).

In the light of the above revelation, it is the responsibility of Christian Education to relate all knowledge to Christ. He becomes the unifying force in the curriculum.

The third axiom of Christians is, "Truth is self-consistent." No system of Christian Education needs to withdraw from any fact of God's creation as unveiled by modern science. The truth of natural revelation is consistent with the truth of special revelation. Distinction needs to be made frequently between fact and theory and between fact and hypothesis as all too often the prejudice of a non-believer shapes his conclusions in a manner adverse to the Christian understanding. In other words the inferences of theologians from the Scriptures and the inferences of scientists from science may clash even when the supporting facts are in agreement.

It is precisely at this point that there is today a great implication of Christian responsibility. Only occasionally like a voice crying in a wilderness do we hear a truly Christian appraisal of the known facts of science. Our Christian educational system needs more textbooks, lecturers, and magazines devoted to the interpretation of scientific knowledge in the framework of Biblical Theology. We have assumed that this task is done by teachers of science in our Christian schools. But the sad truth of the matter is that few s c i e n c e teachers are trained in theology, and few theologians are serious students of science. Our American mania for specialization has created a gulf of misunderstanding and poorly integrated knowledge in the fields of Science and Theology. The hour is late and the task is of highest im-

portance if Christianity is to rise in power and influence in an age of space.

A second major implication of Christian Education is that it must take an increasing concern with man as a person in this modern world.

We have already seen that God did not stop with natural revelation. While it may be accepted that a man may come to the knowledge of the existence of God through a telescope, or a microscope, or a cyclotron, he can only know the attributes of God through special revelation. The holiness of God, the justice of God, the love of God, the mercy of God, man's relationship to God, and many more concepts come to us through special revelation. We see the personality of God in the record of the written word and we see the Word made flesh in Jesus Christ.

It is the wonderful province of Theology to systematize doctrine thereby giving increased understanding of the Scriptures. Concepts of sin, forgiveness, atonement, justification, santification, righteousness, and such like strike at the heart of man's relationship to God and his fellow human beings. Evidences of God's intervention in history through transformed lives of believers, miracles, revivals, providences, and the rise and fall of nations, give implications of hope against today's backdrop of communistic doctrines of inevitability and nonrecognition of God. The Apostle Paul placed a premium upon theologians by paying them this tribute, "Let the elders that r u l e well be counted worthy of double honour, especially they who labour in the Word and doctrine" (I Tim. 5:17). He also instructed Timothy, "Take heed unto thyself, and unto the doctrine; continue in them: for in doing this thou shalt both save thyself, and them that hear thee" (I Timothy 4:16). Let every theologian be aware of the delightful responsibility that is his.

But the great implication of theology in the twentieth century is the concern for moral and ethical advancement to keep pace with scientific technology. Man can circle the globe today in about one hour. Recent news tells us of rocket belts capable of hoisting a single man through the air. Today, special devices magnify light 100,000 times and transform the darkest night into the brilliance and clarity of a television screen. Man is adjusting to the emptiness of outer space and to the pressures in ocean depths. An entire city recently used sea water transformed into drinking water for an entire week without knowing the difference. This wonderful age of science can create a push-button world. Increasingly, the man who pushes the button is our great concern. Basic honesty is deteriorating by popular acceptance of clever forms of cheating. It is reported that crime in the U. S. has doubled in the last 13 years. Whole continents cringe before a man who in a fit of temper could order the destruction of western civilization. Our most important question is not "Who will reach the moon first?" but rather, "Will man be a slave to sin or a servant of righteousness?" It is the role of Christian Education to bring men face to face with the erosive force of sin and the glorious possibility of living "soberly, righteously, and godly, in this present world" (Titus 2:12), as well as the expectation of a "new earth wherein dwelleth righteousness" (II Peter 3:13).

There is a third difference between Christian Education and secular education and that is in the method of forming conclusions. Christian Education considers revelation and insight given by the Holy Spirit as contributing to our storehouse of knowledge as well as experience and reason.

Scientists today seek to confine all knowledge within the realm of experience and reason. However, the area of experience is not confined to personal participation but may also include public experimental verification. From this great body of observable phenomena transmitted from one to another through scientific literature and history conclusions are drawn by the aid of human reason.

Christian Education does not decry the benefits of human experience and reason, but it does claim that faith in God and the revelation of Himself to man and the insights of the Holy Spirit are contributing factors in the formation of conclusions. Frequently, within the realm of scientific thinking the insufficiency of evidence affects the outcome of human reasoning. How can a truly scientific mind seeking for truth and all possible evidences to establish that truth effectively bar by assumption that no evidence other than human experience applies to the case? This is the fatal error of Science. Theology must contribute to science the additional ingredients necessary for correct reasoning and true conclusions. Theology must accept from science the substantial benefit of experience and reason not inconsistent with revelation. Apparent discrepancies must be resolved by faith in the self-consistency of Truth which a more complete understanding will bring forth. Through the medium of a more complete knowledge, theology gives to science a balance toward truth and a guard against error that secular education does not possess.

Permit me to repeat in conclusion a concise statement for each of the main points of this paper.

1. Christian Education must begin with a different set of first-truths or axioms than those used in secular education. This implies different conclusions in all areas of human knowledge. Some first truths that have been presented as a sample of the implications of Christian Education are:
   a. "There is a God" which implies a control of history and a hope in the present critical hour.

b. "God reveals Himself" which implies both natural and special revelation, the former as the basis for science and the latter as a basis for theology.

c. "Truth is self-consistent" which implies a reconciliation between the facts of Science and and the truth of Theology.

2. Christian Education has a primary concern with a moral control over man, a control that it is increasingly apparent is lacking in a purely secular education. This implies a grave and urgent responsibility to our modern life.

3. The method of Christian Education differs from secular Education in that Revelation and Insight contribute to the store house of knowledge as well as experience and reason. This implies the responsibility of Theology to be a balance wheel to Science.

These implications of Christian Education in Theology and Science are presented as a springboard for your personal meditation and development of thought rather than as an exhaustive treatment of the subject.

1. *Standard Dictionary of the English Language, International Edition, 1959; Funk and Wagnalls Co., New York.*
2. *Ibid.*

*The Secondary and Tertiary Structure of Proteins and Its Biological Significance**

V. H. FREED**

A singular feature of the biological world is the interdependent structure which integrates to give a functional whole. One finds at all levels special arrangement of structure such as to produce the most efficient adjustment to the environment for the biological systems (6, 8, 9, 13). Moderate variation or heterogeneity is permitted the biological structure but gross departure from the norm results in malfunction for the entire system.

The importance of protein structure and its significance to the biological system are best put into perspective by first considering the structural organization of biological entities. Examination of the species of higher organisms of either kingdom reveals that they are comprised of distinct but functionally interdependent organs. Thus, in the case of the plant is found such organs as the root, stem and leaves with each structure functionally related to the well being of the other. Similarly in animals, the various organs are clearly discernible and their relation one to another indisputable. Analysis of a function of the several organs reveals that not only is the location of these organs with respect to one another important but that the geometry of the organ itself is a critical factor for its efficient functioning. Thus, for example, where respiratory activity is high, and large amounts of gas are exchanged, the organ will often assume a spongy, laminar shape as in the case of leaves. Other geometrical designs in organs are such to provide the optimum in functional efficiency.

One can follow this analysis to the level of tissues comprising the different organs. Here again the arrangement of structure is such as to promote the interdependence of the different cell types in the tissue for maximum efficiency. Again, as may be seen upon microscopic examination of an organ such as a leaf, structure and configuration is important in the functioning of the cells of a given tissue.

At the cellular level the orderly array of discrete units is still very much apparent. Thus, we find in the cell such structures as the nucleus and the mitochondria, microsomes and plastids of the cytoplasm. These subcellular units are arranged in such a way as to provide the cell for functional efficiency. Examination of the organization and structure of the individual subcellular particles has also revealed an orderly functional arrangement. For example, in mitochondria the molecules of its component enzymes are ordered in such a way as to accomplish transport of the electrons liberated in oxidation with maximum efficiency (13). It has been found that agents of conditions that modify the morphology of these mitochondria materially modify the ability of these subcellular particles to perform their normal functions (15). Such things as the osmotic pressure of the suspending medium (15), ultraviolet light (4), and chemical agents (22) are all capable of inducing serious changes in the ability of the mitochondria to function.

In view of the orderly structural arrangement at the cellular level and above, one would expect to find some order of conformation at the level of the molecules comprising the cell. However, order at the molecular level is not immediately distinguishable visually. It is not surprising, therefore, that our concepts of the structure of proteins in the living cell is only now emerging into a more exact state of knowledge (8, 10, 20). The important relationship of proteins to the living activity of the cell has long been recognized. The ability of many proteins to promote chemical reactions essential to life by serving as catalysts has been the subject of thousands of investigations (6). The key role of proteins in living processes has lead to a determined effort to elucidate the composition and structure of these very important biological materials (6, 10).

The prime function of a catalyst in promoting a reaction is usually to provide a surface at which the reaction occurs. Thus, a catalyst confers on the molecule, by sorption, the ability to become more reactive through a change in its configuration, or a change in the electron density at a particular chemical bond. It is a well-recognized fact that the composition and structure of the catalyst is of paramount importance in determining which particular chemical reaction it will promote. This specificity of catalysis reaches its climax in the enzymes of the living cell (6). It is for this reason that the structure or geometry of surface of these particular substances is of such importance to the biological system. In order for the enzyme to promote a reaction, it is necessary for the enzyme and the reacting molecule to interact to form a complex. The fastidious requirement for certain specific sites by biochemical molecules imposes a stringent requirement for structural specificity on the enzyme that is to catalyze the reaction.

Early study of protein chemistry soon revealed that proteins were composed in large measure of amino acids joined together through an amide or peptide bond. Thus, the amino group (NH_2) of one amino acid was linked to the carboxyl group (^-COOH) of another amino acid. Since each amino acid contained at least one each of an amino group and carboxyl group, it would be possible to build up high molecular weight polymers of such units. Additional groups such as the sulfhydryl (SH) of certain amino acids provide further functional

*Paper presented at the Fifteenth Annual Convention of the American Scientific Affiliation held at Seattle, Washington, August, 1960.

**Dr. Freed is a Professor of Agricultural Chemistry at Oregon State University.

groups which may react to form chemical bonds in the polymer. The sulfur atoms found in the polypeptide molecule cross link at defined intervals and provide further stability to the polymer.

Initial efforts in protein chemistry were directed at determining the specific amino acid composition of various proteins. It was not long until a considerable body of knowledge was built up regarding the kinds and even the numbers of amino acids found in different proteins. With this information in hand, the next question concerning the protein chemist was to determine the order in which the some 20 amino acids were arranged in the protein molecule. The efforts directed toward elucidating this primary structure of protein molecules engaged the attention of protein chemists for many years. It wasn't until some of the newer techniques were introduced that it was possible to map the arrangement of amino acids in a protein molecule (6, 10). The very excellent work of Sanger (16) and others (6, 10) resulted in establishing the amino acid sequence of the protein insulin.

Study of the kinetics of enzyme reactions and the physical chemistry of proteins in solutions suggested that enzyme reactions were occurring at the surface of proteins. The biochemical reactions are so specific that this can only be accounted for by the structure of the catalyst. Accordingly, a great deal of attention had been given to elucidating the secondary and tertiary structure of proteins in solution or in biological environment. Detailed consideration of the chains formed by the peptide linkage of the amino acid finally resulted in the suggestion that these chains form spirals or coils known as helices such as are found in springs (6, 19). This suggestion leads to the proper interpretation of X-ray data obtained on proteins and gave a new clue as to the structure of enzymes.

The protein chemists next concerned themselves with the manner in which the peptide chains arranged themselves to form the two major classes of proteins, namely fibrillar and globular proteins. Recent studies have shown that the different peptide chains could arrange themselves in the form of pleated sheets (fibrillar proteins) or in coiled, spherical particles (globular proteins).

Recent work on synthetic polypeptides has revealed how the peptide chain of a globular protein can form the alpha helix which is so characteristic of this class of compounds (19). It is now known that the hydrocarbon in skeleton in such chains orient themselves to form the various helical forms. The helices then are stabilized by the chemical bonding between sulfur atoms in the chain through ionic interactions, and perhaps of greatest consequence, through intramolecular hydrogen bonding (12). Szwarc (19) also points out that the hydrocarbon or hydrophobic portions of such molecules may interact further to produce the stero specific coils found in the protein molecule. Thus, as an amino acid is added to the end of a peptide chain, the carbon skeleton of this last amino acid not only interacts with the units just adjacent to it but may also interact with units in the chain removed in position from it.

Various studies, particularly that of fluorescence and optical rotation, have indicated that portions of the protein molecule are characterized by an orderly or nearly crystalline structure (8). This has been supported also by X-ray data. Viscosity measurements show that in aqueous media these proteins assume a globular shape. The orderly structure found in the proteins is now believed to be due to the interactions of one portion of the molecule with another through establishment of van der Waals forces and hydrogen bonds. The solvent in which the molecule resides is very important in determining the structural features that the molecule will assume. Thus, in aqueous media or in very dilute salt solutions the enzyme molecule assumes the normal globular structure which provides the surface essential to its catalytic action. However, it is pointed out that in good solvents, that is, those in which the chemical had a high solubility, the molecule tends to produce a random coil structure in which the globular shape is lost and the peptide chain lengthens out (19, 20). In such case, the hydrogen bonds are broken; often indeed the -S-S- bonds of the protein are broken. Such a situation, known as denaturation of the protein, results in a loss of its enzymatic activity. The aqueous media being a poor solvent for the protein molecule allows the material to assume a shape required for enzymatic activity. In this case the coiling of the chain and its folding to produce a globular crystalloid region is due to the intramolecular bonding and the lack of affinity of the hydrocarbon skeleton of the chain and water. In such a situation various functional groups such as a histidine-nitrogen and a carboxyl group or hydroxyl group of a tyrosine are brought into juxtaposition to provide a site at which a reactive molecule might be adsorbed.

A slight modification of the tertiary structure of an enzyme results in a marked change in its catalytic activity (18). Various conditions and agents are capable of bringing about the slight structural modifications with such things as heat (3), ultraviolet light (2, 4, 14, 18), chemical agents (3, 7, 21) and various salts and solutions producing a marked change in the enzymatic activity of a given protein. Conversely it has been found that substrates and coenzymes (16, 22) and such things as fatty acids (3, 5) may stabilize a particular configuration of the enzyme surface thus maintaining its enzymatic or catalytic activity even under conditions designed to destroy it. The author in studying the effect of certain chemical agents on the enzyme amylase found calcium to stabilize the configuration of this enzyme and make it extremely resistant to denaturation whereas univalent ions such as sodium, while giving the same degree of stimulation to the enzyme, would not protect it from attack by the chemical agent.

In the biological system, the structure assumed by the enzymes is of immediate consequence to the respiratory activities of the organism. The possibility of interaction of one protein with another (1), with substrates or with naturally produced chemicals such as hormones (21) provides a means by which the proper configuration is maintained. It has been proposed that enzymes catalyzing certain specific reactions may have their enzymatic properties modified by the presence of certain naturally occurring substances (23). On the one hand the substances may be produced to promote or inhibit the catalytic properties of the enzyme depending on the requirement of the biological system. Thus, the cell would have a built in governor in that by simply modifying the surface geometry of its enzymes it could respond to conditions of its environment or growth requirement. This would be a control in addition to that imposed by concentration of equilibrium.

It has been repeatedly noted that both enzymatic activity and cellular activity of an organism is inhibited by exposure to ionizing radiation or to other agents in its environment. It is clearly established that enzymes (2), mitochondria (4), and organisms may be thus affected. It is implicit in our considerations here that a great deal of this results from modification of the tertiary structure of the proteins. The requirement of a specific structural configuration for enzymatic activity, on the one hand, and the ability of ultraviolet light and other agents to destroy this structure, on the other hand, raises an interesting point with regard to recently suggested schemes (11) of enzyme development on the primordial earth. Although not all authors are in agreement on the conditions that were to have existed at the time (8), most appear to be agreed that ultraviolet radiation and ionizing radiation must have been at a high level. "Primordial protein" existing in a solution, would be thought to be particularly susceptible to having their catalytic powers destroyed by such radiation. It has been suggested that these initial protein-like materials may have been adsorbed on clays or other inorganic surfaces prior to organization of a biological complex. The ability of surfaces to order molecules thus facilitating reaction has been demonstrated (17). However, it would seem that the multifunctional behavior of enzyme systems would require an association of like molecules for further development. It would seem likely that such systems would be most susceptible to the ionizing radiation or other factors of the environment.

Moreover, it has been reckoned that the waters in which such systems may have arisen were deficient in salts. These salts are formed of cations that afford protection of structure to proteins. Such facts as these require of any scheme of protein evolution explanations of how these barriers to enzymatic activity may have been surmounted. Some protection from radiation would be afforded by a sufficient layer of water but diffusion and other types of movement would have sooner or later resulted in these molecules moving to the surface where the possibility of exposure would be increased.

Much remains to be done before complete understanding of the importance of the tertiary structure or geometry of proteins is fully understood. It is not premature to say that the structure assumed by proteins is of utmost consequence to biological systems. We see in this a further means by which sequential chemical events may be controlled in that substrates such as hormones or other chemicals may modify structure, thus increasing or decreasing catalytic activity. Further studies of this problem can only serve to give us a deeper appreciation of the magnificent structural order of the biological world.

LITERATURE

(1) Annau, E., *Arch. Biochem. and Biophys., 78,* 206, 1958.
(2) Aprison, M. H., *Arch. Biochem. and Biophys., 78,* 260, 1958.
(3 Ballou, G. A., *et al., J. Biol. Chem., 153,* 589, 1944.
(4) Beyer, R. E., *Arch. Biochem. Biophys., 79,* 269, 1959.
(5) Boyer, P. D., *et al., J. Biol. Chem., 162,* 181, 1946.
(6) Dixon, M., and Webb, E. C., *Enzymes,* Academic Press, New York, 1958.
(7) Duggan, E. L., and Luck, J. M., *J. Biol. Chem., 172,* 205, 1948.
(8) Edsall, J. T. and Wyman, J., *Biophysical Chemistry, 1,* Academic Press, New York, 1958.
(9) Erhret, C. F., *Science, 132,* 115, 1960.
(10) Fox, S. W., and Foster, J. F., *Introduction to Protein Chemistry,* John Wiley and Sons, New York, 1957.
(11) Fox, S. W., *Science, 132,* 200, 1960.
(12) Goodman, M., and Schmitt, E. E., *J.A.C.S., 81,* 5507, 1959.
(13) Green, D. E., *Subcellular Particles,* ed. T. Hayashi, Ronald Press Co., New York, 1959.
(14) Hvidberg, E., *et al., Nature, 181,* 1338, 1958.
(15) Laties, G., *Plant Physiology, 28,* 557, 1953.
(16) Sanger, F., *Adv. in Prot. Chem., 7,* 1, 1952.
(17) Seigel, B. Z., and Seigel, S. M., *Nature, 188,* 391, 1960.
(18) Smillie, L. B., *Biochem. Biophys. Acta, 34,* 548, 1959.
(19) Szwarc, M., *Chem. and Ind.,* Nov. 29, 1958, p. 1589.
(20) Tanford, C., *Symposium on Protein Structure,* ed. A. Neuberger, John Wiley and Sons, New York, 1958.
(21) Topper, V. J., Maxwell, E. S., and Pesch, L. A., *Biochem. Biophys. Acta, 37,* 563, 1960.
(22) Ungar, F., and Kadis, S., *Nature, 183,* 49, 1959.
(23) Zalkin, H., and Tappel, A. L., *Arch. Biochem. and Biophys., 88,* 113, 1960.

New Testament Christianity and the Morality of Capital Punishment

RICHARD H. BUBE*

With the ultimate execution of Caryl Chessman after more than a decade of successful legal delays, the whole subject of capital punishment has suddenly become a major issue in many parts of the country and in the world around us. Marchers picket governors' mansions across the country protesting the carrying out of the death sentence upon convicted criminals. Emotional radio commentators and newspaper columnists join with the more intellectual authors of the Saturday Review to condemn the whole practice of capital punishment. Nowhere does there seem to be raised a contrary voice in this important sociological controversy. It is important for the Christian to face the issue squarely.

A humanitarian interpretation of society invariably leads to a denial of the right of men to put other men to death for any cause whatsoever. As long as murder is a crime only against man and society, there is no authority greater than that of man to impose the death penalty; since the failings of society are obvious, who is to say that all society is not responsible in some measure for the crime of the murderer? Who then can bear the responsibility of judging another man worthy of death? Besides, what a fine line separates the criminally guilty from the criminally insane; who is to judge between an intent meriting condemnation and an illness calling for pity and help? And so it is that the humanitarian cry of our day is to do away with the barbaric practice of capital punishment.

These same humanitarians have long since done away with the concept of hell, relegating this offensive teaching of Christianity to the bone pile of discarded dogma. They have made God over after their own image; they would convince themselves and their followers that God is not a Sovereign Father after all, but rather an Indulgent Daddy. They have forgotten the basic point in the carrying out of a crime: it is first of all a sin against God, as well as a sin against man. This is the point at which Christianity begins, the point which the Bible sets forth most clearly. When David felt the charge of Nathan after his adultery with Bathsheba and his murder of Uriah, he cries out, "Against Thee, Thee only, have I sinned."[1] And the prodigal son in the parable of Jesus cries out to God and his father as he returns repentant, "Father, I have sinned against heaven, and in thy sight."[2] It is not primarily the sin against man that calls forth the death penalty for the murderer, it is the sin against God.

The death penalty was to be invoked for many sins of men against God and their fellow-men according to the Mosaic law. The command on Sinai, "Thou shalt not kill"[3] carried with it many other statements clearly setting forth the way the murderer was to be dealt with: "He that smiteth a man, so that he die, shall be surely put to death."[4] "And he that killeth any man shall surely be put to death."[5] "The murderer shall be surely put to death."[6] "Whoso killeth any person, the murderer shall be put to death by the mouth of witnesses: but one witness shall not testify against any person to cause him to die."[7] If a man possessed an animal which was known to be dangerous, such as an ox, but did not take adequate precautions to confine the animal, and if that animal killed a man, then the owner was subject to the death penalty. But in this case he could pay a ransom to redeem his life.[8] Such was not the case for a murderer: "Moreover ye shall take no ransom for the life of a murderer, which is guilty of death: but he shall be surely put to death."[9]

The viewpoint of the Mosaic law against transgression of that law was sufficiently strict that the death penalty was to be invoked for many other offenses beyond that of direct murder. Among such offenses were: striking one's father or mother,[10] kidnapping a man and selling him into slavery, [11] cursing one's father or mother,[12] defilement of the sabbath,[13] sacrificing children to the idol Moloch,[14] adultery,[15] incest,[16] sodomy,[17] intercourse with beasts,[18] witchcraft and wizardry,[19] blasphemy,[20] intrusion of strangers upon the tabernacle, the sanctuary, or the priests' functions,[21] false prophecy,[22] enticing to idolatry,[23] stubborn and rebellious behavior on the part of a son.[24] The guilt of sin fell upon the sinner and not on his immediate relatives: "The fathers shall not be put to death for the children, neither shall the children be put to death for the fathers; every man shall be put to death for his own sin."[25]

In many places the Mosaic law emphasizes the importance of witnesses in making sure of the guilt of the accused. The situation is illustrated in its clearest form in the injunction given relative to idolatry:[26]

*Dr. Bube is a research physicist at the RCA Laboratories. He is an authority on photoconductivity and is author of numerous papers as well as of a recent book in this field.

"If there be found among you, . . . man or woman, that hath . . . gone and served other gods, and worshipped them, . . . and it be told thee, and thou hast heard of it, and enquired diligently, and, behold, it be true, and the thing certain . . . then shalt thou bring forth that man or that woman . . . and shalt stone them with stones, till they die. At the mouth of two witnesses, or three witnesses, shall he that is worthy of death be put to death; but at the mouth of one witness he shall not be put to death. The hands of the witnesses shall be first upon him to put him to death, and afterward the hands of all the people. So thou shalt put the evil away from among you."

The problem now confronting us is what part, if any, of these Mosaic regulations have been properly carried over into the new dispensation of our Lord Jesus Christ. As a matter of record, the death penalty is not invoked for any of the above-mentioned causes except that of murder. Is this a valid exception? Jesus Himself in His treatment of the woman taken in adultery indicated the negation of the death penalty for that offense.[27]

A study of the Scriptures reveals that the case of murder is indeed an exception. Or better, not so much an exception, as it is a regulation of God which precedes and follows the dispensation of the Old Covenant with the Mosaic regulations. The form of the commandment in the Mosaic law is merely one embodiment of a universal commandment of God which has always been in effect. Its institution comes early in Genesis when God presents the commandment to Noah after the flood. "And surely your blood of your lives will I require; at the hand of every beast will I require it, and at the hand of man; at the hand of every man's brother will I require the life of man. Whoso sheddeth man's blood, by man shall his blood be shed: for in the image of God made He man."[28] This last sentence clearly sets forth the universal teaching that death by man is to be the penalty for murder. This penalty does not result primarily because of the crime against humanity; it results because a creature made in the image of God has been slain. Murder is intolerable because it is a usurpation by man of a power reserved unto God alone. God has therefore ordained that the murderer must be put to death. This commandment persists through both the Old Covenant and the New Covenant. The last book of the New Testament repeats the same theme: "He that killeth with the sword must be killed with the sword."[29]

Who then is to be the instrument of carrying out this sentence of God against the murderer? Here an interesting insight is obtained by first examining the procedure under the Old Covenant as set forth in the book of Numbers.[30] When a man was murdered under the Mosaic law, another became appointed to be his avenger to slay the murderer. Usually the avenger was a kinsman of the murdered man, and the Hebrew word used for 'avenger' means in part 'to act the role of a kinsman.' A careful system was established to protect a man who might kill another by accident so that he would not immediately fall victim to the avenger. Special cities were set apart as cities of refuge to which the slayer might flee for safety. "Then ye shall appoint you cities to be cities of refuge for you; that the slayer may flee thither, which killeth any person at unawares. And they shall be unto you cities for refuge from the avenger: that the manslayer die not, until he stands before the congregation in judgment."[31] The congregation became the medium for decision: "Then the congregation shall judge between the slayer and the avenger of blood according to these judgments: and the congregation shall deliver the slayer out of the hand of the avenger of blood, and the congregation shall restore him to the city of his refuge, whither he was fled."[32] It was the duty of the congregation to put the manslayer on trial to determine whether or not the crime was premeditated. If he were found guilty, then he was put to death; but if found not guilty of premeditated murder he was returned to the city of refuge where he was constrained to remain, upon penalty of death, until the death of the high priest, after which he was free to return to the land of his possessions. Thus there was a mechanism for trial and judgment, with the decision of guilt being in the hands of the congregation, and the responsibility of execution in case of guilt being assigned to the kinsman avenger.

The principle involved in the Noahic commandment is repeated by the Lord Jesus Himself: "All they that take the sword shall perish with the sword."[33] The correlation between Old and New Covenant is completed by the revelation given through Paul in the 13th chapter of the epistle to the Romans. Here it is clearly shown that the kinsman avenger under the Mosaic ordinance is replaced by the civil authority under the New Covenant dispensation. "For rulers are not a terror to good works, but to the evil. Wilt thou then not be afraid of the power? do that which is good, and thou shalt have praise of the same: For he is the minister of God to thee for good. But if thou do that which is evil, be afraid; for he beareth not the sword in vain: for he is the minister of God, an avenger to execute wrath upon him that doeth evil."[34]

In summary, then, it has been shown that the Scriptures throughout uphold the universal sentence of death upon the murderer. This sentence comes first of all because man, made in the image of God, has been slain by man, and therefore the murderer has sinned against God as well as man. Every safeguard possible to protect the innocent from false accusation and condemnation must be exercised; surely wherever there is reasonable doubt of guilt, the death penalty will be withheld. In the Old Covenant, safeguards were provided by requiring multiplicity of witnesses, setting aside cities for refuge, and granting to the congregation the responsibility of judgment. In the New Covenant, safeguards are provided by the civil courts of law with all their checks and balances. The ultimate conclusion, however, must be that the man who is guilty of murder must be put to death. To abolish capital punishment on principle is to turn one's back on the basic teachings of the Scriptures.

References

1. Psalm 51:4
2. Luke 15:21
3. Exodus 20:13
4. Exodus 21:12
5. Leviticus 24:17, 21
6. Numbers 35:16-18
7. Numbers 35:30
8. Exodus 21:29
9. Numbers 35:31
10. Exodus 21:15
11. Exodus 21:16
12. Exodus 21:17; Leviticus 20:9
13. Exodus 31:14, 15; Exodus 35:2; Numbers 15:35
14. Leviticus 20:2
15. Leviticus 20:10
16. Leviticus 20:11, 12, 14
17. Leviticus 20:13
18. Leviticus 20:15, 16
19. Leviticus 20:27
20. Leviticus 24:16
21. Numbers 1:51; 3:10, 38; 18:7
22. Deuteronomy 13:5
23. Deuteronomy 13:9; 17:2-7
24. Deuteronomy 21:18-21
25. Deuteronomy 24:16
26. Deuteronomy 17:2-7
27. John 8:1-11
28. Genesis 9:5, 6
29. Revelation 13:10
30. Numbers 35:12, 25
31. Numbers 35:11, 12
32. Numbers 35:24, 25
33. Matthew 26:52
34. Romans 13:3, 4

Geology and the Great Flood

WILLIAM F. TANNER*

Many Christians accept the idea that a single flood swept, in the day of Noah, across the entire surface of the earth, submerging even such lofty peaks as Mt. Everest. Many scientists have doubted this story, for two reasons: (1) there is neither a known source from which to draw such fantastically large volumes of water, nor a place to store it after the flood has subsided, and (2) there has not seemed to be any particularly convincing geological evidence in favor of such a flood.

Christian authors have sought scientific support for a strict, literal, interpretation of the Bible account, among the facts of geology. This search has led to rather ludicrous results. Various writers have cited, as proof of Noah's flood, Pennsylvanian beds (deposited about 3×10^8 years ago), as well as rocks which were formed at other times, both earlier and later than that.

Scientists have, in many cases, used their scorn for the flood story as a means of casting doubt on the authenticity of the entire Bible.

Although scientists and theologians have been able to resolve their differences in many fields, the flood narrative has presented an apparently insoluble problem.

Recent results in the earth sciences, however, now raise the hope that perhaps here, again, the historians who wrote the early books of the Bible will be vindicated. It may well be that some Christians will not be pleased with the result; on the other hand, the present agreement beween the observations of geology and the Bible story confirms the latter as well as the nature of the Genesis account will permit.

Many geologists may not be pleased with the results, either. Traditionally, geologists have thought that earth history, over the last 25,000 years or so, was sufficiently well documented to preclude anything remotely resembling the Noachian deluge. The present report is based on a modification of each of these extreme points of view. However, it is thought that in no sense is either the Bible account, or the geological record, undermined or diluted.

The science-oriented Christian must admit, in the first place, that God is quite capable of performing miracles. It is not necessary, therefore, that the total amount of water on and in the earth be conserved. God can create any necessary additional amount, and likewise can later dispose of the surplus. If, however, we can see both a science-based mechanism, and a miraculous mechanism (i.e., one not understood or apparently mechanically contradictory), we should choose the former. This is because God is *not* capricious; He *does* operate within the framework of His own laws; and science is, in the final analysis, merely a study of the behavior of those God-ordained laws which affect the physical universe. A decision to accept the scientifically plausible explanation, rather than the scientifically illogical one, does not prove anything one way or the other; it merely shows that we think that the same God who guided the writing of the Bible account also established the laws which govern the day-to-day operation of the universe. In other words, the *best* answers which we are able to obtain are those that fit into both realms of thought: the Biblical, and the scientific.

If the Bible states flatly, beyond any possible argument, that 100% of the presently-known earth was inundated, we must face the alternative: a miraculous act of some kind. The Genesis account, in translation, does use the word "all." Our interpretation of this word must be colored, however, by other uses of the same word. For example, in Luke 2:1-3 we read that Caesar ordered "all" the world to be enrolled (that is, counted for census and tax purposes), and that "all" the world was, consequently, enrolled. It should be fairly clear that the Incas, Aztecs, and Eskimos were not affected by this order, and that probably large numbers of people in Australia, Asia and Africa never heard of it either. The usage here is essentially that of "all the world that is pertinent to the discussion," which is roughly, but not precisely, the same thing as saying "all the known or civilized world." Such a usage of "all" is standard in spoken English today. When we say, "Everybody's doing it" (whatever "it" may be), we do not mean "100%." The same thing is true in other languages, and particularly true in languages which have not (or

*Dr. Tanner is Associate Professor of Geology at Florida State University, Tallahassee.

had not) been influenced by scientific concepts. The notion of "100%" (mathematically pure and complete) is largely a scientific idea, and should not be forced onto other types of communication. The statement, "All have sinned, and come short of the glory of God," is something else again. This deals with a spiritual principle, is reiterated many times in various forms, and does not admit of an exception.

In the case of Noah's flood, we must choose between the two uses. The physical, non-mathematical one (i.e., "all of the world pertinent to the discussion") is to be preferred.

The foregoing treatment of the meaning of "all" would be pointless if there were no other evidence bearing on the problem. Fortunately, there *is* other evidence, and the notion of "all of the world pertinent to the discussion" is therefore significant.

The Bible does not provide precise dates for the events in the early chapters of Genesis. Bishop Ussher's famous dates are only *minimum* dates; that is, they represent a summation of the recorded events, and hence the least possible time in which those events could have happened. They do not allow for events which Bible writers thought unimportant or not germane, and therefore may, or may not, be accurate dates. It is interesting to note that Ussher's chronology places the Noachian flood at about 5 x 10^3 years ago, or even further back. Any important flood which occurred appreciably later than about 5 x 10^3 years ago is, apparently, not the flood discussed in Genesis.

One other general fact emerges from the Bible account. Man was, at the time of the flood, practicing agriculture. This development occurred, according to the most reliable archeological estimates, between 7,000 and 9,000 B. C.—that is, 9 to 11 x 10^3 years ago (Braidwood, 1960). The Ussher chronology, plus the limit placed by the advent of agriculture, restrict us to a period between 11 x 10^3 and 5 x 10^3 years ago. Of course these dates are not precise, but they may prove useful.

General information obtained from the Bible story includes the fact of severe, prolonged, wet, stormy weather. This, also, may prove useful.

One important fact is not provided. The Genesis writer states that the flood receded, but we do not know whether or not the water level actually returned to its original position. It is quite possible that, after Noah and his family disembarked, sea level stood higher than it had before. The Bible does not clarify this point.

Recent geological research contributes a considerable body of information to the discussion. Radiocarbon dates from the Gulf of Mexico area (including the Mississippi River delta) show that an extremely rapid rise in sea level began about 12 x 10^3 years ago (Fairbridge, 1960). This rise continued until roughly 9 x 10^3 years ago. During this period, sea level was changed by about 400 feet. The average rate of rise was close to 1.5 inches per year (about 12 feet per century). At the end of this period sea level stood about 50 feet below its present position. The water for the rise was provided by partial melting of the major ice caps and glaciers of the world.

A reversal of the climate trend (back toward more snow and ice) lowered sea level temporarily, until it reached a position approximately 100 feet below the present level, roughly 8 x 10^3 years ago. Between that date and about 6 x 10^3 years ago a warming trend sent sea level up to within 15 or 20 feet of the modern position. This was, likewise, a rapid rise, and an erratic one. The average rate was only about five feet per century, but much of this rise may have been concentrated in relatively short periods of time at rates perhaps as rapid as one or more feet per year. No precise geological figures are available on this point.

At approximately 2 x 10^3 years ago sea level stood at minus five feet. It has risen slowly and somewhat irregularly since then, and apparently is still rising. If estimates of present ice volume are correct, a complete melting would result in a rise to about 300 or 350 feet above the present level. Such a rise, if fairly rapid, could be quite disastrous.

A summary of the geological data shows two rapid rises, separated by a fall of about 50 feet, with the second rapid rise followed by a slow rise up to the present. Of the two rapid rises, the second appears to coincide with the general interval available for the Great Flood, as established by Bible chronology and general archaeology. This agreement between the two lines of evidence may make a solution possible.

Geological Events	Thousands of Yrs. ago	Biblical and Archeological events
Rapid rise begins	12	
	11	)
Rise ends; fall begins	10	) *First agriculture?*
	9	)
Rapid rise begins	8	
	7	
Rise slows down	6	
	5	*Chronology limit?*
Slow rise	4	Abraham
	3	
Slow rise	2	Birth of Christ
	1	
Slow rise; levelling off?	0	

The accompanying table compares the two sequences of events, as obtained from geological evidence, on the one hand, and from archeological and Biblical evidence, on the other. Noah's flood apparently must be fitted between the italicized items. The agreement is excellent, considering the limitations of the method of study.

This preliminary comparison allows examination of a possible geological setting for the Great Flood. Sea level was rising rapidly from about minus 100 feet to about minus 20 feet. The climate was becoming warmer, and the moisture capacity of the atmosphere correspondingly greater. The latter suggests, for non-glacial regions such as Asia Minor, the possibility of more rain, perhaps (temporarily) extended periods of extremely heavy rain. Wet periods, covering very much of the world, coupled with a warming trend, should accelerate glacial melting, and produce short, fairly sharp, rises of sea level.

The pre-flood civilization described in the Bible was probably centered in the valley of the Tigris-Euphrates river system. There the relief of the land is low, largely because much of the area is constructional, built up of river sediment. A low, smooth, nearly flat alluvial plain of this kind is easily covered, to relatively large depths, by a slight rise in water level. A typical alluvial or delta-plain gradient is only one or two inches per mile at the lower end. A water level rise (for example, during a severe storm) of 15 feet would translate the zero contour to a point about 100 miles inland. If the gradient of the plain were much steeper, perhaps as much as four inches per mile, a 15-foot rise would move the shore line about 50 miles inland.

The entire low-land length of the drainage system is only about 400 miles (straight-line measurement; *not* winding river length) at the present time. A disastrous river flood, coupled with a rise and advance of storm-driven sea-water, could inundate the entire valley, sweep everything man-made away, leave nothing (within an area of roughly 10^5 sq. mi.) visible above the water surface, and drown the entire population of the area (with the exception of people who were already on or near well-provisioned boats). Combine this with an extended torrential down-pour, and we have a pretty fair picture of what may have been the flood story.

When the waters receded, the face of the plain would have been unrecognizable, for several reasons: (1) Storm tides, along the Persian Gulf, would have severely eroded the coastal areas; (2) Various rivers, during the high-water stages, would have changed their courses (a well-known geological fact); and (3) Much of the plain would have been plastered with new alluvial deposits, possibly several feet thick. Furthermore, by the time man could re-inhabit the plain, rising sea-level would have buried relatively large areas which previously had been cultivated.

Similar catastrophes must have occurred in the earlier, longer, sea-level rise (from 12 to 10 x 10^3 years ago). Man was not, at that time, a farmer. Since he was more or less nomadic, he would not have been anchored to cultivated fields, probably would not have preferred the deltaic end of the valley, and would not think of the sea level rise as a disaster.

The incident of the birds, and the tree leaves, as recounted in Genesis, is revealing. Burial of leaves under water, for long periods of time, is fatal. The green branch was either a direct miracle, or the bird found it on an unharmed tree growing on adjacent hills, perhaps 100 or more miles away.

We do not know the path taken by the drifting ark. One would infer that it, eventually, drifted sea-ward, rather than upstream against the flood-time river current. Where it finally struck land we do not know. The traditional identification of the spot with a mountain in Turkey does not, at the present moment, seem to have any validity.

A combination of sea-level rise, rapid glacial melting, torrential rains, and widespread floods would affect, primarily, coastal areas and the down-stream ends of river valleys. The entire world would have been so affected. Man probably had not spread over the entire world; the Bible account does not clarify this point, but geological and glaciological evidence do. However, wherever he was, along the waterways and coasts (which provided the only good means of transportation), he must have suffered the same fate.

The hypothesis advanced here distorts neither the geological, nor the Biblical, picture. The result is not a 100% universal flood, with water 30,000 or more feet deep over the modern coasts. The Bible, however, does not require such a flood. Falling back on minimum Bible requirements, we find a reasonable agreement with the best evidence provided by geology. The relatively simple, straight-forward picture which emerges is not miraculous. But it does tend to show that Bible history is completely reliable. That, in itself, is a worth-while result.

References

Braidwood, Robert J., 1960: "The Agricultural Revolution," *Scientific American,* September, pp. 130-148.

Fairbridge, Rhodes W., 1960: "The Changing Level of the Sea," *Scientific American,* May, pp. 70-79.

Biology

Irving W. Knobloch, Ph.D.

The Imperfections of Science

There are two main schools of thought about science —one being that science has limitless possibilities for solving all of our problems and its authority is not to be questioned. The other view, held largely by some clergymen and social scientists, is that science is not the universal panacea claimed for it by its articulate proponents. Warren Weaver is now the Vice-President of the Sloan-Kettering Foundation, a research organization. He deals delightfully with this problem in the March 1961 issue of the American Scientist, the official organ of the Sigma Xi scientific fraternity. I would strongly recommend the reading of this article by our members although it is not necessary that one believe everything that Dr. Weaver says (since science is imperfect, possibly Dr. Weaver's philosophy is also imperfect).

Many scientists believe in satisfying their craving for understanding and they understand things when they have a satisfactory theory for it; a theory, in many cases consisting of a body of mathematical equations. These equations are set up by procedural rules. Another group of scientists (sometimes the same ones) believe that a phenomenon is understod if an analogy can be produced (if you don't understand what genes are, just think of beads on a string). I gather that Dr. Weaver does not believe that either the theory or the analogy method really provides *understanding*. They *deal* with phenomena but do not explain them. Both, however, have value. The ideal theory should have generality (wide coverage), elegance (compactness), control power, and predictive value. Most theories are small and only have control and predictive value. It takes someone on the order of a genius to produce a theory having elegance and generality as well.

The admission that science cannot furnish any ultimate explanation is evidence of the science field's honesty. It places science with o t h e r disciplines in not claiming perfection. Heisenberg's principle of indeterminancy also lends a human aspect to science in that the mechanistic principle of life is largely invalidated. Of course, Weaver is careful to point out that large scale events are deterministic because the probabilities cancel one another out (maple trees always drop their leaves in northern climates in late fall or early winter).

Another imperfection of science has to do with fallacies in the structure of both induction and deduction, the elements of science logic. Neither one can be depended upon to furnish sure or complete answers. We shall not analyze either deduction or induction here, but the reader will find the rather short summary given by Weaver quite satisfactory.

Naturally those Christians who have been unwilling to accept the dogmatic statements of certain rabid scientists regarding the exact origin of the universe and the earth, of the start of life and of the evolution of life, will find a great comfort in this article, as well they might. One must not, however, criticize science for attempting to find out the "answer" in its own ways. Critical observation and controlled experimentation still remain the accepted mode unless we wish to go back to the relatively fruitless speculative methods of the Greeks.

*Some Problems In High School Biology**

R. R. BOWER**

At the start, I would like to point out that the teaching of high school biology can be very rewarding from the Christian view point even though the public law prohibits religious teachings. Although many evangelical church groups have strong feelings against such laws, I see them as worthwhile ones. In the teaching of science it is most important to remember that—"There is no place in science for beliefs not supported by facts" and that "scientific principles are accepted only if they check with all the known facts." These two sentences appear in the first chapter of the high school biology text[1] I have instructed from for four years. They certainly provide the framework for evaluating many phases of biology besides the evolutionary hypothesis. The text operates within this framework in showing the falsity of the theory of spontaneous generation and in showing that the earth is much older than the few thousands of years as indicated by Bishop Ussher.

The majority of the students in tenth grade biology know very little concerning evolution, but they feel that science verifies the belief that we came from monkeys—even though they feel opposition to the idea. I have had many students who expressed a disbelief in the theory of evolution, but when we began discussing some of the proposed evidences they would bring up some of their former teachings that they thought supported it. This is particularly true in the discussion of embryology and vestigial organs. This view point of the students comes chiefly from their previous teachers rather than from the texts. In my six years of teaching science, I have yet to meet a teacher of science that actively opposes the theory of evolution in the high school, although I have personal acquaintance with five teachers from my own school who support it actively.

In addition to previous instruction favoring the evolutionary hypothesis, a number of students with religious instruction also come with ideas that "are not supported by facts." They have been taught Bishop Ussher's dating for man, that "after his kind" referred to species, that species hybrids can never reproduce, that most of the fossil finds for man are fakes, etc. Here I have the opportunity to point out that it is just as wrong not to accept information that apparently does check with the facts as it is to accept beliefs that are not supported by facts.

High school texts attempt to show that "according to the theory of evolution, fishes evolved from some primitive lancelot-like organisms which appeared some 425 million years ago; amphibians evolved from fishes, reptiles from amphibians, and birds and mammals from reptiles. In other words, according to the theory of evolution, all vertebrates evolved directly or indirectly from fishes."[2] Proofs of this theory are then discussed in the fields of comparative anatomy, embryology, vestigial organs, fossils, and from X-rayed organisms.

The 'evidence from comparative anatomy' is easily set aside as no evidence at all. It is used by the evolutionary group to show kinship and it is used by those who believe in the God Creator as evidence of His general plan for animals living under similar conditions.

In the study of embryology we bring in more facts to show that only a very few of the characters recapitulate, while the many missing and the conflicting ones are not discussed in the texts. We also note that the embryological recapitulation is not even considered by botanists for the plant kingdom.

The third field of 'evidence' from vestigial organs is especially interesting. This part ties in nicely with the section on genetics that we have already covered. The texts ably show that the various organs are controlled by genes. Now under this section the f a c t s are disregarded and these vestigial organs are made a product of use-and-disuse. Then in the following chapter we find statements such as this: "The use-and-disuse theory would be a lovely theory if it were true." and "So the use-and-disuse theory must be considered false."[3]

In the presentation of the material concerning fossils and X-rayed organisms the texts pay close attention to the factual record, but they tend to make sweeping assumptions. The pedigrees of the horse, the camel, and man are given to show the changes that have taken place. Then the assumption is presented that these animals all have had a common ancestor. By further investigation into the fossil record we find that the above mentioned animals have certainly changed, but within rather well defined limits. In man, even the ten million year fossils of Oreopithecus are described as human and not ape-like. One of the most significant things to point out to the students is—and the texts show this—that ten of the eleven major groups (phyla) of animals all leave fossil remains in the first layer of rocks that contains undisputed animal fossils.

The 'evidence from X-rayed organisms' again contains things that we can actually examine from our text and previous studies. We have learned that mutated genes do cause changes in the organisms and that a few may be beneficial under differing environments. Although these mutations may be beneficial, they still leave us with the same animal—just one that is a bit better adjusted for its environment. The evidence from these X-rayed organisms do not give support to the ideas as presented in the theory of evolution.

*Paper presented at the Fifteenth Annual Convention of the American Scientific Affiliation held at Seattle, Washington, August, 1960.

**Mr. Bower is a Science Instructor at Beaverton (Oregon) High School.

In summary of the text's so-called evidences, we find that three of them do not fit in the category of science as defined by the text in "sticking to the facts and all the facts." The real evidence from fossils and mutations certainly shows that the plants and animals have inherent ability to change—but within limits. So the students begin to see that the *facts* of evolution are entirely different from the *assumptions* of evolution.

Most of the high school texts have a section on the possible methods of animal evolvings following the section concerning evolution. The three theories presented are those of Lamarck—use and disuse, Darwin—survival of the fittest, and De Vries—mutations. Usually just a few paragraphs are devoted to the theories of Lamarck and De Vries and many pages to Darwin and his exploits on his trip around the world. Although the texts usually do indicate that each of these three theories is insufficient to explain the vast diversity of life we see today, they are not clearly explained so that the students can get the proper evaluation of these theories. The concluding paragraph is one from an older high school text that does give the proper evaluation and I capitalize upon this one.

"Thus each of the three major theories, which science has developed to answer the question of how we came to be as we are, seems to be inadequate in certain respects. The theory of natural selection seems not to account satisfactorily for origins or beginnings. The theory of inheritance of acquired characters appears to have little or no experimental evidence to support it. The theory of mutations usually seems not to carry development in the proper direction, that is, toward more desirable adaptions . . . . Biologists are still on the watch for an adequate theory. They are still looking for an unknown factor."[4]

References

1. Smith, Ella Thea, *Exploring Biology,* 3rd edition, pages 6 & 7, Harcourt, Brace and Company, 1952.
2. Smith, Ella Thea, *Exploring Biology,* 4th edition, page 465, Harcourt, Brace and Company, 1954.
3. *Ibid.,* p. 473.
4. Bayles & Burnett, *Biology For Better Living,* page 608, Silver Burdett Company, 1944.

Sociology

R. Heddendorf, M.A.

Problem Areas of Sociology: Sociology of Education and Sociology of Science

Part III

Sociology of Education

There are probably fewer areas in our present society which could profit more from the findings of sociology than the field of education. The problems of teaching remain the problem of the educator. This condition seems most unfortunate, since close cooperation between educator and sociologist would undoubtedly reap great benefits for both.

It is true that sociologists have been loath to enter the field until recently. There seem to have been two main reasons for this trend of the past. First, educators, being quite ubiquitous in their research, have tended to deal with problems of social relationships by themselves. Resulting studies have been largely framed in educational terms. The lack of mutual communication and respect which prevailed discouraged sociologists from entering the field.

Secondly, the field has been considered by the sociologist to be relatively sterile for research purposes. It has been only recently that the problems of academic groups have been seen as not being unique. Hence, the school and classroom are now viewed as typical social systems with the inherent characteristics of such a system. It is significant to note that although Waller presented such a view in his pioneering work *Sociology of Teaching* in 1932, there has been very little building upon his foundation. This is most unfortunate in view of the great increase in conceptual tools which has been made since then.

Perhaps the fact that an educational system has not been viewed as a producing unit requiring efficiency of performance has been a factor in the slow growth of the sociology of education. It was precisely this view of the industrial system as a producing unit which provided the major breakthrough of interest in industrial sociology. The recent stress on superior educational performance has brought into more clear focus the potentially motivating framework of an educational system.

Studies in industrial sociology have shown the precarious equilibrium which is inherent in a social system. It is quite likely that the stresses and strains existing in industrial systems would also be found in educational systems, since there exist in both, similar organizational structures based on size and complexity. The balance of structural elements is particularly difficult to maintain in the dynamic conditions in which our schools find themselves. Unlike industrial systems, top echelons are comprised of laymen who meet in local boards. The fact that these local board members are neither professional nor full-time personnel often makes more difficult the necessary adjustment.

A number of other basic problems present themselves within the structure of the school. How does the nonvoluntary nature of the student's role affect the social system? What are the bases for a well balanced student-teacher relationship? Since change is such a dynamic factor in present systems, what are its effects on such structural aspects as classroom size? What are the norms governing the school, particularly in consideration of the increasing importance of the power influence of education? Stress on such questions concerning the internal structure of schools is needed to balance the earlier emphasis on school-community relations.

At present, our philosophies of education have been dominated by two basic views. One is the traditionalist, relying upon an authoritarian structure. The other is the modern pragmatist, depending on what is considered to be a democratic structure. It could be legitimately asked whether either view is consistent with what our educational system is or should be. It is believed that educational sociology would illuminate a middle of the road approach.

Sociology of Science

This is a field which is unique in the respect that although it had an early beginning, it has had little growth since. Even when conceptualized as part of the broader field of the sociology of knowledge, there seem to have been few significant developments within the last 30 years, though interest has increased.

There have been three primary frames of reference for work in this area. First, there has been an attempt to develop a history of science and knowledge in general. However, such studies have proceeded with the historical point of view principally as a means and not as an end. Hence, historical analysis has become the means of research for the sociology of science. The second conceptual view of science has tried to discover relationships between science and other cultural views of that society.

Weber and Marx were early proponents of such studies, indicating the relationships which existed among science, economy, and religion. Merton later developed these ideas and showed how science was molded by the religious and economic milieu of seventeenth-century England.[1] Perhaps the man who provided the most theoretical insight into the problems of the field was Karl Mannheim. He showed that many kinds of ideas are related to the structure and goals of the groups in which they were created and maintained.[2] Hence, the image of the world which is held by a society will depend upon its cultural background.

The cycle is completed in the third main conceptual view of science. Two leading proponents of this view are Ogburn[3] and Sorokin,[4] who stress the effect that the social environment has on the development of technology in a society. In these modern statements, the individual scientist's part in molding the future of his discipline is minimized and a cultural determinism of science is developed. More recent developments, however, would seem to indicate that this strong cultural and technological determinism is being tempered by a clearer understanding of the scientist's role. Perhaps the convergence of extreme views into a more harmonious synthesis is a clear indication of developing maturity.

Nevertheless, further growth is limited by several factors. Despite solid foundations, modern sociological theory does not lend itself as well to studies in science as it does in other areas. The natural consequence is the lack of developing modern research methods to deal with these problems. Although methods of research other than historical analysis are developing, they are not in the mainstream of methodology. Another great lack is the necessary personnel sufficiently sophisticated in natural science and sociology to deal with more complex problems. Undoubtedly this problem will be adequately solved only when that scientific utopia is achieved—a convergence of social and natural science.

[1]Robert K. Merton, "Science, Technology and Society in Seventeenth-Century England," *Osiris,* 4:2, Bruges, Belgium, 1938

[2]Karl Mannheim, *Ideology and Utopia: An Introduction to the Sociology of Knowledge,* Harcourt, Brace, 1936

[3]W. F. Ogburn, *The Social Effects of Aviation,* Houghton Mifflin, 1946

[4]P. A. Sorokin, *Social and Cultural Dynamics,* 4 vols., American Book, 1937, 1941

Psychology

Stanley E. Lindquist, Ph.D.

Multiple Impact Therapy

It was my privilege to stop at the University of Texas Medical Center in Galveston on the way to Europe for a year's sabbatical leave. In the Youth Development Project, a device of psychotherapy called "Multiple-Impact Therapy" is being used. As further information about it was needed, a special visit was scheduled.

Dr. Robert MacGregor, Research Director, and Mrs. Agnes Ritchie, Psychiatric Social Worker, were kind enough to brief me on the process, and to play some tapes of actual interviews. Dr. Alberto Serrano, the psychiatrist, was also present at many of the discussions, and provided opportunity to sit in on an intake interview.

The method in brief, is a short-term treatment procedure. The entire family is brought to the Center. They are interviewed about two days only following this plan:

1. Total family meets together with an equal number of therapists. In this session, attempts are made to create further tension and desire to alleviate the problem. When this tension has reached almost explosive dimensions sometimes, members of the family are separated for the next period.

2. Each member goes into an individual session with a separate therapist to release tensions and talk out the problem.

3. Some individual sessions are longer than others, and as a result, one therapist may come to another session not finished. He is briefed on what has gone on by the continuing therapist, and tells what he has learned from his interview. This breaks down what is called "privileged communication"—(the holding of information told to a therapist in strict confidence). The reason given for violating this cardinal rule of therapy is that as the session is very short, they must impress upon all that honesty is a necessity, and that all information given will be checked by others in the family, so they might as well be truthful to begin with.

4. At lunch, members of the team confer with each other, to find discrepancies or air general impressions.

5. After lunch, the problem adolescent is usually given psychological tests, while the other members continue the "cross-ventilation interviews" described above, with different therapists. In these sessions directive suggestions are often made, capitalizing on positive forces noted in the previous sessions.

6. The following day is similar to the first day.

7. A final conference, with all present, attempts to bring to a head all problems noted, and provides some suggestions for procedure when the family gets home.

This is not intended to be a thorough discussion of procedures, but only a survey. For those interested in further information, see the bibliography for a more complete presentation.

Many concepts in this approach are of interest. One question raised was that there no doubt was plenty of tension already present in the family, and no more need be engendered. The r e p l y to this was that for such short-time treatment, the more tension the better. This no doubt has merit.

Another objection raised was the violation of privileged communication which could create suspicion of the therapists. They felt this didn't happen, and was a very important part of the whole process.

The multiplicity of therapists in the group session tends to overpower the clients in my own experience. There was no good explanation as to how this was handled. The taped interview gave some evidence of the above problem occurring.

Another factor, the reviewing of the material that has gone on in therapy for the n e w l y arrived therapist, seems to rob time which might be better spent in therapy itself.

In the lunch sessions, a neutral moderator who has not been in the session presides. In practice, this session becomes in effect, group therapy (much needed in this concentrated approach!). This allows the individual to become more objective about his ideas, and as such is a very helpful procedure.

This method is still new. As such, its effectiveness cannot be reliably ascertained. However, follow-up studies show improvement "as good as in regular therapy approaches." As such it certainly merits further study and practice.

Bibliography

1. Ritchie, Agnes. "Multiple Impact Therapy: An Experiment," *J. Soc. Wk.*, pp. 16-21, July, 1960.
2. Schuster, F. P. "Summary Description of Multiple Impact Therapy," *Texas Reports on Biology and Medicine*, v. 17, No. 3, pp. 426-430, Fall, 1959.
3. Further information may be had by writing to: Dr. Robert MacGregor, Research Director, Youth Development Project, Medical Branch, University of Texas, Galveston, Texas.

BOOK REVIEWS

The Unleashing of Evolutionary Thought, Oscar Riddle. New York, Vantage Press Inc., 1954.

Reviewed by I. W. Knobloch

This is an ambitious book of 414 pages and is frankly a rather violent attack upon religion. It has been praised by many irreligious people and condemned by those of the opposite persuasion. Riddle's four conclusions (on page 388) may be paraphrased as follows:

1. The attitude of organized religion toward evolutionary thought constitutes a dangerous cultural impasse.
2. Science has now advanced far enough to make any imaginable view of the supernatural unacceptable to a high proportion of the best-informed minds.
3. Organized religion consumes and hoards much wealth, enlists and misdirects much human effort, represses thought, freedom and progress, points men to unreal goals and socially ruinous hopes.
4. Human for supernatural purposes must be now substituted and this remains the big task of science.

Religion has, of course, tended to stifle evolutionary thought in the past. At present, however, there are some who admit the truth of evolution and are able to reconcile it with the articles contained in the Apostle's Creed. Others recognize that organic evolution and speciation are not synonymous; that the former is forever destined to remain a theory and the latter is a proven fact. Modern religionists do not read deviltry into scientific research. It is questionable if the "best-informed" minds have, by scientific experiment, ruled out all possibility of the supernatural. It is an axiom of science research that more mysteries are unfolded by it than are solved and that the universe grows more marvelous and intricate with each passing decade. It seems almost impossible for a scientist not to believe nowadays in some supreme intelligence. Parts of Riddle's third charge are true. Some of them are only half-truths, and others are open to serious question. Making the world a better place to live in is a worthwhile goal, but the entire world is somewhat empty and without meaning if there is not some higher goal than this.

We do not know what background Dr. Riddle had or what caused him to launch such a vitriolic attack on religion. We do know that men of 78 (in 1954) tend to be overly dogmatic at a time when they should be starting to understand things.

NEW MEMBERS

William D. Beaney, 172 N. Main Avenue, Burbonnais, Illinois, is an instructor at Olivet Nazarene College. He holds the B.S. and M.S. degrees from Brockport State Teachers College in Science Education. He also attended Pennsylvania State University where he majored in Botany.

Jean Dunn of 404 N. W. Twelfth, Pendleton, Oregon, is a psychologist at Eastern Oregon State Hospital, Pendleton, Oregon. She attended the University of Michigan from which she received the A.B. degree with a major in Psychology and a minor in Sociology. She also attended the University of Oregon where again her major and minor were Psychology and Sociology.

Leif E. Evans, retired pastor of the American Lutheran Church, Des Moines, Iowa, attended Luther College, Decorah, Iowa, where he received the B.A. degree, as well as Luther Theological Seminary, St. Paul, Minnesota, where he received the C.T. degree. His present address is 3500 Shawnee Place, Des Moines, Iowa.

Robert A. Hirschy is at the present time a graduate teaching assistant in the Department of Bacteriology at the University of Wisconsin. He received the B.S. degree from Wheaton College in June 1961. His address is 20 S. Orchard Street, Madison 5, Wisconsin.

Adrian C. Kanaar of 3881 Bailey, Buffalo 26, New York, is Chief Psychiatrist at Meyer Memorial Hospital, Buffalo 15, New York. He received the following degrees: M.R.C.S. from Dulwich College, London, England, M.B.B.S. from the University of London, F.R.C.S. (E) from the Royal College of Surgeons of Edinburgh, and the F.R.C.S. (C) from the Royal College of Surgeons of Canada.

Robert W. Laird, 616 Barkley Drive, Fairfax, Virginia, is an Engineering Supervisor for Atlantic Research Corporation, Alexandria, Virginia. He holds the B.Ch.E. degree from the University of Delaware.

Jakkanahally M. Ramaradhya of 305 Murray Drive, Trail, B.C., Canada, is a Research Officer for Consolidated Mining & Smelting Co. of Canada. He has received the B.Sc. degree from Mysore University (India) in Chemistry and Physics, the M.Sc. degree from the same university in Physics, the Ph.D. from McGill University in Surface Chemistry, and also another Ph.D. degree from the University of Alberta in Radiation Chemistry.

Pierce D. Samuels is a Foreign Missionary employed by the Board of Missions, Evangelical Congregational Church. He received the A.B. degree in Zoology from Houghton College, the M.D. degree from Jefferson Medical College of Philadelphia. He also received the "D.T.M. & H." degree from London University—School of Tropical Medicine and Hygiene—in 1956. His current address: c/o Otto Nemitz, Chittenango, RD 2, New York.

Paul H. Scherer of 235 Whitmoor Terrace, Silver Spring, Maryland, is an Electronic Engineer with USI Western Design and Electronics, Division of United State Industries. He holds the B.S.E.E. degree from Purdue University with a major in Electrical Engineering and a minor in Mathematics, the M.S.E.E. from the same university.

J. Whitney Shea, 20 Campus Heights, Houghton, New York, is a professor of Economics and Sociology at Houghton College. He received the B.A. degree from Houghton College in Economics, the M.A. degree from Columbia University in Sociology, and the Ed.D. degree from the same university in 1952.

Norman R. Smith is a Technical Brand Manager for the Proctor & Gamble Co., Cincinnati 17, Ohio. He attended the University of Michigan from which he received the B.S. degree in Chemistry. He also attended Salmon P. Chase College where he will receive the L.I.B. degree in June 1962. His present address is 3301 Monteith, Cincinnati 17, Ohio.

Ronald B. Stuckey of 2610 William Street, Newfane, New York, is a Teaching Fellow in the Department of Sociology at the University of Buffalo. He received the B.A. degree in Sociology from Houghton College in June 1961 and will presently be working in the area of Epidemiology at the University of Buffalo.

Donald F. Tweedie, Jr., Box E, Beverley Farms, Massachusetts, is a professor of Psychology at Gordon College. He holds the A.B. degree in Philosophy from the University of Maine, and the Ph.D. degree in Psychology and Philosophy from Boston University.

William H. Vanden Born of 12287-129 A Street, Edmonton, Alberta, Canada, is an assistant professor of Crop Ecology in the Department of Plant Science at the University of Alberta. He received both the B.S. and M.S. degrees in Plant Science from the University of Alberta. In June 1961 he received the Ph.D. degree in Plant Physiology from the University of Toronto.

Richard T. Wright, 224 E. Park Avenue, Haddonfield, New Jersey, received the A.B. degree from Rutgers College of South Jersey in Natural Science and the A.M. degree in Biology from Harvard University. At the present time he is a graduate student at Harvard University.

NEW ASSOCIATE MEMBERS

Dwight E. Ericsson of 2599 N. Lexington Ave., No. 513, St. Paul 13, Minnesota, is an instructor in New Testament at Bethel Theological Seminary. He received the A.A. degree from Bethel College, the B.A. degree in Elementary Education and Social Studies from San Diego State College, the B.D. degree from Bethel Theological Seminary, and the Ph.D. degree in New Testament from the University of Chicago.

Howard A. Hanke, 521 N. Lexington Avenue, Wilmore, Kentucky, is a professor of Bible at Asbury College. He holds the B.A. degree in Sociology from Asbury College, the B.D. degree in Old Testament from Perkins School of Theology, and the Th.D. degree in Old Testament from Iliff School of Theology.

Paul A. Jones of 3319-Sherwood Avenue, Columbus, Georgia, is a meter reader for the Gas Light Company of Columbus.

Thomas C. Larter is a Senior Member of the Technical Staff at Space Electronics Corporation. He holds the B.S.E.E. degree from the University of California and the M.S.E.E. degree from the University of Southern California. His current address is 341 N. Geneva Street, Glendale 6, California.

J. Morris Rockness is an Associate Home Director for the China Inland Mission. His address is 302 W. School Lane, Philadelphia 44, Pennsylvania. He received a diploma from Prairie Bible Institute in 1936 and the B.A. degree from the University of Washington in 1946 where his major was Far East Greek.