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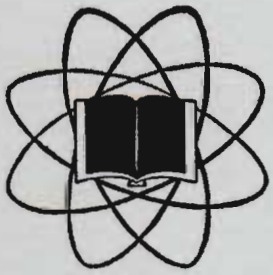

The fear of the Lord is the beginning of wisdom. Psalm 111:10.

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*Neutron-Induced Variation of Roses**

WALTER E. LAMMERTS**

INTRODUCTION

Curiosity over the origin of a naturally occurring albino bud sport on a plant of Audie Murphy, on the part of my physicist friends, Philip Livdahl and Harlan Zodtner, led to the consideration of experiments to induce mutation. Since studies on the effect of gamma radiation were already underway at Brookhaven, neutron radiation was an obvious line of attack. The following experiments, begun in the fall of 1957 and continuing until 1959, have given such unusual results as to be worth reporting.

Materials and Methods

Rosebuds of the vigorous Grandiflora rose, Queen Elizabeth, a red Hybrid Tea H56024/39, and Rosa *multiflora* were cut from bud sticks and placed on wet filter paper, 50 in each petri dish. Except for a control group of about 100 buds left on bud sticks in Experiment 1, this method of exposing buds was used throughout. The following five experiments were performed:

1. In the fall of 1957, Philip Livdahl, then at Lawrence Radiation Laboratory in Livermore, California (now at Argonne Laboratory near Chicago), used the A-48 linear accelerator bombarding a copper target with 7.5 Mev deuterons. The approximate radiation intensity at the main axis of the beam was estimated to be about 400 rad, with neutrons emitted at a wide angle. Two petri dishes, each with 50 Queen Elizabeth buds were placed one immediately behind the other. A small bundle of bud sticks having about 100 buds of Queen Elizabeth was placed as near as possible to these petri dishes as a control, to study possible shielding action of bud stick tissue. All the exposed buds and 50 control unexposed buds were budded into R. *multiflora* understock the same afternoon immediately following exposure.

2. On March 14, 1958, 50 buds of Golden Rapture #5 were exposed to thermal neutrons from a "water boiler" reactor receiving approximate 1000 rad and budded into R. *multiflora* understock in the greenhouse.

3. On March 18, 1958, four petri dishes, each with 25 buds of Golden Rapture #5 were exposed to 400, 600, 1500, and 3000 rads respectively of 14 Mev neutrons from a Cockcroft-Walton accelerator. These were neutrons resulting from deuterons accelerated to 500 kev bombarding a tritium target. The buds were immediately budded into R. *multiflora* understock in 4" pots in the greenhouse.

4. On April 23, 1959, 50 buds of a red Hybrid Tea H55024/39 were placed 11 centimeters from the target of a Van de Graaff accelerator and exposed to about 90 rads of 15 Mev neutrons obtained by the accelerated deuterons impinging on a tritium target. Similarly 4 other petri dishes of 50 Queen Elizabeth buds each, were exposed to 90 and 120 rads, and 2 at 180 rads. As a check to test the effect of placing one petri dish behind the other, an upper dish at 9 centimeters away was exposed to 120 rad. All were budded in R. *multiflora* understock soon after exposure; i.e., the same afternoon.

5. Finally on July 9, 1959, 3 petri dishes (150 buds) of H56024/39, 1 petri dish (50 buds) of Queen Elizabeth, and 50 buds of the single 5-petaled white R. *multiflora* understock were exposed at 9½ cm from the target to 15 Mev neutron radiation obtained by using a Van de Graaff accelerator. As a check on the "protective effect" of petri dishes a "triple piggy back" group of 3 petri dishes, each with 50 buds of Queen Elizabeth, were placed one above the other so that the dish closest to the target (8 cm) received 500 rad of neutron radiation. These were all budded into R. *multiflora* understock the same afternoon following radiation exposure. The R. *multiflora,* single petri dish of Queen Elizabeth, and all 3 of the H56024/39 petri dishes at 9½ cm received about 350 rad of neutron radiation. The third petri dish of the "triple piggy back" group received about 280 rad. One of the H56024/39 dishes was removed after 180 rad of neutron radiation.

Results

Before giving results it should be explained that Queen Elizabeth is a hybrid of the Hybrid Tea rose, Charlotte Armstrong x Floradora, a Florabunda.

Experiment 1—The most striking result of this experiment was the almost complete lack of mutations or even bud retardation from buds left on bud sticks when exposed. By comparison the 50 buds in the petri dish nearest the target were *all* retarded and slow to start and very deformed as to foliage and leaf appearance. Gradually many of them became more normal by growth from buds on deformed stems, but even these shoots were abnormal, having "strap" leaves and segments of heavily pigmented tissue. Finally by the spring of 1958, most of the plants had normal shoots which "took over" the growth. The original deformed branches continued to grow, and buds taken from them showed a wide range of variation. About 20 of the plants, however, remained completely changed, both as to color, form, number of flower petals, and appearance of plant and leaves. A thick large rugose leaf type was obtained so unlike

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Queen Elizabeth that one would never suspect its relationship by induced mutation. Equally unusual was a very narrow strap leaf type, having thin long, pointed buds. Several had flowers about the size of Floradora with 50-60 petals as compared to 20-25 in Queen Elizabeth and were light scarlet in color. All were *weaker* in growth than Queen Elizabeth and one was so similar, except for its dwarf habit, as to be of possible commercial value, since some gardeners object to the remarkably vigorous growth of Queen Elizabeth.

Even more interesting was the unusual fact that plants from buds in the petri dish above the one next to the target were normal, except for one possible color variation to light scarlet. The buds were but little retarded, as compared to the control buds not exposed to any radiation.

Experiment 2 may briefly be stated as negative, in that no mutations were observed following exposure to thermal neutron radiation.

Experiment 3 was discouraging in that the two most desired mutations, i.e., increased petal number and darker yellow color, were not obtained. Occasional changes, such as reduction of petal number to 5-6 from the usual 20-25 (2 plants), and one plant with slightly narrower leaves were observed in those radiated at 3000 rad. These changes are valueless commercially. Evidently the genetic variability potential of Golden Rapture #5 was not great. Possibly this may be due to the fact that it carries at least 2 factors for pale yellow (YY). Hence, though genetically carrying recessive factors for deep yellow (yy), both dominant factors would have to be inactivated to allow expression of recessive deep yellow as hoped for.

Experiment 4—As the buds of those exposed to lower dosages of the high energy neutron radiation of this experiment began growing, it seemed at first that, even at this low level, we had variability comparable to that of Experiment 1. The following is a summary of observations made June 9, 1959, followed by summary of final results, as of August 18, 1960.

1. H56024/39—20-25 petaled, rose-red hybrid were radiated at 89 rad. 15 plants were normal in height, i.e., 16"-20". 7 were 6"-8", 5 were 2"-4", and 8 buds were just starting. Some were of normal height with lighter anthocyanin pigmentation. One plant has flowers with only 7 petals.

8/18/60. 34 surviving plants. One very weak plant died after transplanting. Final results were: 1 plant has 8-10 petals and 2-3 petaloids, and 1 plant is very slender and weak and 12" high compared to normal pf 26"-30".

2. Queen Elizabeth—89 rads exposure. Nine were normal 16"-20", 13 were 6"-8", 20 were 1"-4", 3 buds were just starting, 2 were dormant, and 3 were dead. Some normal plants were darker in anthocyanin pigmentation and all showed malformation areas.

8/18/60. 22 surviving plants. All were normal Queen Elizabeth plants both as to flower and plant habit.

3. Queen Elizabeth—178 rads exposure. Ten normal plants were 16"-20", 20 were 6"-8", 16 were 1"-4", 3 buds were just starting, 1 was dormant, and 2 buds were dead. Much greater deformity was present, even in those plants normal in height, than among the group receiving only 90 rads. One plant was almost black with anthocyanin. About a dozen were sectoral chimaeras for 50-60 petals; several of these also were light scarlet.

8/18/60. 28 surviving plants. Six were much weaker than normal, of which 2 had abnormally small leaves and flowers.

4. Queen Elizabeth—178 rads exposure. Four were normal 16"-20", 22 were 6"-8", 19 were 1"-4" high, 3 were dormant, and 4 buds were dead. Like #3, all plants were much deformed, even those normal in height.

8/18/60. 24 surviving plants. Four were much weaker than normal.

5. Queen Elizabeth—118 rads exposure. Four were normal 16"-20", 18 were 6"-8", 18 were 1"-4", 4 buds were just starting, 4 were dormant, and 1 was dead. Much deformity was present in all, seemingly more than in #3 or #4. Some small plants with leaves were not at all like Queen Elizabeth.

8/18/60. 34 surviving plants. All quite normal in appearance.

6. Queen Elizabeth—177 rads exposure. The bottom petri dish was nearest target at 9 centimeters. These generally were more affected than any. None were normal in height: 15 were 6"-8" high, 24 were 1"-4", 3 were just starting, 3 were dormant, and 2 were dead. Many, as they developed, showed sectoral chimaeras for increased petal number, light scarlet, and small-sized flower.

8/18/60. 37 surviving plants. All were quite normal in appearance.

7. Queen Elizabeth—118 rads exposure. Upper dish, 11 centimeters from target, was protected by first petri dish. Eight were normal height 16"-20", 26 were 6"-8", 9 were 1"-4", and 7 were dormant buds. Relatively little deformity noted on 4-5 plants affected at all.

8/18/60. 33 surviving plants. One plant had most of its leaves smaller and yellowish green. Flowers definitely were more scarlet. A normal shoot is now growing vigorously from the base. One plant had a thicker, leathery, dark green foliage and a light scarlet flower. Two very weak plants had narrow, dark green foliage. Three plants had sectoral chimaeras, i.e., stems having flowers much more scarlet than typical of Queen Elizabeth; one of these had over 60 petals, beautifully imbricated. All three stems were weaker than the rest of the plant.

At low-dosage rates evidently only a small percentage of cells in each bud mutates. As the plants continue to grow, normal shoots "take over" and except as noted the final result was a normal Queen Elizabeth plant.

Generally then the many changes were transitory, i.e., chimaeral. However, by budding from these, some were stabilized and may have horticultural value, even though they are not as vigorous as Queen Elizabeth.

Experiment 5, which was started on July 9, 1959, was comparable to Experiment 4, as regards Queen Elizabeth and H56024/39. In addition, 50 buds of R. *multiflora* were exposed to 356 rads of neutrons. Since the results are rather similar, they may briefly be summarized as follows:

1. Queen Elizabeth—50 buds in petri dish 8 cm from target receiving 502 rads of neutrons. Only 4 plants survived which are now quite normal. Ten of the exposed buds started and the plants at first were very delicate and prostrate. But buds from these more normal and finally basal shoots were completely normal. The original prostrate shoots are being budded to study variability.

2. Queen Elizabeth—50 buds in petri dish 9.5 cm from target, i.e., just above #1 and receiving 356 rads of neutron radiation. 41 plants survived of which 5 remained much weaker than normal. One originally prostrate plant now has normal basal shoot. There were many sectoral chimaeras for such qualities as:

(a) Scarlet.
(b) Small flowers similar to Floradora, having many petals.
(c) Flowers the size of Queen Elizabeth with many petals.

3. Queen Elizabeth—50 buds in petri dish 11 cm from target, i.e., above #3 and receiving 265 rads of neutron radiation. 42 plants survived, one with chlorotic leaves and 7 weak plants. Relatively few sectoral chimaeras appeared compared to #2.

Samples 4, 5, and 6 each had 50 buds of H56024/39 and received 356 rads of neutron radiation. Sample #7, also H56024/39 received only 178 rads. There were 49, 50, 46, and 43 surviving plants, all discouragingly normal in appearance. Occasionally flowers with only 10-12 petals were found, but unlike Queen Elizabeth radiated buds, no flowers with increased petal number were found.

The last experiment—petri dish #8—was 9.5 cm from the target and received 356 rads of neutron radiation. It contained 50 buds of a basic species, R. *multiflora*, having small white flowers and only 5 petals.

Evidently this species was highly resistant to change as there were no variations in flower color, petal number, or size. Of the 47 surviving plants, 6 are very definitely much weaker than normal and one of these is very weak. These plants will be budded to see if this reduced vigor is a stable condition.

Discussion

Quite evidently by neutron radiation of buds at about 4000 rad we can tremendously increase the rate of mutation almost to the 100 per cent level in terms of mutation per bud radiated, since all buds showed at least sectoral chimaeras for changed tissue.

Horticulturally, the results were encouraging in that we did get several selection with increased petal number, having good bud form and a pleasing change to a light scarlet or what is popularly known as "coral pink" color. Also a dwarf type identical to Queen Elizabeth in bud, open flower form, and color was obtained which may have commercial value in that some gardeners object to the extremely vigorous growth of Queen Elizabeth (to 8 feet high in California gardens). This "buds true" in tests so far made.

Horticulturally, the results were discouraging in that we did not get color variations at least theoretically possible genetically. Thus, though we did get a white variation, the leaves were adversely affected, being semi-chlorotic, i.e., yellowish green in appearance. Possibly bud selection may segregate the color change from the leaf change should the cell tissue still be variable. Perhaps the situation may best be stated by listing the variations we did *not* get as follows:

1. Change to dominant R[1] or crimson red color from the recessive r or light scarlet range.

2. Change to dominant S or dark scarlet such as is characteristic of Floradora. Evidently all variations were to the recessive s or salmon to coral pink (light scarlet of British Horticultural Color Chart).

3. Change to the large-flower and large petal characteristics of Charlotte Armstrong. All the variations had petals either slightly smaller to much smaller than Queen Elizabeth.

4. Change to the long bud characteristic of Charlotte Armstrong.[2] Long bud is dominant to short bud due to a series of dominant or semi-dominant factors.

5. Change to climbing type or more vigorous pillar type.

6. Changes to long cutting stem with flowers occurring singly as in Hybrid Teas. All changes were toward cluster behavior of Floradora, the Floribunda parent.

7. Increase in leaf size. Queen Elizabeth has a large-sized leaflet fully as large as Charlotte Armstrong. Most variations, even the large rugose one, were toward smaller-sized leaflets.

Quite evidently most mutations were toward the recessive type as exemplified by:

1. Decrease in size of flower coincident with increase in petal number, i.e., resulting in many smaller petals.

2. Change to the recessive s or salmon (light scarlet appearance). These mutations were very frequent, i.e., in ratio of about 100 to 1 for change to white.

It would seem that the dominant M factor[3] was frequently inactivated, thus allowing the recessive s factor to show, or simultaneously the dominant S factor was also changed to s.

Compared to Queen Elizabeth, Golden Rapture is much more difficult to affect by radiation. Genetics tests show definitely that it carries recessive factors (yy) for dark yellow, a much desired color. Accordingly it was hoped that neutron radiation would result in mutation to dark yellow. However, quite evidently, much higher dosage rates must be used and probably more buds radiated in order to inactivate both of the dominant YY factors present. Contrariwise, Queen Elizabeth has only one dominant M factor which was relatively easy to inactivate, as judged by the frequency of sectoral chimaeras for light scarlet.

Both the red H56024/39 and Golden Rapture are of Hybrid Tea ancestry. Unlike Queen Elizabeth they are not Fl hybrids between a many-petaled, small-flowered Floribunda and a large flowered Hybrid Tea. Accordingly they do not carry factors for many petals. Hence their variability potential in this respect is low. We know that the single, 5-petal con-

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1. Mehlquist, G. A. L., "Inheritance in the Carnation, Dianthus Caryophyllus—1. Inheritance of Flower Color," *Proc. Amer. Soc. Horticultural Science, 37*: 1019-1021 (1940).

2. Lammerts, Walter E., "The Scientific Basis of Rose Breeding," *American Rose Annual*, 1945, pp. 71-79.

3. Lammerts, Walter E., "Inheritance of Magenta Red Color in Roses," *American Rose Annual*, 1960, pp. 119-125.

dition is recessive. As noted above, both H56024/39 and Golden Rapture mutations to 5 petals were found, as well as intermediate conditions. Mutations increasing the number of dominant factors for increased petalage simply did not occur.

Finally the stability of the R. *multiflora* species is highly significant. Again mutations to the dominant, many-petaled condition simply do not occur. Likewise mutations to the A factor, basic to pigment formation, the dominant R factor for crimson red, or the S factor for dark scarlet did not occur. Again it is significant that there were no variations to increased flower size. R. *multiflora* is a *semi-trailing,* climbing type of plant. Though the sample is small, it is also significant that no mutations to upright bush type of growth, or recurrent flowering occurred. The conclusion is inescapable that mutations to dominant traits are difficult to effect by radiation.

In other words the success of a radiation experiment depends, not only on dosage rate, but the variability potential of the variety used.

Biologically stated, *all* changes were toward weaker less viable types, certainly not comparable to Queen Elizabeth in vigor or survival ability. In fact, it was quite clear that as the plants developed, the most *viable* tissue combination "took over" in that if any normal unchanged cells were present, eventually buds formed from them and they became the main plant. In the case of the 1957 experiment, evidently the 20 plants which remained changed and transmitted their changed traits by budding, were of homogeneous cell type. However, as these grew from buds, one could observe segregation of tissues and the plants grew progressively stronger as the cells with best gene combinations "took over" and became buds growing into uniform-appearing but changed plant type.

Some of these obviously differ from Queen Elizabeth by many factors. Since *all* are either completely sterile or semi-sterile, it may never be possible to determine their exact genetic make-up. Crosses of four, which showed a low percentage of apparently good pollen back to Queen Elizabeth, do not give much promise of setting seed.

Though it is recognized that many of the mutated types may well be "abnormalities" involving chromosome disintegration and so not be pertinent to the following discussion, many obviously are rather simple changes to the recessive condition. Certainly we have here a technique by which we can observe more "mutations" from one group of 50 neutron-radiated buds than usually is possible in a lifetime of looking at several million plants per year in the field run of plants from unradiated buds.

Are then these changes the sort of thing leading to evolutionary divergence? In this respect the results of neutron radiation of rosebuds checks closely with reports of other radiation work. By far the greater majority of all mutations found are defective. Occasionally as in the rose experiments, some are found which *horticulturally* are desirable. Even certain ones are recorded in the literature as showing increased resistance to some plant disease. But so far careful inquiry has brought out that as in roses, *associated* defects make the *survival* value of the mutant type in a natural environment highly questionable.

It would seem then that the idea that evolution can occur through the accumulation of mutations is simply not borne out by the ever-increasing array of experimental evidence. In fact, it becomes more and more clear that species and even varieties are very complexly integrated units tolerating very little "tinkering" or change. Quite obviously some species such as the chromosomally basic R. *multiflora* species are particularly resistant to change. Others have a greater variability potential.

Quite obviously the ability of species and varieties to change as they spread over the surface of the earth has been pushed out of all proportion into the idea of evolution. The inability of older naturalists such as Darwin to evaluate this variability potential of species and varieties properly and so to mistake it for evolution or change of one species into another is quite understandable. After all, they had no clear concepts of genetics and even set up genetic postulates completely at variance to what we now know occurs. But the continued interest and belief in evolution, at least in some modified form, on the part of so many modern biologists is puzzling, since the facts of genetic variability and mutation so clearly show that species and varieties have such clearly defined boundaries of variability.

Contrariwise, the idea of evolution has had a deadening effect on the minds of many, especially younger and less imaginative research workers, since the very concept tends to make one feel that changes come slowly. Actually, plant breeding experience shows that within the limits of species or variety-variability potentials changes can be effected very rapidly. In fact, with the development of modern tools of radiation research, we can in a few months probe the variability range of even such normally slow reproducing species as apples, pears, and peaches. Thus by neutron radiating buds of peach varieties and growing the budlings under continuous light,[4] we can get a crop in one year from radiated buds from which we can see the entire range of variability potential. However, we also must be clearly alert to the fact that once the range of variation is reached, further attempts to increase variability are a waste of time.

Conclusion

1. Data are given showing technique and dosages use to get maximum percentage of mutations from rosebuds by neutron radiation.

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4. Lammerts, Walter E., "Effect of Photoperiod and Temperature on Growth of Embryo-Cultured Peach Seedlings," *American Journal of Botany 30,* No. 9: 707-711.

2. Varieties differ strikingly in their variability potential. Thus variations in Queen Elizabeth toward increased petal number, smaller flowers, and change in color from carmine rose (presence of M factor) to coral pink (m) with s factor for light scarlet occur frequently. Change to white occurred only once.

3. Horticulturally, neutron radiation of buds shows great promise, since it so greatly speeds up mutation.

4. Biologically, all mutations are defectives, hence any postulate of evolution by mutation is contrary to evidence.

5. It is observed that the concept of evolution has had a bad influence on research in that it tends to make the scientist work on the theory that nature acts slowly and mutational changes occur slowly. Hence he tends to limit himself as to possibilities of getting results rapidly.

ACKNOWLEDGMENT

The author wishes to acknowledge the advice and help of Philip Livdahl, Howard Tewes, and Harlan Zodtner in planning and executing the radiation of the rosebuds in these experiments.

*The American Economic System in the Light of Christian Teachings**

A. ROBERT HEMMINGSON**

To survive as well as to improve his material well-being, man has long been concerned with economic activity. God gave to man the capacity to work. Further, He gave man command over the world and its resources. So it has been that man has worked, putting these resources to use to produce material goods to satisfy his needs and wants.

It was not long before man began to order his economic activity. This was a necessity, since the resources needed to produce economic goods were not available in unlimited quantities. Choices had to be made to allocate these resources among their many alternative uses, and to try to insure that they would be used efficiently. Also, since resources were limited, the final goods produced were limited, too, and so some means of dividing these among men had to be devised. What we call an economic system evolved to answer these questions of what to produce, how to produce it most efficiently, and who would get what was produced.

Today our economic activity is guided by elaborate economic systems; our American free enterprise or so-called capitalistic system being one of the significant ones. Though we live our lives within the framework of this economic system and should be familiar with it, it will be well to pinpoint a few of its major characteristics, without making any evaluation at this juncture.

The basic fact about our economy is that it rests upon free choice by individuals and business firms within limits set by law, custom, and an individual's personal situation. There is no one authority which dictates the operation of the system. Rather, this is dependent upon many individual decisions.

This basic fact can be seen in several ways. The term private enterprise is often used. It indicates that the decision to undertake a particular enterprise is privately and individually made with only limited public direction. The ownership of property and the uses to which it is put are also privately and individually made, with only few limitations. Consumer sovereignty is recognized. Consumers freely decide what they want to buy according to their desires and their ability to pay.

Aside from this fact of freedom, there are two other aspects of our economic system which should be mentioned. One is the profit motive. To a great degree individuals and business firms are stimulated to work and produce because of a desire for greater wealth and income. Further, arising out of the profit motive is the attitude of competition which exists within a free economy between both individuals and firms. This competitive profit motive is said to be a necessary stimulus in order to increase effort and efficiency.

The other characteristic is the price system. Price is the instrument by which goods and services are evaluated and exchanged. Pricing works as a system to determine what is produced. If a producer can sell goods at a price which consumers will pay, the goods will get produced and sold. It also works to deter-

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mine who gets what is produced. Income received can be thought of as a price paid for services performed. The amount of income received will depend upon the price the economy will pay for particular services. Whatever income is thus received will determine what share of the goods produced can be purchased.

This is a very brief summary of the main elements of our American economic system, but it will help to fit the discussion which follows into context. The study of this system in action is the work of economists. It is their job to measure the success or failure of an economic system in meeting the needs and wants of people; that is, "to study all of the decision-making forces, practices, and traditions, and to decide whether they are promoting the general welfare."[1]

The term general welfare immediately raises questions. What is welfare? Economists have no true answer to this question, since it lies in the realm of value. On the whole, economists respond to the question of values by accepting those of the culture in which they find themselves. Their analysis of the economic system will relate itself to this given set of values. Hence, economics *per se* deals with means not ends.

A Christian approach to economics, however, must raise the question of values. Christianity is concerned with ends as well as means. The intent of this paper then is to raise questions about the goals to which our economy is directed, as well as the means by which they are achieved, and to examine the cultural values on which these goals are based. The latter involves not only a consideration of cultural values as determinants, but also, how these values are shaped by the economic system itself. Admittedly, this entire analysis must be selective and brief because of the time available.

As a basis for evaluation, some of the ethical ideals of Christianity, which have a bearing upon economic activity, should be indicated. One of the principal elements is a depreciation of the importance of material wealth and riches. Many Scripture passages could be cited to substantiate this. The content of these passages would suggest that it is the worship of material goods which is wrong and not the material goods in themselves. In addition, men are identified as stewards of their possessions, which are really gifts from God, rather than as owners in any absolute sense.

Another element of the Christian ethic is the creation of a society based upon love and justice for all men. This must apply to the economic ordering of life. Economic activity should not be directed to benefit a few at the expense of others, nor should a concern for one's neighbors be neglected while promoting selfish personal goals.

The New Testament, however, clearly states that man because of his nature cannot achieve perfection. His nature leads him to alienate himself from God as well as his fellow men. His attempts to maintain ethical ideals will always falter to some degree. However, if the Christian faith has permeated a man's life, he will make every effort to show forth the love of God which has claimed him.

Since all economic systems are the devices of men, they, too, are not perfect instruments of love and justice, but bear in their operation the marks of human sin. No system has been created and carried out by man which conforms to the perfect will of God. But as stated by Rufus Cornelsen in the book, *Life in Community:*

> . . . the purpose is not the negation of life. Veiled in the dark cloak and the iron hand of law is the positive function of leading and impelling man to order his life at least in a minimal way according to the will of God embodied in His creative act.[2]

With this introductory background we turn to one of the chief goals of our economic system. This is the goal of producing an ever-increasing flow of goods and services. Certainly, the free enterprise system has succeeded in the long run in organizing production so that Americans have been supplied with an increasing quantity and variety of material goods. When a comparison is made of the average American at the turn of the century with his counterpart today, there is little doubt that his possessions have vastly increased. In the eyes of most citizens this is a pleasant situation, and they point with pride to this success of the free enterprise system. This success, however, is not without ethical implications.

As has been suggested earlier, the automobiles, refrigerators, etc., that people have are not in themselves an evil, as long as they remain only a means of improving human existence. It is hardly wrong in itself to lift life from the level of bare necessity.

It seems, however, that for many people the accumulation of goods soon becomes more than a means to better enjoy life. Rather, it becomes an end in itself. This appears to have happened to a great degree in our own American situation. Many expend their entire thought and effort to improving their material comfort. The fact that the Smiths have a new car means that they, too, must shortly own one above all else. An insatiable desire for more and more becomes their obsession.

When this is the case, there is little doubt about the effects upon human values. Men become engaged in a struggle over the available goods, and thoughts of brotherhood and charity are relegated to academic discussion. The idea of stewardship of goods is not generally recognized. As E. J. Urwick said in an article, "Ethics of Competition.":

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1. John S. Gambs and Sidney Wertimer, Jr., *Economics and Man* (Homewood, Illinois, Richard D. Irwin, Inc., 1959), p. 11.
2. Rufus Cornelsen, "Christian Faith and Economic Life," *Life in Community* (Philadelphia, Muhlenberg Press, 1957), III. p. 76.

> Surely, the simple fact is that an acquisitive society is also a sick society, and its sickness is of the soul rather than of the body. It does not so much matter whether or not its competitive activities fill all our stomachs with the sort of food we want or whether they satisfy some or many of our shifting desires. Its real curse is that it trains us and even compels us to become more insatiable in our desires with no goal before us except the goal of more.[3]

It must be admitted further that the economic system as such has helped promote this perversion of values. Driven as it is by the desire for private profitable business success, the system requires continuous expansion of the consumption of goods. Unless newly created goods are taken from the market, a business decline may well result with its attendant effects upon all areas of the economy. Hence, consumers are told it is un-American not to desire and buy more goods. Advertising is used to create demand where none previously existed. This pressure upon consumers promotes the tendency to make more possessions the all-prevading ambition.

Related to and intensifying this alienating desire for material goods is the concept of private property. It is not my intention here to argue whether it is or is not God's will that men have private property. Rather, given this fact, it is true that goods become even more attractive when individuals can privately own them. This tends to emphasize concern over them.

However, there is another side to this. The private ownership of property seems necessary if individual Christian stewardship of goods is to have meaning. A person who recognizes this stewardship can only exercise it to the degree that he possesses property.

Closely associated to this discussion is the matter of the profit motive. The profit motive refers to the driving force of individual economic endeavor in the accumulation of profit. It is this motive which deserves ethical scrutiny. What has already been said about the accumulation of material goods as an end in itself has as much application in this context. The moral effects of seeking profit for its own sake are about the same.

Would this suggest rejection of the profit motive? Such rejection hardly seems possible. It is yet to be proved that other nobler motives can be substituted successfully, taking man's imperfection into consideration. A change in the profit system does not bring the desired result either, as evidenced by the Soviet Union. What is necessary is that Americans develop a sense of stewardship over all wealth. This relates both to profit and to the general accumulation of goods. If individuals accept Christian stewardship as a means of voluntary discipline, they will be less preoccupied with the pursuit of gain.

The distribution of income and wealth, or really the distribution of produced goods, is another issue of ethical import. All individuals do not face in the same degree the problem of accumulated goods. Even in this country there is still a wide difference between the highest and lowest income families, though a considerable leveling of incomes has taken place. The difference is more pronounced if accumulated wealth is compared.

As indicated previously, the price system operates to determine what share of goods each individual has; this being based upon the income the economy supplies to him for the services he performs. In the free functioning of the system no ethical evaluation is made of the distribution which results. Again a Christian economic evaluation must go the additional step.

The effect of income distribution may be noted in several ways. Production, to some extent, tends to be directed to meeting the luxury demands of the wealthy, while the basic needs of the poor sometimes are not satisfied. In a free market economy the desire for goods must be backed up by money demand, if the production of these goods is to result. Along the same line, certain services in a free economy are not justly remunerated.

There are social consequences of the distribution of income, too. Opportunities, education, and legal justice are often tied to an individual's wealth and income.

Various methods have often been advocated for bringing about a more equitable income distribution. It is difficult, however, to determine how much equality is advisable. Too much may reduce incentives and efficiency and place restrictions upon freedom which are not consistent with democratic ideals. On the other hand, since the level of income for an individual is often a matter of inherited ability, good luck, or other fortuitous circumstances, gross inequality cannot be maintained as an absolute individual right.

It appears that justice, equality, and freedom must be weighed one against the other to arrive at what might be a reasonable distribution of income. Perhaps, these can only be brought together in the light of Christian love. There is little doubt that the more fortunate should be responsible to a degree for the less fortunate. That the government has and should help to level the inequalities of income and wealth, as well as directing the use of income to certain areas, is generally accepted. The question remains—how far should we go? Most economists admit that present inequalities could be alleviated further without damage to the economy.

Another feature of our economic system which deserves attention is the tendency for economic activity to follow a cyclical pattern, shifting from peri-

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3. E. J. Urwick, "The Ethics of Competition," *The Canadian Journal of Economics and Political Science,* III, No. 2 (May, 1937), p. 254.

ods of expansion and inflation to periods of decline and depression. The effect of this business cycle upon the lives of Americans is considerable.

Recession and depression have plagued our economic system throughout its history. Though considerable progress has been made in understanding the causes of such periods of business decline, economists are not yet fully agreed about the initiating factors nor about the cures. However, the consequences are certainly measurable. Unemployment of the labor force, a declining income level, bankruptcies, bank failures, discouragement, and despair are all a historical reality.

During the last few years we have experienced the other extreme of instability, that of inflation. A demand for goods which has expanded faster than the supply, as well as other institutional factors, produced this inflation trend. It has had its effects, too. Those on fixed incomes have found their purchasing power declining or accumulated savings have lost their value. Continuous or hyper-inflation can destroy people's confidence in the economic system.

Inflation and depression have not only had short-run effects, but have produced lasting changes in our social thinking. One of these developments is the security consciousness of American people today. One needs only to mention such things as social security, unemployment benefits, guaranteed annual wage, and many more to prove the fact. These demands for economic security in various forms have arisen because of the desire of individuals to offset the shifting tide of business activity.

Much has been written about the good and bad aspects of this security emphasis. Some writers have chided people for becoming so concerned about security and the elimination of all risk. These writers say people are too willing to obtain security at any price, including the price of freedom. Others have suggested that too much economic security breeds moral degradation. This relates to what was stated earlier about being too well-off as a nation. It has been said that a rousing depression is good for us once in a while to help clear the air.

On the inflation side, writers suggest that inflation is a necessary price paid for economic growth. A little inflation serves as an incentive mechanism for the economy.

Viewed from an ethical standpoint, extremes of depression or inflation are to be questioned. Reference to the depression of the 1930's will show how the lives of many individuals were permanently scarred by this economic crisis. It is hardly right to talk about "clearing the air" to a man whose family is bordering on starvation. Further, it is an open question whether people have higher values during such a depression period. The reformation of men is accomplished from within and not simply by changing physical surroundings. Extreme inflation is likewise to be condemned because it works hardship upon many, though it may be of advantage to some. To wipe out the value of savings accumulated from a lifetime of hard work does not seem justifiable.

To offset the extremes of the cycle our national government has come to have an increasing role in guiding economic life. This is another apparently lasting effect. Today the use of fiscal and monetary policies is accepted as a necessary approach to solving the cyclical problem. Our current government-sponsored welfare programs are also an outgrowth of depression-inflation concern.

The widening sphere of government influence has led some to protest. It is said that creating a welfare state to which individuals turn for the solution of their problems saps the strength of a nation. Man was meant to face many of the hard problems of life himself and not turn their solution over to an inanimate agency.

Once more the lines are not easily drawn. In our industrial society an individual cannot overcome his economic problems alone, since he is involved in an economic structure over which he may have little control. Thus, out of personal concern he must depend upon group action in certain areas.

It is also again difficult to reconcile justice and freedom. Justice might demand the creation of a planned economy, where economic instability could be eliminated to a much greater degree However, such a planned economy would of necessity involve a sacrifice of freedom. The middle way is a mixed economy, such as we are presently attempting, where a compromise of justice and freedom is hopefully affected.

To this point the discussion has centered primarily on the economic activity of man as a consumer of goods. The picture is not complete unless man is also viewed as a producer of goods.

Production in this country results from the operation of a vast industrial complex. It is hardly necessary to point out that few goods produced today can be associated with particular workers. Products are created through the interrelationship of men and machines and flow from an assembly line process which leaves unknown the individual identity of workers.

The development of this industrial society has resulted in man becoming a marketable commodity. Like a machine with interchangable parts, the industrial system can interchange workers. With efficiency of production set as an economic goal, both men and machines are manipulated to achieve this goal. Technological improvements, for example, will often require the shifting of various productive factors.

The existence of such an industrial society seems to frustrate man in his role as a producer. Man was meant to be creative according to his abilities. To be a creative producer, however, he must be able to express himself in that which he produces. Since the industrial system does not permit identity with pro-

duction for the individual worker, he is left without the power of personal expression, and even more, without a sense of responsibility to his work.

Another consequence of the industrial system is to place the fate of workers into the hands of business managers. When workers are viewed as a commodity to be added or subtracted as production or efficiency demands, the worker finds that his job affords him little security. Of course, the development of labor unions may be explained in part as an attempt to provide protection against such insecurity.

There is still another problem which will require greater concern in the future. The industrial system has reduced the working day from about seventy hours to forty hours per week. It appears certain that with more technological advancements or automation this working day will be reduced even more. Men are thus being provided with increased leisure time. It is questionable whether people have learned how to creatively use these free periods. To some it has been a personality-destroying factor. If the trend toward greater leisure time continues, this may well be one of the major challenges to be faced by our culture in the years ahead.

Considerable criticism has been directed toward industrial society in recent years because of its highly organized and regimented nature. "The organization man" is an expression of this idea. This criticism really revolves around the loss of identity and personality by management people. Everyone is to be a measurable quantity and conform to set standards and practices.

One final consequence of industrial society has been the increase in the pace of living. In a highly competitive and efficient world, men are forced to move at high speed. The ulcers and nervous conditions are the price paid for this pressure.

In evaluating these consequences of industrial society, one would not want to suggest its destruction, if that were possible. Though many presently cannot express themselves creatively in their work, perhaps, relief lies in the fact that workers may be freed eventually from this position as automation continues. It would be possible then for man to be creative in his leisure time. Such creativity would not involve producing goods for the market, but only to provide the self-satisfaction of accomplishment. As far as business managers viewing workers merely as a commodity, this is not as serious a problem today, given the power of labor unions and the actions of government. However, the problem of conformance and the pace of life may be much more difficult for a person to cope with. To remove oneself from the active arena of life to a totally separated society does not seem to be an adequate solution. Christians are often tempted by such possibilities. Rather, the attempt should be made to live within the given framework of society and help to remold it where possible, but even more, it is necessary to learn to rise above the pace of life and view it in a higher perspective.

Though really a problem for sociologists to study, a few comments should be made about the social tensions which have arisen as a result of the institutional arrangements of our economic system. These social tensions have had their effects upon our culture.

One obvious tension is between labor and management. Though we do not have a class struggle as Marx predicted, the labor unions and management do often represent conflicting interests.

Another tension may exist for economic reasons between the government and individuals or groups. This may result from some groups pressuring for concessions, or it may arise from others objecting to the concessions that have been given. The present farm problem involves conflict of both kinds, for example.

A tension may be recognized between consumers and business. Business firms are often able to create agreements which damage consumer interests, such as price fixing. Consumers as a group have not been able normally to defend themselves except through government action.

The distribution of income creates some tension between the haves and the have-nots. This is not of the proportion found in nations where extreme wealth is set over against bitter poverty.

Of course, the fact of competition itself creates social tensions. Business firms sometimes engage in battle tactics to overcome a competitor. Individuals compete with one another for better jobs or better income.

Such tensions as these are proof that our society is not perfectly ordered. It is further evidence of the basic alienation of man from man and man from God. Some Christian realists state that since such tensions cannot be fully resolved, we must work to structure our society so that competing groups have equal power, and then create standards based upon love and justice which these groups can attempt to follow in a particular situation of conflict.

Though all of the goals and characteristics of our economic system have not been covered, nor all of the ethical implications adequately examined, it is hoped that enough has been said to indicate some of the issues.

One point which has been emphasized throughout is that our economic system operates according to the values of the individuals within this country. Their lack of sensitivity to higher values creates the ethical issues of economics. The hope then for an economy which more perfectly reflects God's command to men must lie through reaching individuals with the message of God. This message can transform people, bringing them to see that they need to reorder their lives according to the basic command of love. Though this does not guarantee the solution of the tensions which exist in an industrial society, men committed

to the Christian Gospel will reach a higher plane in resolving them.

The ethical improvement of our economy cannot come by legislation or by the creation of government agencies. By this means one evil may be corrected, but in its stead a new one is created. This often appears to be quicker solution, but not an acceptable one.

The words of Kenneth E. Boulding in his book, *The Organizational Revolution,* seem a fitting conclusion to this paper:

> . . . there is also no substitute for the Word of God —the sharp sword of truth in the prophetic individual, the penetrating moral insight that cuts through the shams and excuses of even the best organized society. However clever we may become and however far we move toward betterment through cleverness and skill, there is always a place for wonder, for humility, for reverence, for sensitivity to the still small voice of the Creator of all men and all morals.[4]

4. Kenneth E. Boulding, *The Organizational Revolution,* (New York, Harper and Brothers, 1953), p. 220.

*The Victoria Institute and the Bible**

F. F. BRUCE**

I. The Institute and Biblical Scholarship

The Victoria Institute is an avowedly Christian society, even if it is at the same time an investigating body. The fact that a philosophical society with a Christian basis should devote itself so unrestrictedly to investigation in every realm of human interest reflects the sturdy faith of its founders that all truth must be one, and also their complete freedom from obscurantism—from any anxiety lest their investigations might lead to the discovery of inconvenient or unpalatable facts.

The first object for which the Institute was established is stated thus: "To investigate fully and impartially the most important questions of philosophy and science, but more especially those that bear upon the great truths revealed in Holy Scripture; with the view of reconciling any apparent discrepancies between Christianity and science." The place given in this statement to "the great truths revealed in Holy Scripture" suggests that the relation of this Institute to the Bible is a subject of high importance to all its members.

Some of us no doubt belong to churches or other confessional fellowships in which the doctrine of Holy Scripture is more explicitly defined. There is naturally room in such bodies only for those who subscribe to these more explicit definitions. But the Victoria Institute is not a body of this kind. Our constitution recognizes "the Christian religion as revealed in Holy Scripture" without trying to define the nature of revelation or the exact content of what is revealed; just as it provides that fellows and members of the Council shall be "professedly Christians" without trying to delimit the meaning of the term "Christian." This affords a wide basis for pursuing the researches which form the purpose of our existence, and the Institute would fall short of that purpose if it came to be identified in the public mind, or in actual fact, with one particular view of Biblical revelation or one particular Christian tradition.

But since we do acknowledge the distinctive authority of Holy Scripture, it is proper that Biblical studies should figure in our program year by year. It would be well, too, if we made more use of the wealth of Christian Biblical scholarship available in this country. The Institute, of course, has always counted leading Biblical scholars among its members and officers. The list of former presidents includes the name of Dr. Henry Wace, Dean of Canterbury, and more recently that of Sir Frederic Kenyon. Sir

*The Victoria Institute in England, established in 1865, is an organization with aims generally similar to those of the A.S.A. The annual address of that Institute for 1954, given by F. F. Bruce, covered some thoughts that appear quite revelant to some problems being considered by our group. Several members have suggested that it would be appropriate to reprint his address.

**Dr. Bruce is on the Faculty of Theology at the University of Manchester and is well known for his writings in defense of the Christian faith. His address is being reprinted in the *Journal* by his permission and by a general permission of the Victoria Institute to the *Journal*.—Editor

Frederic did not think of himself as a Biblical scholar, but it is widely recognized that his contributions to Biblical scholarship were of the highest value.

A study of the back numbers of our *Transactions,* however, shows that not infrequently matters of Biblical scholarship have been dealt with by men whose special claims to eminence did not lie in the Biblical field at all. And sometimes (it must be said) the results were not such as to raise the prestige of the Institute. We should immediately realize the lack of wisdom in inviting a specialist in Biblical philology to discourse on, say, organic evolution, but the equal lack of wisdom of inviting a distinguished biologist to read a paper on, say, the Seventy Weeks of Daniel has not always been appreciated, as it certainly would be today.

I have long been struck by the widespread view that any man's opinion on Biblical subjects is as valid as any other man's, but the prevalence of this idea has been brought home to me with special force since I exchanged the teaching of classical philology for the teaching of Biblical history and literature seven years ago because I do not remember meeting a comparable idea in the field of classical studies. I know that this idea in the Biblical field to some extent reflects a healthy instinct which will not permit the Bible to become the preserve of specialists, but insists on its remaining, as it is, Everyman's Book. Sometimes, however, this idea takes the extreme form of a conviction that the specialized study of Biblical subjects positively disqualifies a man from expressing an acceptable opinion on the Bible. It is possible that this conviction has even been ventilated in our Institute. At any rate, as I read some back numbers, I get the impression at times that some experts in other realms of study who have read papers on Biblical subjects are persuaded that Biblical specialists very often do not really know their own business.

I was interested some time ago, when studying old membership lists, to observe that for a number of years one of the leading Biblical scholars in our English universities in a former generation was a member of the Institute. I was equally interested to observe that he never read a paper before the Institute. Of course, he may have been invited to read one and declined. I cannot say.

At the same time, I should not dream of suggesting that nonspecialists should never air their views on Biblical criticism and interpretation in a learned society such as this. The previous chairman of our Council, the late Air Commodore P. J. Wiseman, whom we all remember with grateful affection, made some acute contributions to Biblical studies both in the Institute and outside. And his is not the only name we can bring to mind in this regard. Very often the contributions of a nonspecialist are peculiarly fresh and stimulating, as he looks at the subject and raises questions from an unusual point of view.

We are—and properly so—a mixed lot in this Institute, and our approaches to the Bible will vary. The mathematician or natural scientist, for example, contemplating the second and third chapters of Genesis, may be inclined to interpret them with exact literalism and either dismiss them too hastily or expend needless toil in reconciling with his scientific knowledge language which really calls for no such reconciliation. The student of literature, on the other hand, may recognize in these chapters a style of highly symbolic diction, such as he is familiar with elsewhere. The philosopher may concentrate on eternal truths which he discerns beneath the picturesqueness of the narrative. The anthropologist may compare the beliefs reflected there with beliefs held at various times in other parts of the world. The historian may try to determine the chronological setting of the stories and to understand them against their contemporary background. The student of ancient geography may try to fix the location of Eden in terms of the four rivers mentioned in the story. The archaeologist may try to relate the Genesis narrative to parallel narratives extant in early Mesopotamian and other records. The Biblical critic may collate the Massoretic and Samaritan texts with the ancient versions or try to discover the source or sources from which the narrative was derived. He may even try to penetrate beyond the earliest ascertainable written form to an antecedent oral stage. But the theologian, and all Bible readers who bear in mind the prime purpose for which the Bible was given, will ask what these chapters teach us about God, and about our duty to Him. They will recognize, of course, that these chapters belong to an early stage in God's progressive revelation of Himself, but they will also recognize that these chapters do have the nature of revelation, and only by approaching them thus can we begin to grasp their essential meaning. All the other approaches have their varying values, but their chief value lies in the service which they can render to the theological understanding of these chapters (as of the whole Bible).

"The Scriptures principally teach," said the Westminster divines, "what man is to believe concerning God, and what duty God requires of man." If we believe that, we shall understand that in the study of these chapters of Genesis it is not nearly so important to argue whether a serpent really spoke or not as it is to consider seriously what the serpent really said. For what the serpent said to Eve is what the same serpent is still saying to us, in an endeavor to distract our minds from God's revelation of Himself and of His will.

The other avenues of approach are by no means unimportant or irrelevant. But they become most important and relevant when they are made to subserve the primary interpretation of the Scriptures as divine revelation. And here surely is the whole *raison d' être* of our Institute. In all our divergent fields of study we have a common interest which brings us

together, and that common interest is the Christian faith. The various sciences to which we devote time and strength (Biblical science included) will yield their most fruitful results if theology is accorded her true place as queen of the sciences. Whether she receives her crown rights elsewhere or not, here in the VICTORIA INSTITUTE they can never be disregarded. And Christian theology can be nothing other than *Biblical* theology, if the Bible is rightly recognized as the unique recital of God's saving and self-revealing activity on which our faith rests.

II. BIBLICAL SCHOLARSHIP AND CHRISTIAN ORIGINS

Sir Frederic Kenyon, in successive annual addresses which he delivered as our president, emphasized the special opportunities presented to the Institute to meet the need of the hour, provided that our work was characterized by "liberty of investigation, an open mind, charity toward our opponents, and faith in the victory of truth." One particular way in which he thought the Institute might well provide "the sound basis of scholarship" for carrying on the struggle against anti-Christian forces was in making known the historical foundation of the Christian faith. This is something which I should like to repeat and underline.

For Christianity is nothing if it is not a historical faith—that is to say, a faith founded on things which have really happened. Some Christian leaders have propounded outlines of "basic Christianity" which (they urge) men and women might well accept and live by, even if *(per impossibile)* it could be proved that Jesus of Nazareth had no historic existence. But such a "basic Christianity" is a very different thing from the basic Christianity of the apostles, which consisted in the affirmation that God had acted for the redemption of mankind in the events of the life, death, and resurrection of Jesus of Nazareth. The beliefs and ethical principles of which modern "basic Christianity" consists were certainly inculcated by the apostles, but the apostles inculcated them as corollaries of the redeeming act of God in Christ. And if we continue to use the term "Christianity" in its historic sense (as we should), then Christianity must rest upon the foundations of the apostolic witness.

At this point it will perhaps be interjected that I am doing the very thing that I deprecated earlier—imposing a restrictive definition on the word "Christian." I hope I am not. The propounders of the "basic Christianity" I have in mind are sincere and highly esteemed Christians; it is not their personal Christianity that is in question, but their wisdom in recommending as essential Christianity something which omits what was fundamental and indispensable to Christianity as first proclaimed.

Julian the Apostate might say of certain pagan mysteries of his day: "These things never happened, and yet they are eternally true." But the glory of the Christian *ηῦθος*, the *ἱερὸς λόγος* of our salvation, is that it did happen once for all, as a real historical event, in the Roman province of Judea, when Pontius Pilate was procurator; and *therefore* it is eternally true.

There has never been a time when the evidence for the truth of Christianity, rightly so called, was more abundant and cogent. What our time demands is that this evidence should be made widely known.

From time to time books appear which profess to tell the story of Christian beginnings as they really happened, with the implication that the account which has come down to us in the New Testament writings is too tendentious, too completely rewritten in accordance with an unhistorical bias, to be accepted as a trustworthy source of information. It cannot be too strongly emphasized that the sources of information which the authors of some of these books prefer to the apostolic writings are much later and more precarious than those which they reject—where the authors do not draw on their own imagination. No one will quarrel with a writer for drawing on his own imagination and publishing the product as an avowed work of creative fiction. Books like George Moore's *The Brook Kerith* or Robert Graves' *King Jesus* are of this kind, and since they claim to be fictitious reconstructions, they must be appraised as such. It is not works like these, but others which are presented as the products of scholarly and dispassionate research, that I am thinking of. The trained historian will not be led astray by them, nor yet the ordinary Christian who knows whom he has believed, and has some acquaintance with the origin, nature, and transmission of the New Testament. But for the sake of others who might be deceived it is desirable that the historical foundations of our faith should be made more widely known than they are.

The New Testament, to be sure, is not a disinterested account of Christian origins, such as might have been recorded by a reporter from another planet. The men who wrote it were too totally committed to the truth of what they recorded to present it in a spirit of complete detachment. These things were literally matters of life and death to them. The New Testament is, directly or indirectly, the transcript of the personal testimony borne by the apostles to Jesus as Saviour and Lord: "That which we have seen and heard declare we unto you." But in bearing this testimony they constantly challenged the severest scrutiny of their claims: This thing was not done in a corner, and the events were sufficiently recent to be investigated impartially. Not that historical research then or now will suffice to make a man a Christian. But many of our contemporaries who would fain be wholehearted Christians are deterred, I believe, from this total commitment by the idea that the intellectual basis of the Christian faith has somehow or other been undermined. If this stumbling block could be removed from their minds, and if this Institute could do something toward its removal, that would be an inestimable service to our age.

III. Christian Origins, the Bible, and God

But the Christian story is not detached from its background. A heretic like Marcion might begin his edition of the New Testament with the announcement that "in the fifteenth year of Tiberius, Jesus came down to Capernaum" — down from heaven, full grown, having no link, biological or historical, with anything that went before. He might insist that the Creator-God of the Old Testament was a completely different Being from the superior Redeemer-God of the New Testament. But the Gospel which has been delivered to us, in which our salvation lies, tells a different story. It tells how the God who brought the universe into being by His creative will, whose tender mercies are over all His works, who cares for all mankind, who chose His people Israel that they might communicate the knowledge of His truth to the other nations of the earth, and who therefore displayed His mighty acts of mercy and judgment in a special way in Israel's history, is the God who ultimately fulfilled His age-long purpose and promises by sending His Son for our redemption. It tells how the divine Word became flesh, sharing our nature that as man He might work out man's salvation and make us partakers of His nature. The story is one, and the whole Bible is the Book which records it.

But if that is so, what endless scope there is for our investigations in every field of knowledge! For there is nothing in the universe which is irrelevant to the knowledge of God the Creator—nothing pertaining to mankind that is irrelevant to the knowledge of God our Saviour. Moreover, since this God is one God, all truth, however discovered is His truth, and is therefore ultimately one. Lack of knowledge may make it necessary for us to suspend judgment on many things, but we cannot be true to the purpose of this Institute and hold mutually contradictory beliefs. Whether we study the natural revelation of God in His work of creation and providence, or His redemptive revelation enshrined in the Bible, we need never be afraid of discovering something that will undermine our foundations. We can do nothing against the truth, but only for the truth.

Many things in the Bible which belong rather to the setting of God's revelation than to the essence of the revelation are fascinating subjects of study in themselves, but it is good to keep them in their proper perspective by considering what part they play in relation to God's saving Word to men. It is, for example, interesting to study the census figures in the Book of Numbers, over which there was much serious disputation in the very early days of our Institute. Were there actually six hundred thousand men of military age in the wilderness, or was the real figure more like five thousand, or have the figures of David's census somehow strayed into the wilderness narrative? Whatever the results of a study like this, we shall not nowadays argue the point with a warmth that would suggest that the truth of Christianity depends on the answer.

There is never any need to tremble for the Ark of God; it is always good for us to tremble at the Word of God. And we use the Bible aright if we use it in such a way as to hear that Word speaking to our heart, and assuring us that God has reconciled us to Himself by Jesus Christ. The Spirit of truth, the Lord and Giver of life, who spoke by the prophets, still bears witness to Christ in all the Scriptures and, as I read them, supplies the inward guarantee that here is God Himself speaking to me.

To compare the truth discovered from the study of the Bible with the truth discovered in the pursuit of our studies is both necessary and profitable, but it can take us only so far and no farther. For the purpose of the Bible is that we may know God, and therefore any light that the Bible may throw on these other subjects of study is incidental and secondary. They show us but the outskirts of His ways; the Biblical revelation lays bare His very heart.

The Bible was not given, for example, that we might know exactly the order of events at the beginning of time or at the end of time, or even the order of events in the intervening course of time. Those parts of the Bible which deal with the first things and the last things are primarily intended to teach us not about these things themselves but about the One who is Himself the First and the Last, the Creator of all in the beginning and the Judge of all at the end. And in so far as the Bible deals with the intervening course of time, its main burden is not the sort of thing for which we have recourse to secular histories, but the message that at the consummation of the ages, the nodal point of time, the real Judgment Day of this world, God revealed Himself supremely in Christ. The age-long war between good and evil, as Oscar Cullmann has reminded us, is not of doubtful issue. The decisive battle was fought, the decisive victory won, in the passion and triumph of Christ. The Victory Day celebrations still lie in the future—the important thing is not whether that Victory Day is near or remote, but the fact that its advent is already assured by the finished work of Christ. The Lion of the tribe of Judah has conquered; the slaughtered Lamb is Lord of history.

Our situation today is very different from that in which the Victoria Institute came to birth eighty-nine years ago. But as then, so now, there is need for a body of men and women who love the truth and are prepared to follow it wherever it may lead, assured that it can only lead us toward the God of truth. In a day when earth's foundations flee, it is good to follow Herbert Butterfield's counsel: "Hold to Christ, and for the rest be totally uncommitted." But those who hold to Him who is truth incarnate and love all truth for His sake will see light in His light and by so doing they will not only save themselves, but others also.

*Creation, a Finished Work**

WILLIAM J. TINKLE**

There is agreement among Christians that God should be credited with the existence of the universe. If there were no God, there would be no universe, for His plan and activity have brought it into being.

Since the universe has immense size and complexity, however, the methods and details of the formative process are not all known. One need not fear to plead ignorance regarding some of the steps in creation. Indeed the person who has all the answers is often suspect for that very reason.

The purpose of this paper is to shed light on one embarrassing controversy among Christians regarding the general nature of creation. Is it a process which was finished, or is it being accomplished gradually at the present time? In speaking of the formation of the universe, should one use the past or present tense? It is agreed among Christians that God had the power to do either, but considering His revealed Word and the record of nature, which method was used?

Definition

The word creation is understood to mean bringing something into being, whereas neither it nor its forebears had being before. Primary creation means the formation of substances out of nothing. Secondary creation is the ordering and combining of substances in such a way that a new entity is formed which is more than the product of pre-existing factors.

Creation is not the sole type of divine activity. The continuous maintaining and ordering of the universe is called providence, and excites one's admiration in a manner similar to the contemplation of the original bringing into being. When one observes a landscape and is religiously moved, he should not say he has evidence that God is still creating.

Growth and reproduction of living things should be classified as providence rather than creation. The new plant or animal is built up according to a plan which is not new at all but which existed in its ancestors. The plan is embodied in a minute blueprint composed of genes, passed on to the new individual in the egg and sperm of the parents.

Does It Matter?

Since it is admitted that God could finish His creative work or prolong it endlessly, some say that the question does not matter or that it is not more than academic. A minister of my acquaintance said that one guess is as good as another. He simply refused to consider the question. He and his kin are so interested in building a tall superstructure that they neglect the foundation.

Another minister, a student in Juniata College, approaches the question through reference to the nonconformist group of young people commonly called the Beat Generation. After discussing their rebellion against organized authority, he continues: "A second characteristic or expression of the Beat Generation is their denial of meaning and purpose in life. To them, life is blatantly full of question marks but starkly void of satisfactory answers. We stare about us in search of meaning or purpose but we see only the reflections of our own anxiety. It is as if life were a blank slate on which the only meanings to be found are those which we ourselves in desperation write to ease the pain of meaningless existence. We cry out for meaning and purpose, and the world cries back: 'Confusion and frustration. . . .' The conformist may be content with his unreal set of meanings, but the Beat chooses despairing sincerity rather than superficial contentment."[1]

Need we wonder at this denial of all purpose, since evolutionists have been crying out against teleology for one hundred years? Evolution is not the only support of the idea that the world has no purpose, but it definitely is one support. Natural selection based upon struggle for existence presupposes an arena where the violent and crafty ones win, whether they deserve to win or not. It denies the providence of God in order to account for creation without God. Those who give only lip service to this philosophy are not greatly affected, but the Beat actually accepts the outlook and yields to despair.

At this point someone objects that he does not believe in materialistic evolution but in development guided by God at each step. Such a belief, however, is at variance with that of the scientific evolutionists, and thus does not resolve any conflict. This desire to compromise with science and avoid an argument is the chief reason for formulating theistic evolution. Since it does not agree with the conventional evolutionists after all, one reason for accepting theistic evolution is lost.

Another reason why it is important to consider God's method of creation is the Biblical statement that God made man like Himself.[2] Why should God find it necessary to perfect His creature by eons of

*Paper presented at the Fifteenth Annual Convention of the American Scientific Affiliation, Seattle, Washington, August 22-25, 1960.

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1. R. B. Gardner, *Brethren Life and Thought,* Summer 1960, p. 53.
2. Genesis 1:26, 27.

brutal struggle in order to make him in His own image? And what does such a process suggest about the nature of God? It might teach that He is a selfish, relentless warrior rather than a God of love.

Concerning the fall of man, it may be that some theistic evolutionists accept it because it is in the Bible; yet there is no logical place for it in that system of thought. Evil is accounted for by man's incomplete development, and time alone may make up the deficiency. Evolution does not point out the need for a Saviour.

As stated above, not all evolutionists hold these anti-Christian ideas, but they do if they have accepted evolution wholeheartedly. Such ideas are inherent in the philosophy of evolution.

Another reason for holding the original meaning of creation is that some people reject the Bible rather than compromise. They do not appreciate the circumlocution which is necessary to harmonize the Bible with evolution.

Compromise Seems Necessary

Let us consider the situation which has made a revision of the meaning of creation seem necessary. Science has been very successful in improving machinery and human health, thus winning the acclaim and gratitude of the public. One branch of science receives accolades as well as another, even though its pronouncements are only theories. When it is stated in the name of science that all life has developed gradually from lifeless matter, people feel that it is futile to deny it. It must be that we have not understood the Bible, and it is necessary now to interpret it in such a way that it will agree with this new truth.

To aggravate the situation, students in some Christian institutions have been advised not to study the data on which evolution is based. Such was not the experience of the author of this paper. In college I was not told what I must believe about creation, either by the college or by the church. The textbooks taught evolution in the same arguments that are used now, while the teachers made no definite commitments. Plodding and vacillating through my biology major, studying geology also, I finally decided that nature says, "No."

While some evolutionists browbeat their opponents by classifying them as either uninformed or prejudiced, others admit that gradual development has not been demonstrated. Newman wrote, "Reluctant as he may be to admit it, honesty compels the evolutionist to admit that there is no absolute proof of organic evolution."[3] S. W. Fox writes in much the same vein in the present year: "Darwin's theory of evolution has, for example, been judged and has proved to be intellectually useful on the basis of its consistency with much general knowledge, rather than on that of any single dramatic experiment."[4] While it agrees with the temper and thoughts of the modern age, it has not been clearly demonstrated.

On the other hand, most scientific conclusions have been demonstrated. Photographs of the earth taken from great height show its surface to be shaped like an arc. The earth's rotation is demonstrated by Foucault's pendulum, one of which is located at the Museum of Science and Industry in Chicago.

Biblical Testimony

Since all Christians accept the Bible, although they do not agree as to its interpretation, we should seek to learn what is says. The first chapter of Genesis relates the formation of the earth and the different types of plant and animal life, concluding with man, and God is pleased with the success of His work. This seems to be a series of completed acts and the idea of completion is confirmed in Genesis 2:1: "Thus the heavens and the earth were finished, and all the host of them." Edwin Monsma comments, "This rules out any idea of a continuous creation after the sixth day, an idea inherent in evolutionary thinking."[5]

Later Scriptures likewise speak of creation as having been accomplished in the past. "Thou, even thou, art Lord alone; thou hast made heaven, the heaven of heavens, with all their host, the earth, and all things that are therein, the seas, and all that is therein, and thou preservest them all; and the host of heaven worshippeth thee."[6] This agrees with the Genesis account, using the perfect tense in speaking of the creation and the present tense in speaking of His providence, the preservation of these things.

Further confirmation is given in Psalms: "Let them praise the name of the Lord: for he commanded, and they were created."[7]

These Scriptures do not rule out the possibility of change, and certainly do not make it impossible for God to create a new heaven and a new earth, but they give no hint of a slow, upward, developmental process. We see in the Biblical account idea, plan, purpose, and command, rather than development by struggle, with elimination of the ones that fail to make the grade.

Testimony of Nature

Since God is the Author of nature, we should see in it the same kind of creation which is described in God's Word. Many scientists have not noted the similarity, however, but have observed individuality and change. When some Christian protagonists denied changes in living things they made a mistake. The truth is, however, that the changes which can be observed do not add up in such a way as to make permanent progress, except where man guides the process.

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3. H. H. Newman, *Readings in Evolution, Genetics and Eugenics*, University of Chicago, 1921, p. 57.
4. S. W. Fox, *Science 132*, 22, July 1960, p. 207.
5. E. Y. Monsma, *If Not Evolution, What Then*, privately published.
6. Nehemiah 9:6.
7. Psalm 148:5.

Much change is cyclical in nature. Growth in a living thing is progressive, but the next generation starts back at the base line, with no advantage from the environment of the parents. There is agreement among geneticists that "acquired characters" are not inherited.[8] Since this is true, most of the changes in plants and animals are for one generation only and do not influence future generations.

A tremendous amount of data has been accumulated to show that the characters of living things are determined by standard factors known as genes. They are located in the rod-shaped chromosomes in the nucleus of each cell, and had been seen by only a few men a hundred years ago, but now are observed and drawn by college freshmen. Genes are in no sense hypothetical or theoretical, but are entities proved by experiment.

If creation took place gradually by development, we might expect that a gene would develop gradually, making its character more pronounced with each generation. But Mendel, the father of genetics, held a very different idea, as reported by Nordenskiold: "Much surprise has been expressed over the fact that Mendel's brilliant observations did not attract greater attention, and the blame has been laid upon the unknown journal in which they were published. One might with greater justification ask oneself whether any of the more important publications of the time would have undertaken to print results of research so utterly at variance with the prevailing conception of biology. We have only to remember that Mendel denies variability in those characters that he observed, whereas all the biologists were just at the time seeking after variations as material in proof of natural selection; and then come these assertions as to absolutely constant or constantly divisible characters from the pen of a monk in a monastery! It would certainly have been a miracle if they had found support from the generation that had been brought up on Haeckel's *Natural History of Creation*. Nevertheless, the Mendelian principle of cleavage now forms the basis of all hybrid research."[9]

Modern geneticists are agreed that a gene does not change at all unless it makes a sudden and fortuitous change called a mutation. This change may be small or great, but takes place rarely. Snyder and David make the following statement: "Most genes are exceedingly stable. . . . The natural mutation rate is very low. Many species have remained much the same for long geologic ages. The brachiopods among animals and the seaweeds and others among plants are examples of groups of organisms in which almost no changes are observed in present-day species as compared with fossils. Even in the laboratory among organisms chosen for their capacity to produce mutations a high stability of genes is found. Muller, by means of cleverly devised experiments in Drosophila, has recently estimated that the mean life of a gene (that is, the average time elapsing without change in any particular gene and its descendants) approximates 100,000 years."[10]

Moreover, a very large percentage of changes due to mutation are harmful to the plant or animal. This is true to the extent that beneficial mutations are seldom named. If mammals developed from reptiles we should expect to find incipient organs developing in reptiles such as mammary glands or umbilical cords. If birds developed from reptiles, we might expect to observe a pin feather on a lizard now and then. Such advances have not been reported. Under the scrutiny of many observers, mutation should be caught in the act of originating some advanced character, of which the above are examples.

At the A.A.A.S. Convention at Indianapolis, T. Dobzhansky spoke on evolution and asked for written questions following the address. I asked him to name several mutations which have conferred an advantage to the organism. His reply was that there are a number which give an advantage under changed conditions, but one should not look for a mutation which gives an advantage where the environment has not changed.

I appreciated his frank reply which makes creation by development a devious and long-drawn-out process, if it exists at all.

Much could be written about abnormal numbers of chromosomes and abnormal positions of genes within them. But since no change in a gene itself is involved, the change in the plant or animal usually is slight, unstable, and not of an advanced nature. Such details are interesting to students of heredity, but they would make this paper too long.

Conclusion

Every Christian who is also a scientist is confronted with conflicting systems of interpreting the universe. He has God's revealed Word and also the explanations formulated by men who have thought but little about God, yet have some interpretations which are helpful.

For one who is not averse to recognizing the power of God, it would seem that the most direct interpretation is that God created the genes of plants, animals, and men, some of which have reproduced themselves down to the present, but others have met with accident. Theistic evolution is an unnecessary compromise, not well supported by observation.

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8. W. R. Breneman, *Anatomical Form and Function,* Ginn, 1954, p. 413.
9. E. Nordenskiold, *History of Biology,* Knopf, 1928, p. 591.
10. Snyder and David, *Principles of Heredity,* Heath, 1957, p. 349 f.

Length of Life

STEPHEN E. SLOCUM, Jr.*

One of the most stimulating scientific authors writing today is Dr. Hans Selye, whose 600 articles and 12 books have been widely circulated in many languages throughout the world. Writing with a unique combination of warm humor coupled with a keen understanding of human nature, Dr. Selye has demonstrated a rare skill for presenting complex medical theories in a manner understandable to the everyday citizen. Born in Vienna in 1907, Dr. Selye received his medical degree from the German University of Prague in 1929 and, two years later, his Doctorate in Philosophy from the same institution. A Rockefeller Research Fellowship brought him to John Hopkins and subsequently he moved to the University of Montreal where he is now Director of the Institute of Experimental Medicine and Surgery. His most recent article entitled "What Makes Basic Research Basic?" appeared in January 24, 1959, in the "Adventures of the Mind" series being published by the *Saturday Evening Post*.. However, it is his General Adaptation Syndrome Theory, concerning the stress of life, for which he is being widely heralded throughout the medical world as having made a major contribution to the course of modern medicine.

Although developed from a purely scientific point of view by Dr. Selye, this theory nevertheless has some far-reaching implications when applied to the problem of longevity in the early chapters of the Bible. Thus it is of particular significance to any Christian who, at one time or another, has had some uneasy twinges of uncertainty in attempting to reconcile the great spans of life outlined in Genesis 5 with the relatively few years now lived by man.

To the avowed skeptic, of course, the fact that "all the days of Methuselah were nine hundred sixty and nine years" is just another evidence of the inaccuracy of the Bible. To the skeptic the fact that Lamech is reported to have lived seven hundred and seventy-seven years is further proof of the foolishness of accepting the Biblical account. Even the somewhat reduced ages found later in Genesis 11 are subjects of his scorn because even they run well over man's normal life expectancy today.

Many have been the theological gymnastics attempted by more conservative Bible scholars in order to bring such "implausible" age spans into better harmony with present-day experience. Some have argued that the earlier records suffered in transmission or that the "year" was different from our present one. Others have suggested that the disparity is due to the rapid spread of disease. Still others have quietly sidestepped the whole problem. Some, however, have been content to face the fact that here is a problem as yet unanswered and to look for its explanation in God's chosen time. Perhaps these latter have shown the better wisdom when considered in the light of Dr. Selye's new hypothesis.

As popularly expounded in his book, *The Stress of Life,* Dr. Selye postulates that each of us is born with a certain store of adaptation energy from which we draw to meet the wear and tear of life. He states, "Life is essentially a process which gradually spends the given amount of adaptation energy that we inherited from our parents." Furthermore, since it is not possible for us to replenish this store, Dr. Selye says our length of life depends upon the speed of its consumption. Taking an example from everyday life, he likens vitality to "a special kind of bank account which you can use by withdrawals but cannot increase by deposits." Thus, the only control one has over this most precious fortune is the rate at which the withdrawals are made.

In answer to those who believe that, after having exposed themselves to very stressful activities, a rest can restore them to where they were before, Dr. Selye says that such a view is misleading. His experiments have shown that "each exposure leaves an indelible scar, in that it uses up reserves of adaptability which cannot be replaced," and just a little deficit in adaptation energy every day adds up to what we call *aging.*

In pursuing this thesis, Dr. Selye points out:

> Due to the great advances made by classic medicine during the last half century, premature death caused by specific disease producers (microbes, malnutrition, etc.) has declined at a phenomenal rate. As a result of this, the average human life span increased in the United States from 48 years in 1900 to 69.8 years in 1956. But since everybody still has to die sometime . . . an ever-increasing proportion of the human population dies from the so-called wear-and-tear diseases, or degenerative diseases, which are primarily due to stress.

He summarizes this by saying:

> Life is a continuous series of adaptations to our surroundings and, as far as we know, our reserve of adaptation energy is an inherited finite amount which cannot be regenerated. (Nevertheless) *I am sure we could still enormously lengthen the average human life span by living in better harmony with natural laws.* [My italics.]

Special note should be taken of his use of the word

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"enormously" in connection with the possibilities of increasing the average human life span. In substantiation of this very startling statement, Dr. Selye asserts that in all his autopsies he has never yet seen a man who died of old age, nor does he think anyone ever has. "To die of old age would mean that *all* the organs of the body would be worn out proportionately merely by having been used too long." Thus would be accomplished the ideal objective of medical science. However, man invariably dies because, due to uneven stress, one vital organ has worn out too soon in proportion to the rest of his body. Since this is so, Dr. Selye is "certain that the *natural* human life span is far in excess of the *actual* one" of today. [My italics.]

Here then is a world-recognized medical scientist who, based upon careful research and extended experimentation, is convinced that given wisdom to properly adjust to the demands of life, man could *enormously* lengthen his average life span by living in better harmony with natural laws.

While not attempting to evaluate the scientific merits of Dr. Selye's hypothesis, it is interesting to note that his suggestions tend to corroborate what the Bible has stated simply as fact for these many generations. Furthermore, the correlation between Dr. Selye's theory and the Biblical record is even more precise than appears at first glance. Not only is his theory axiomatic, but the Bible offers the answer as to at just what point in history mankind lost this ability to live in proper harmony with natural laws. Despite the fact that Genesis 3 outlines the fall of man, Genesis 5 goes on to outline the genealogical list of some who lived to such extended ages after the flood and so we conclude that even though man was separated from God by the fall, he still was able to live in some reasonable harmony with natural laws. It would seem that, up to this point, the tensions in man's life were for the most part due only to his estrangement from God. As we read on, however, a noteworthy event appears which takes on great significance in the light of Dr. Selye's theory. It is in Genesis 11 that we read of man's willful defiance of God at Babel and the subsequent judgment of the diversity of language. Here is the division of mankind into countless fragments with the result of conflict between mankind ever after. Certainly history has confirmed this ever since.

It is interesting to reflect that it was with this division into many separate groups that man's tensions multiplied, and that such multiplied tensions directly effected the drastic curtailment in life expectancy. Nor can it be argued that this is not so just because Genesis 11 follows with a list of ages that are many times greater than those today. The significant fact is that the ages in Genesis 11 are a recap of those who lived during the time of the division, and already it is to be noted that there is a sharp decline in life from over 600 years to somewhere around 200 years or less.

Although conflicts were obviously present in man's effort to set up a society apart from God, it is with this separation into many national fragments (each within its own limiting barriers of language) that man's tensions really intensified. Peace was no longer possible. Justice became, at best, a relative matter. Oppression was more the rule than the exception. Poverty and hunger were common experiences. Man lived in constant fear and unrest. Certainly these same factors in our present-day society are those for which the psychologists blame much of the anxieties and tensions that claim men's minds and shrivel their souls.

If it be true, therefore, that man's life expectancy sharply declined because of the sudden increase in the tensions of life, then the interesting question is raised as to whether the Bible promises a yet future time when all such tensions will be removed and, if so, just what the effect will be. Man, of course, is striving to accomplish this very thing through human means as may be witnessed in the United Nations. However, it is God alone who can remove such divisions and prophecy confirms that such will actually take place with the Second Advent of the King! At the return of the Lord to earth the removal of such tensions will at once become reality. Scripture abounds with statements concerning the glories of this period when there will be universal peace and joy throughout the world. There will then be perfect justice because of the presence of the Lord. All language will be one and worship will be without fear of enemy or oppression. A perfect economy will provide abounding prosperity and once more nature will be in perfect harmony. Among all these blessings (and probably because of them) will also be a longevity of life which will once again extend to many hundreds of years. Isaiah 65:20. Thus it would seem that the validity of Dr. Selye's theory is further attested by the Biblical prophecy that as soon as the tensions between men are removed there will be a time when once again man's life expectancy will parallel those in Genesis 5.

In this age when science is daily uncovering new areas for exploration, it would seem wise for today's skeptic to adopt a somewhat cautious position in his approach to the Biblical revelation and particularly so in regard to this matter of the langevity of life when considered in the light of Dr. Selye's theory.

BIOLOGY

Irving W. Knobloch, Ph.D.

High School Science Curriculum

In June, 1960, a two-year study of science in the Rochester, New York, high schools was completed. A portion of this report was published in *Ward's Natural Science Bulletin,* Vol. 34(1), 1960. The ideas presented there seemed so common-sense that we are reprinting a portion of the report below, leaving out the specific recommendations as they apply to the Rochester schools. High-school biology teachers in our membership may find some helpful ideas here.

Science makes a vital contribution to the student's liberal education. Training in scientific method can develop the powers of observation, analysis, and synthesis. Science engenders a respect for truth, stimulates the imagination, and promotes habits of creative and rational thinking. It enriches life by providing an appreciation of nature and natural phenomena.

The committee agreed to confine itself to the natural science curriculum—life, earth, and physical sciences. Thus the term "science," as used here, refers only to the natural sciences.

Purposes of Science in the Curriculum

The committee concluded that an over-all science program from kindergarten through twelfth grade could make a significant contribution in the following areas:

1. Scientific Reasoning. An important value that scientific training can give the student is training and experience in reaching objective conclusions independently on the basis of available evidence, carefully evaluated.

2. Cultural Appreciation. The scientific and technological revolution has affected all aspects of life so profoundly that no understanding of our society is possible without knowledge of the science that has created it.

3. Civic Competency. With the rise of such issues as fluoridation, space exploration, nuclear tests, bacteriological warfare, fallout, etc., it is increasingly important for the electorate in a democracy to follow the arguments involving scientific information and to arrive at informed opinions on these subjects. This is especially important for officials who occupy positions of leadership in the community or nation.

4. Consumer Skills. Scientific information and understanding should help to make individuals wiser purchasers, users, and maintainers of an increasing proportion of the consumer products of our time.

5. Occupational Choice. Science as a profession is a richly rewarding field and opportunities are constantly increasing. An introduction to science as a possible profession is necessary at an early age so that adequate preparation can be embarked upon.

6. Manpower Needs. With increasing numbers of persons going into technical and science-related occupations, preliminary familiarization with the methods and achievements of science provides a necessary orientation.

Guidelines

1. The science curriculum should distinguish between science and technology. Science deals with the phenomena and general laws of nature; technology with their application, outside of basic research. Both are important, but science is basic to technology. The curriculum should devote primary attention to science, with technology introduced as it may contribute to and reinforce the understanding of science.

2. The science curriculum should emphasize the mastery of concepts. The goal should be thorough understanding of a limited number of important concepts rather than a superficial survey of many. This requires careful selection of concepts at each level and course.

3. The science curriculum should aim to stimulate and develop the abilities of students to think boldly, creatively, and critically. This can be best done by a problem-solving and experimental approach, i.e., by posing questions about natural phenomena and seeking answers by inductive or deductive investigation and reasoning. The science curriculum should provide opportunity for individual or small-group investigations leading to basic insights.

4. The science curriculum should be extended beyond the classroom and the formal school day. Community resources and the summer period should be used to extend science opportunities for interested students.

5. The science curriculum should have balance and continuity from kindergarten through grade twelve. The content should not emphasize one area of natural science excessively. The curriculum should be a sequential continuum with its goal the establishment of a sound foundation in all of the areas of science.

6. The science curriculum should include both "enrichment" and "acceleration" opportunities for the talented student. "Enrichment" is defined as enabling a student to pursue a subject more extensively or at greater depth than the over-all curriculum provides. "Acceleration" is defined as enabling a qualified student to take a subject at an earlier date in the school program. Since more rapid completion is not the aim, acceleration opportunities should also make available advanced courses for those who qualify.

7. Time and/or funds for continuous in-service training for science teachers should be provided.

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CHEMISTRY

Walter R. Hearn, Ph.D.

Now that the A.S.A. Commission on the Philosophy of Science has been established to give continuing attention to such matters as metaphysics and epistemology in relation to science and Christian faith, a lot of us probably feel we can breathe more easily—somebody else is watching the store. Some of our most capable people will be looking after this aspect of our work; so the rest of us can go back to less complicated matters for which our scientific training and Christian experience have better prepared us. Most of us, perhaps the chemists especially, were well described by C. P. Snow in his lecture on "The Moral Un-Neutrality of Science" before the recent meeting of the A.A.A.S. in New York (*Science, 133,* No. 3448, pp. 255-62, 1961): "We all know that the philosophical examination of the concept of empirical truth gets us into some curious complexities, but most scientists really don't care. They know that the truth, as they use the word and as the rest of us use it in the language of common speech, is what makes science work. That is good enough for them. On it rests the whole great edifice of modern science. They have a sneaking sympathy for Rutherford, who, when asked to examine the philosophical bases of science, was inclined to reply, as he did to the metaphysician Samuel Alexander: 'Well, what have you been talking all your life, Alexander? Just hot air! Nothing but hot air!' "

Sir Charles's entire lecture and the accompanying comments by Theodore M. Hesburgh and William O. Baker are well worth reading. The main theme of the lecture is that scientists *cannot* be morally neutral because in the first place the *doing* of science involves us in the love of beauty and the search for truth; in the second place, our "direct" knowledge of the probable consequences of certain actions puts on us "a greater responsibility than is pressing on any other body of men." Snow includes not only knowledge of what nuclear bombs can do and knowledge that, statistically, if enough are manufactured, some are bound to go off, but also knowledge of what definitely *can* be done technologically to transform the living standard of half of the world now living in poverty. Hesburgh, from a background of graduate study in Roman Catholic theology as well as of science administration, adds two critical comments: First, he reminds Snow that there are two other generally recognized transcendentals besides truth and beauty: *being* and the *good*. Second, he states a personal distrust of statistical certainty where men are concerned. Baker, dealing with practical problems of science in human affairs, points out differences between the scientist's attitude toward truth, certainty, and discovery and the attitude of the ordinary citizen.

A debate perennially carried on at A.S.A. meetings and by correspondence in between meetings is over the question: "What effect does my being a Christian have on my research, and what effect *should* it have?" Usually I have taken the position that the "rules of the game" in science are so restrictive that the philosophical orientation of an investigator should *not* affect his research; *i.e.,* research done by a Christian will look the same as if done by a non-Christian, and the *research* papers published by a Christian will give no hint of his theological position. I think the situation *is* this way, and I think it *ought* to be this way, but the latter point often stirs up strong reaction. I can understand this from theologians and philosophers, but a lot of working scientists in the A.S.A. also seem to feel that their research should stem directly from their philosophy and should bear directly upon it. The fact that this feeling has been shared by scientists other than Christians is brought out in the statement from *The Principles of Scientific Research* by Paul Freedman quoted in the review of that book in this issue. Freedman tried unsuccessfully to base his research on a philosophy of dialectical materialism, but gave up the attempt without giving up the philosophy. His experience is like that run into by many of us in trying to base our research on Christian philosophy.

"A scientist who attempts to start his research from the point that his initial hypothesis must include some or all of the four principles of dialectic materialist philosophy will either frame an unsatisfactory hypothesis, or will find that he cannot make any satisfactory progress, do his research in another way, and either decide that dialectic materialism is useless as an instrument of research or attach it irrelevantly to his final conclusions. The only way in which it seems possible for a scientific investigator to make use of principles of dialectic materialism as instruments of research is for him to proceed with research without using them until he encounters certain effects which naturally suggest to him that he is witnessing a union of opposites, or a negation of a negation, or a change of quantity into quality: he is then able to make use of this discovery in framing a better hypothesis and planning more decisive experiments for its verification."

Christians might answer: "But dialectical mate-

Owing to the continuous development of science, the science teacher's training can never be "completed." Opportunity to keep up to date should be provided for every science teacher. He should not have to do this completely on his own time nor at his own expense.

rialism is a *false* philosophy and Christianity is *true;* so *it* ought to make a difference even if dialectical materialism doesn't." The point is, as the author points out, that "the inherent nature of scientific reasoning" excludes the application of general laws of the universe to a particular problem at the outset, "no matter how true and important such laws might be." I agree with Freedman that the influence of one's philosophy on his science *may* come naturally, but cannot be forced without damage to the research. When we find that our Christian position does affect the way we approach our investigations, we should certainly be frank to admit it, and in publication as well, but the rest of the time we shouldn't feel that we are "missing something" from either our science or our Christian experience. In areas of social science the bias of the investigator is often extremely significant, and it is a legitimate scientific procedure to acknowledge this bias in publication and to describe carefully the ways in which it was taken into consideration in planning and carrying out the research. A social scientist friend of mine said once, "Walt, your Christian philosophy may not make much difference if you're trying to grow crystals in the lab or corn in the field, but it makes a lot of difference if you're trying to grow kids. If the corn crop doesn't turn out too well because you used the wrong fertilizer. that may be embarrassing and even painful for a while, but if the crop of kids goes wrong because we teach them the wrong things, that's downright serious."

Well, this column is written for chemists, not social scientists, and many of us *do* feel that we want our scientific work and our Christian faith to be more closely integrated. How can we go about it if we're merely growing crystals in the lab? I staked out three broad areas the last time this column appeared: evangelizing our colleagues, serving through our technical skills, and contributing our scholarship to the Christian community. To relate this to the point of C. P. Snow's address, these areas all have to do with the scientist himself, rather than the science he does. Thus a Christian may worship in the lab by rejoicing aesthetically in his scientific work, praising God for the beauty of it (and confessing to God when our work is not as "neat" as it could be). We may rejoice also that our investigations lead us toward better understanding of God's truth in the ultimate sense, and that in carrying them out we are doing and telling the truth in the ordinary sense (and we must confess to God when we are tempted to "fudge" to make our work look better than it really is). Furthermore, we may joyfully take on this tremendous burden of responsibility which our scientific knowledge puts on us to *do* something for our fellow man (confessing that we are more often priest and Levite than Good Samaritan, always finding reasons why direct aid to the man in the ditch would be bad for him in the long run or would distract us from going about God's business). We can rejoice even though we fail because we *know* the forgiveness of God in Jesus Christ. Is this not our witness, as scientists who are His?

Recently in church I was meditating on the sermon and thinking that the points made in it were all such general ones that they could have no direct bearing on the life of anyone in the congregation, and it began to occur to me that almost all preaching is of this character. Preachers are often criticized for not getting down below this plane of platitudes to the level of personal conviction over specific rights and wrongs. At the same time, however, churches are criticized for being socially restrictive to a particular class or economic level. It occurred to me that it is impossible to go in both of these directions at once: If members of a church are from many walks of life and from different educational levels, preaching must be in the most general terms and understandable at the lowest educational level, and even at that is bound to be extremely difficult. If all the members of a church were of the same class, e.g., all scientists, or university professors, or migrant workers, then it would be possible to get down to consideration of the real temptations, sins, and spiritual needs of the congregation. Perhaps this accounts in part for the apparent warmth and spiritual vitality of sects which arise among people who are predominantly in the laboring class. I'm sure I have read accounts of social stratification of denominations in *Practical Anthropology* which bring this out. The point I am trying to make here is that if our local churches *are* to cut across boundaries of social class, race, educational achievement, etc., which most of us think is desirable, we are *bound* to be dissatisfied with preaching if we expect it to be directed at our own lives in any specific way. Looking back over my own Christian life, I find it to be a fact that the most effective work of the Holy Spirit has come in the midst of relatively small groups in which we all had much in common, and not in "public" worship or in the larger church family. This has led me to a re-evaluation of my concept of the structure and function of the church, but this is not the place to discuss that.

My point here is that if anyone is going to apply Christian principles to our lives as scientists, it must be we ourselves who do it. Preachers, theologians, even Christian philosophers cannot do it for us because they are not really familiar with our problems. So this becomes a vital function of the A.S.A., and the A.S.A. becomes a vital arm of the church. I suppose what we are talking about here could be called a Christian "sociology" of science rather than a Christian philosophy of science. Most of us are as poorly prepared in sociology as we are in philosophy! On the other hand, our actual behavior as Christians in science is part of the data, and we are the only ones who can provide it. Discussion of what we *ought* to do should be based on consideration of what we *are*

doing. We should acknowledge our sinfulness if we seek cleansing.

Actually, what most of us are concerned about are the "how" questions rather than the "why" questions after all. We know why we want to do the right thing—because we belong to our Lord and Savior Jesus Christ. What we don't always know is *how* to do it.

How do we go about doing research? How do we choose between ideas? How do we feel toward our own accomplishments and failures? How do we teach our students? How do we decide between working as hard as we could at the lab and spending more time with our families? How can we balance justice and mercy when evaluating students? How do we behave toward our research directors? How do we treat our technicians? How *should* we do these things?

These are some things I would like to explore in this column in future issues, and I would appreciate contributions from the rest of you, whose experience is undoubtedly different from mine. Suppose we begin next time by discussing ways of choosing research problems. Have some of you had experience of direct spiritual guidance, of answered prayer, of Scriptural insights in handling this problem? Is this one of the areas in which a Christian's approach might be different from a non-Christian's? Have scientists of the past who were Christians described their own experiences in the literature? Well, to paraphrase Freedman, let us begin this investigation as scientists would, with the data at hand that bear on the problem rather than with philosophical generalities, no matter how true or important these might be. Eventually we may get to a Christian philosophy of science.

Indeed, we may begin to construct one.

PHILOSOPHY

Robert D. Knudsen, Ph.D.

Modern Thinkers

An event worth noticing in evangelical circles is the appearance of the first volumes of a projected "Modern Thinkers Series," monographs on important modern leaders of thought, edited by David F. Freeman, of the Philosophy Department of the University of Rhode Island. The series is intended to include ". . . a critical analysis from the standpoint of the Reformed Faith of those philosophers and theologians of this century who have rendered outstanding contributions in their field." To date eight volumes of approximately fifty to seventy pages have appeared, and it is expected that the series will gradually be augmented by other titles. The booklets are being published by the Presbyterian and Reformed Publishing Company, Box 185, Nutley, New Jersey.

The publication of this series should fill a real need. For a considerable time it has been difficult to discover adequate material on leaders of contemporary thought to place in the hands of inquiring college and seminary students. The "Modern Thinkers Series" should to a great extent eliminate this difficulty. The monographs are written by competent men in their fields, they are attractively designed, and though the proofreading is sloppy, the writing itself is generally good.

Of the eight available titles four are on philosophers and four are on theologians. In this and succeeding columns we shall take note of these volumes and also of subsequent ones as they appear.

The first monograph we shall consider is that of the Kampen professor of New Testament, Herman Ridderbos. He writes on another New Testament scholar, Rudolf Bultmann, professor emeritus at Marburg. After a decade or two of intensive interest in Karl Barth, there are definite signs that the more radical Bultmann is about to receive more attention in evangelical circles. For one who is interested in a short introduction to an important area of theological discussion Ridderbos' *Bultmann* ($1.25) should be welcome.

For clarity and organization, Ridderbos' contribution is one of the best of the theological series to date. He presents in a clear and readable fashion Bultmann's famed program of demythologization and a critique from a conservative, Biblical point of view.

To be sure, the problem of myth does not occupy Bultmann only. In the development of Reinhold Niebuhr's thought, for instance, this problem has played an essential part. But Bultmann can be said to have impressed it most forcibly on the contemporary theological mind.

The problem arises because of the supposed expulsion of a naive, mythical view of the world by the enlightened scientific understanding, which desires to interpret all phenomena in terms of immanent categories. Thinking in terms of Bultmann, Ridderbos says, "The question which one raises in connection with the New Testament is: Can a person who no longer thinks in mythological terms find divine redemption, kerygma, within the redemptive act, described in the New Testament as a mythical event, and within the person of Jesus, conceived of as a mythical divine person" (p. 20).

As Ridderbos points out, Bultmann answers affirmatively in terms of a message which he believes he can disentangle from the mythical

trappings in which it comes to us in the Bible. This Biblical message, in turn, is interpreted strongly in the line of the existentialistic philosophy, particularly that of Martin Heidegger.

Ridderbos' essay is helpful in placing the contemporary theology of Bultmann with reference to the older liberalism. (Cf. p. 20.) There is also sound understanding of the existentialistic motifs in Bultmann's thought. (Cf. p. 19.)

Even though he must be respectful of Bultmann's erudition and the massiveness of his New Testament interpretation, Ridderbos concludes that Bultmann's reconstruction of the New Testament message in existentialistic terms is a failure, and itself comprises a greater unlikelihood than the supposed mythical world view that Bultmann is intent on deciphering. (p. 46.) The reading of Ridderbos' careful presentation should be of value to anyone who wants to have an introduction to a theologian who will increasingly receive attention in evangelical circles.

SOCIOLOGY

R. Heddendorf, M.A.

The Christian's Role: The Pattern Variable Frame

Part IV

There is not a Christian who would deny that the role of the Christian begins with the new birth. When viewed in this way, however, it should be seen that an individual is initiated into the Christian's role by means of a creative act of God in the same way that the process of physical birth is a creative act. For this reason, the role of Christian is unique because it cannot be completely anticipated as a future social role by the actor. Thus it is not always possible to "train" for the correct performance of the role.

The two general classes of status recognized by the sociologist are the ascribed, which is mandatory and assigned to the individual such as age and sex, and the achieved, which is the culmination of a person's striving and effort such as an educational or occupational status. Apparently the Christian's status doesn't clearly fit into either of these categories.

Rather, the "new birth" implies that the Christian role is a unique experience for the individual, one which may completely cut into his normal pattern of social development. The new Christian, therefore, finds that the new behavioral patterns expected of him are quite different from those for which he has been trained and which society has indicated were acceptable. This break in expected status fulfillment is referred to as a discontinuity.

The role of Christian, therefore, must be viewed as one which is not only incompatible with the roles in society with which the individual must come into contact, but also as one which may be contradictory to the previous roles which the new Christian has experienced. Not only are many new Christians without "training" for their new role, but they are hindered by their experiences in previous secular roles. The testimony of Paul in Philippians 3:5-7 is vivid evidence of God's power to overcome such a background. Nevertheless, the resultant tensions of this discontinuity are real and must be understood as a potential source of role strain.

Some of the most glaring contradictions between expected Christian role behavior and the behavioral patterns of contemporary American society may be seen by comparing what are generally referred to as the pattern variables of social behavior.

When individuals interact, their relationships will vary between a very general interest in one another to a rather limited concern. The former is referred to as the diffuse variable and the latter, the specific. Our society motivates the individual to stress the specific form of role such as the contractual agreements into which we enter every day. There is little concern for the individual in this relationship. What is important is the status or position which is represented. The salesman is concerned only with his client as a potential buyer of his product. The relationship is relatively superficial and temporary and often directed toward the achievement of some ulterior purpose. Such a value is not in agreement with the Christian's role.

Rather, the Christian is oriented toward a more diffuse role. He should become more interested in the general attributes of the individual. There must be a concern with the person's spiritual and other personal needs, regardless of his particular social position. Since there is little training for such a pattern of behavior in our society, the new Christian must seek to overcome this discontinuity.

It should be noted here, however, that the diffuse role has an inherent weakness. The characteristic generality of the role may be stressed to such an extent that the role becomes meaningless with a lack of purpose and direction. Either there would no longer be a compulsion to relate to others in accordance with the role requirements, or else the expected role performance might become so vague as to result in severe inefficiency of role performance.

The affectivity-neutrality pattern variable has to do with the amount of "feeling" or affect which may be permissible in performing the role. There are many signs in our current society which would indicate that we are strongly oriented toward "neutral" relationships which require us to control our feelings and suppress them. This trend is particularly evident in our patterns of child rearing.

The role of Christian probably relies more heav-

ily on an affective response than a neutral. There is, undoubtedly, a need to suppress feelings in maintaining the discipline which the Christian requires. Nevertheless, in interpersonal relationships, there is a greater need for sincerity and committed affective concern for the individual than would be manifested by the non-Christian. While the existence of neutrality in the Christian's role is relative to the amount of secular learning which must be suppressed, the affective response is more inherent and demanding.

Quite similar to the diffuseness-specificity pattern is the variable of universalism-particularism. This concept centers in the obligations an individual has toward another based upon group memberships. In our society, many relationships accrue from the obligations one has with members of his social class, political party, or social groups. Such obligations are particularistic. They are necessary for training social members to conform to social patterns, but they often restrict the individual, particularly in the transfer of such obligations to a more general social grouping.

The Christian, however, must concern himself with any unsaved person, whomever he might be. This emphasis on the individual, regardless of social position, is the peculiarity of the variable of universalism. It refers to all people of all times. Hence, the Christian must have sufficient flexibility to see beyond his narrow social group. Nor is this a requirement only for the missionary who must deal with members of an unfamiliar culture. "Social myopia" of the Christian, causing him to relate only to the secular groups with which he comes in contact, may result in weakening his role peformance.

The quality-performance pattern variable stresses the particular personal characteristics of an individual which may form a basis for a relationship. The quality pattern emphasizes objective characteristics such as age and sex, previously referred to as ascribed. A relationship concerned with performance pays particular attention to what a person can do, or the achieved characteristic.

Our society has traditionally been oriented to the performance variable. The great emphasis on competition and success has filtered into every aspect of our social life. Again, however, the Christian, in order to maximize his role performance, must minimize the importance of such a behavioral pattern. It is necessary that he realize that his achievements have been directed by God. He must view others as stripped of their social statuses and see their objective need of salvation.

Previous articles in this series have stressed the point that the Christian role must be deviant. It should be noted, however, that the discontinuities discussed here are the result of such deviancy. When he differs from the standards of the world, the Christian must realize that he must adjust to new behavioral patterns. These are necessary requirements for adequate role performance.

BOOK REVIEWS

The Principles of Scientific Research, by Paul Freedman; Pergamon Press, Inc., New York, Second Edition, 1960; 288 pp.; $4.50.

Reviewed by Walter R. Hearn, Associate Professor of Biochemistry, Iowa State University, Ames.

I was attracted to this book by its title because of my desire to compile a short reading list for my graduate students of significant but entertaining books dealing with philosophical, social, and "political" aspects of science. The author was a British electrical engineer who apparently spent most of his research career in industrial laboratories; his son has up-dated the original (1948) edition by adding accounts of recent developments to the historical section and some tables of current information to the section dealing with sources of support for science.

The author stresses throughout that ability to do first-class research is not shared equally by all scientists. His purpose in writing is largely to encourage young scientists who may have the gift not to give up science before they find opportunities to develop and use their gift. Unfortunately, I found the book as dull as some young Britishers apparently find their early years in scientific careers! A much more enjoyable way of getting a glimpse of the principles of scientific research in an English setting is to read C. P. Snow's fascinating novel, *The Search.* However, several aspects of the book were of interest to me. Instead of a historical account of science itself, a short history of "research" is presented, the author attempting to sort out real innovators in science from mere accumulators of knowledge. Some of the choices and omissions inevitably seem arbitrary in spite of efforts to justify them. The difference between a scientific and a theological approach to questions is pointed out acceptably, and the tendency of scientific orthodoxy to establish itself and stifle further investigation is also noted.

I was perhaps most fascinated by the chapter on research and philosophy because of a parallel to some of our A.S.A. discussions on the subject. Freedman was apparently quite eager to base his research on the philosophy of dialectical materialism, just as many of us are trying to relate our research directly to our Christian philosophical position. He eventually gave it up, largely because of "the inherent nature of scientific reasoning." Some of us have come to the same conclusion, I think: "Successful scientific reasoning appears always to require as its starting point a consideration of available data relating to the specific problem, and not an attempt to apply to the particular problem general laws of the entire universe, however true and important those laws might be."

A few helpful suggestions are found in chapters on the mental approach, planning and organizing research, making a choice between accuracy and economy, and determining the minimum number of essential observations. One point seldom discussed elsewhere is how to estimate the amount of time necessary to "finalize" a piece of research before going on to something else. Most of these points are illustrated by examples from the author's own experience, and indeed, the examples are much more helpful than the tiresome categorizing into types of problems, types of investigators, types of research teams, etc. I have the feeling that if a young scientist had enough experience to appreciate these categories, he would also already know what the book is trying to tell him. In my own experience, discussions of such matters as "how to apply statistics in research" seem completely useless until I am faced with a particular problem and am looking for a particular statistical method.

The one chapter I *would* like for my students to read is the chapter on general conditions of experimentation; an example of the "Socratic method" of dialogue between research workers is given that is really choice. The real excitement and challenge of scientific research comes through in that example better than anywhere else in the book.

Self-Organizing Systems: Proceedings of an Interdisciplinary Conference, edited by Marshall C. Yovits and Scott Cameron; Pergamon Press, Inc., New York, 1960; 322 pp.; $8.50.

Reviewed by Walter R. Hearn, Associate Professor of Biochemistry, Iowa State University, Ames.

Most readers of this book will probably have as much trouble as I did trying to understand the technical points made in individual papers, but that is to be expected when chapters by zoologists, psychologists, electrical engineers, and mathematicians all appear in the same book. "Who is sufficient for these things?" But the over-all impact of the book should get through to all of us in the A.S.A. who have been thinking about the nature of life and the nature of man: model systems *can* be constructed which have the ability to "organize themselves," to sense their environment and adapt to changes in it, and to "learn" to discriminate between stimuli. The limitations of present understanding of such systems are freely admitted in the papers and further revealed in discussion following each paper, but this admission does not detract at all from the impression that extremely useful theoretical generalizations are beginning to be made about how life processes work, including processes in the human brain.

One of the most readable papers is by H. von Foerster on the relationship of self-organizing systems to their environments. His paper begins with the thesis: "There are no such things as self-organizing systems!" He means this in the sense that such systems do *not* violate the Second Law of Thermodynamics, but merely appear to because of failure to consider the environment as part of the system. If the self-organizing system is considered to be "that part of a system that eats energy and order from its environment," and if it is realized that the environment is real and has structure, then it is all right to say that some systems do increase their internal order. With some ingenious illustrations he shows how order can arise from apparently random processes in a model; a later paper by the embryologist Robert Auerbach describes beautifully a simple "living" system which illustrates the point even better. The most biochemically-oriented paper is by Stanford Goldman on cybernetic aspects of homeostasis, dealing specifically with the problem of how blood glucose concentration is controlled in the mammalian body. Goldman is in a department of electrical engineering!

Most of the book is concerned with analogs of brain function. Titles of some of these papers are: "Self-Organizing Models for Learned Perception," "A Variety of Intelligent Learning in a General Problem Solver," "Blind Variation and Selective Survival as a General Strategy in Knowledge-Processes," and "The Natural History of Networks." A. M. Uttley sums up the area covered by the conference in a short final address entitled "The Mechanization of Thought Processes," closing with some of the questions which will be raised in the mind of the ordinary man by this kind of research: Will unemployment result from the development of automata? Shall we make brains? Are we debunking man? In my opinion, evangelical Christians capable of understanding some of the scientific problems involved here owe it to the rest of the Christian community to prepare themselves for some hard thinking about these things, lest new warfare between science and theology spring up and our theologians, unprepared, find themselves fighting in unfamiliar territory once again, and once again have to retreat. Reading this book carefully is as good a place to begin as any I know of.

Christianity and the Scientist, Ivan G. Barbour, Chairman of the Department of Religion and Associate Professor of Physics, Carleton College, Northfield, Minnesota. Published by Association Press, New York; 1960; 128 pp.

Reviewed by R. L. Mixter

This is one of the Haddam House Series on the Christian in His Vocation.

You do not read this book to develop a Christian apologetic from observations of natural science but rather to view yourself as a scientist who is putting his Christian principles in practice in his vocation "to serve human need, to seek truth, to work for a better society, and to worship God." Barbour discusses each of these elements in a concise and forceful manner.

Research should investigate any field, even if its results can be detrimental to man, for it is likely that most accomplishments can be turned to man's benefit, and the scientist needs to lend his influence toward the proper use of his findings. The problem of national policy and nuclear warfare is an illustration. Even the value of space research is considered.

The ethical requirements of scientific activity are rationality and honesty, universality and co-operation, disinterestedness and open-mindedness, and freedom.

Other significant topics treated are: the science teacher and the student (in which the author discusses teaching the methods of science, religious implications in science courses, and relationship of students and faculty); science and the social order (ideas on freedom in science and society, worship of technology, and science and national policy); and the scientist as a person (who has pressures on the job, whose beliefs are influenced by science, and whose religious faith should include personal involvement and reflective detachment).

Barbour mentions the American Scientific Affiliation in two connections, as an example of Biblical conservatism, and as a group stressing the evidence of design.

This book will give you an increased appreciation of your status in church and community and your sense of duty toward them.

Available from A.S.A. librarian, R. Mixter, Wheaton College, Wheaton, Illinois.

LETTER

January 24, 1961

Editor:

I was pleased to read Dr. Knobloch's review of our book, *Darwin, Evolution and Creation* in the December, 1960, issue of *The Journal of the American Scientific Affiliation.* Dr. Knobloch indicates that he was puzzled by the statement that the uranium-lead method is limited to rocks of less than a million years in age. I think both he and your readers would appreciate knowing that this was an unfortunate typographical error in the book. Actually the statement is intended to say that the uranium-lead method is used primarily in dealing with rocks greater than a million years in age. The reason for this lies, of course, in the long half life of the uranium isotopes. I am glad that Dr. Knobloch called attention to this, since it provides me with the opportunity to make this correction.

Very sincerely yours,
Paul A. Zimmerman
Concordia Teachers College
800 North Columbia Ave.
Seward, Nebraska

A.S.A. Executive Council Meeting

August 22, 1960
Seattle, Washington

The following report is a condensed summary of the secretary's minutes.

Chinese Translation

Permission was granted for a translation into Chinese of *Modern Science and Christian Faith* by Scripture Press.

Old Business

Reports were discussed from the Planning Commission and for the publicity brochure.

Annual Convention Locations

1961: Houghton College is to be host, August 22-25. Dr. R. Luckey will be the General Chairman.

1962: Bethel College is to be host in August.

1963: Westmont College has extended an invitation. However, the Council did not make a decision.

Annual Convention Programs

The Planning Committee proposed establishing permanent committees in areas of study (natural science, social sciences, psychology, and philosophy of science suggested) with responsibility for long-range planning of convention program devoted to a single area each year.

Local Sections

The Delaware Local Section was officially recognized, having submitted the required ten-member petition.

The Indiana Local Section was also officially recognized, having met similar requirements.

A.S.A.-E.T.S. Joint Committee

A.S.A. members of the committee are J. W. Klotz, W. J. Tinkle, and I. R. Brunk. Tentatively, the meeting may be at Goshen College, June, 1961.

Manuscripts

An Editorial Committee is to set up to consider A.S.A. publications other than the *Journal.* (This is a different group from the *Journal's* Editorial Board.)

A.S.A. Executive Council Meeting

Friday and Saturday
October 28, 29, 1960
Chicago, Illinois

[*Below is the Editor's condensation of Secretary Hearn's minutes.*]

The meeting on October 28 began at 10:00 A.M. in a classroom, continued through lunch in the M.B.I. cafeteria, and adjourned at 6:00 P.M. From 8:30 to

10:00 P.M. the meeting was continued in a conference room at the Lawson YMCA, where the Executive Council members stayed. On October 29, the meeting was continued in the classroom at M.B.I., from 8:30 A.M. to noon and 1:00 to 3:30 P.M. The full Executive Council was present at all sessions: H. H. Hartzler, presiding; H. D. Weaver, Jr.; W. R. Hearn; W. L. Bullock; J. F. Cassel; and D. N. Eggenberger. The meeting was opened by prayer led by each member of the Executive Council.

1. *Devotional Meditation*

Dr. Hartzler read a passage from Psalm 139 and commented on the importance of the task of the A.S.A. and of this meeting.

2. *Reading of the Minutes*

H. H. Hartzler reported that J. W. Klotz has resigned from the committee for joint A.S.A.-E.T.S. meetings and been replaced by J. Kraakevik of Wheaton College. In the minutes of the August 22 meeting, designations of 2, 4, and 6 years for these committee members mean replacement after the 1961, 1963, and 1965 joint meetings, respectively.

W. R. Hearn discussed the problem of unsolicited manuscripts coming to the secretary's office and expressed the opinion that policies need to be established soon to avoid becoming "a haven for unpublishable manuscripts on science and faith." H. D. Weaver moved that a Publication Board be established to decide on policy and procedures for publications other than the *Journal;* the motion was seconded and passed, but action was deferred until later in the meeting.

3. *Report of the Nominating Committee*

H. H. Hartzler reported that Chairman J. R. Howitt had written that the report of the Nominating Committee was not yet complete.

The problem of functioning of committees appointed on a nation-wide basis was discussed, and it was agreed that having committees meet and function during annual conventions would be more efficient than trying to come to decisions entirely by correspondence. It was agreed that the Executive Council and national committees, commissions, and boards should have scheduled meetings on the first day of annual conventions; the program of papers and symposia to begin on the second day. The Nominating Committee and other *ad hoc* committees are to be appointed by the president and announced during his annual report at the beginning of the convention; the annual business meeting will be held at the end of the convention and reports of all committees made at that time. This move places more emphasis on attendance at annual conventions and is in line with procedures of other scientific societies.

4. *Candidates for Fellow Grade of Membership*

A lingering misunderstanding of responsibilities in election of new fellows was cleared up by discussion. The vice-president is responsible for the recommendation of new fellows to the Executive Council; the secretary is responsible for the election by the body of fellows of those nominated by the Executive Council. A lengthy discussion of the significance of nomination by the Executive Council followed, and it was agreed that nomination implies only that the Executive Council endorses a candidate's qualifications as spelled out in the Constitution and By-Laws and nothing more; *i.e.,* nomination does not imply endorsement of any candidate's position on matters of interpretation of Scripture or philosophy of science. It was also agreed that a statement to this effect should appear on the ballot sent to fellows.

The vice-president was instructed to set up a systematic procedure for selecting candidates for fellow grade from the ranks of members. It was agreed that only those actually holding an earned doctorate should be considered eligible, except in rare cases.

5. *Report of Publicity Brochure*

H. H. Hartzler circulated the preliminary copy prepared by D. Suter. Suggestions made by the council for changes are to be incorporated by the secretary and the revised copy circulated by mail to the council for further criticism or approval before being sent back to Mr. Suter for designing of the layout and art work. President Hartzler is to express the council's appreciation to Mr. Suter for the fine work he has done and to request that he take charge of the printing. It was agreed that a high press run is desirable, using the business manager's present address in a form that could be overprinted when a permanent office is established.

5a. *Publicity for Evolution and Christian Thought Today*

H. H. Hartzler reported that *Evolution and Christian Thought Today* had been picked as one of the best books of the year by 25 book reviewers for *Eternity* magazine, and suggested that this fact ought to be publicized. Discussion of ways to stimulate the distribution of the book followed. W. R. Hearn requested permission to give copies of the book to certain persons when this might conceivably result in increased sales for the book or favorable publicity for the A.S.A. This permission was then extended to the entire Executive Council to be used at their discretion.

6. *A.S.A. Directory*

Recommendations for the new edition of the *Directory* were as follows: Size should enable it to be carried in a coat pocket; Constitution and By-Laws should be included; geographical listing should also be included; fellows, members, and associates should be listed separately; the field of specialization of fellows and members should be in all capital letters so it can be picked out easily. For future editions it was recommended that telephone numbers be included on the information request cards and printed in the *Directory* to promote contact when members travel.

6a. *A.S.A. Mailing List*

The council recommended that the secretary have

the business manager inquire of our *Journal* publisher concerning the cost of making approximately a dozen copies of the *Journal* address list from addressograph plates on 3 x 5 or other convenient-sized cards, plus the cost of running off the same number of sets of cards each time additions or corrections are made.

7. *"Story of the A.S.A." Reprinting*

D. N. Eggenberger was instructed to proceed with the reprinting of *The Story of A.S.A.* immediately, by having the business manager circulate the copy to the Executive Council for approval. Recommendations were that the size be suitable for mailing in a Number 10 envelope and that it be used primarily for sending to good prospects for membership in A.S.A.

8. *Plans for Annual Conventions*

The suggestion (see Item 3) that all annual conventions begin on a Monday—with Monday reserved for official meetings of the Executive Council, committees, boards, and commissions to be listed on the program—was adopted officially. The program of papers and symposia will then begin on Tuesday, or perhaps on Monday evening.

For 1961—Place: Houghton College, Houghton, New York; Dates: August 20-24; Program: planned by former *ad hoc* Planning Commission, with H. D. Weaver as chairman.

For 1962—Place: Bethel College, St. Paul, Minnesota; Dates: August 20-24; Program: planned by Psychology Commission.

For 1963—Place: Westmont College, Santa Barbara, California; Dates: August 19-23; Program: planned by Social Sciences Commission.

For 1964—Place: Midwest, possibly Chicago or Indiana; Program: planned by Natural Sciences Commission.

For 1965—Place: East or South; Program: planned by Philosophy of Science Commission.

It was agreed that a general policy of holding annual conventions preferentially in cities or regions with strong Local Section activity be adopted and publicized to the membership. It was also agreed that where possible the Local Section should have the responsibility of making local arrangements, including the recommendation to the Executive Council of one person to be designated official local arrangements chairman by the council, and encouragement of at least that person and preferably persons to attend the annual convention held the previous year.

8a. *Report on Plans for 1961 A.S.A.-E.T.S. Meeting*

H. H. Hartzler read a letter from M. C. Tenney, chairman of the committee to plan joint meetings of the A.S.A. with the Evangelical Theological Society. The topic chosen is "The Future of Theology and Science." Proposals for the program made by the committee were discussed by the council and several suggestions for changes were made which are to be communicated to the committee by President Hartzler.

9. *Commissions and Committees Recommended by Planning Commission*

Considerable time was devoted to consideration of the Planning Commission's recommendations. The possibility of having a commission devoted to problems of archaeology, linguistics, and perhaps Biblical exegesis was considered. It was concluded that the scientific aspects of these topics could presently be treated under the four recommended commissions, and that theological aspects could best be treated in joint meetings with E.T.S. The problem of length of service for members of commissions and number of members for each were discussed. It was agreed that those appointed to a commission by the Executive Council would be better informed than the council about other A.S.A. members who should serve on the commission and should make recommendations to the council on this point. It was agreed that in general a commission's responsibility should continue until it had planned and directed the program of an annual convention, but no specific machinery for retiring members of the commissions was set up.

The following were appointed to commissions:

Psychology
P. Davis, Chairman
D. Busby
L. Granberg
N. E. Peterson

Social Sciences
P. Peachey, Chairman
J. Buswell, III
D. O. Moberg

Natural Sciences
A. Smucker, Chairman
W. Ault
J. McIntyre
D. S. Robertson
A. Van der Ziel

Philosophy of Science
T. H. Leith, Chairman
C. Hatfield
W. Liefeld
G. K. Schweitzer
C. Starkey

President Hartzler is to inform these appointees by letter and to activate the commissions so they may begin planning future annual convention programs.

Appointment of the functioning committees recommended by the Planning Commission was not completed in the press of other business. It was agreed that a Membership Committee whose function is to promote the enrollment of new members of all classes is desirable. It was also agreed that a Publicity Committee to handle press releases, magazine articles, advertisements, and other methods of publicizing the A.S.A. is desirable. It was agreed that the Executive Council should continue to do the work which might be assigned to a Finance Committee, at least for the time being.

Appointment of a Publications Board to determine policy and procedures for publications other than the *Journal* (and exclusive of publicity and public relations items) was made without designation of a chairman, as follows (see Item 2):

R. Bube
R. P. Dilworth
I. Knobloch
R. L. Mixter
C. T. Moore
K. Turekian
G. D. Young

W. Hearn recommended one type of publication that might be of value to the Christian community and provide good publicity for the A.S.A. in the near future: a list of books on science and faith for church libraries, annotated with brief comments or classified as to point of view of the author and probable value to readers.

10. *Encouragement of Local Sections*

The method of building up a local mailing list before sponsoring a meeting, used effectively by the North Central Section, was recommended by the council for all local groups. The policy of holding annual conventions in regions with active Local Sections and letting the Local Section have responsibility for planning local arrangements (see Item 8) should also encourage the formation of Local Sections—members who have been unable to attend an annual convention can thus bring the convention to their own locale. An increased use of Christian magazines and other magazines for articles on the A.S.A. was also suggested as a means of attracting attention to local groups.

It was moved, seconded, and passed that the rebate should be made on the basis of members and fellows only, and that no activity other than the paying of annual dues should be required. It was also agreed that for the time being the Local Section should use its own judgment in setting its geographical limits. It was brought up in the discussion that the By-Laws permits but does not require rebates up to $1.00 per local member, so that the policy can be changed if too great a financial drain on the national treasury results. The secretary-treasurer was instructed to write to the officers of each official Local Section to explain the rebate policy and to notify them of the necessity of turning in a complete annual report.

H. Hartzler presented the petition of the Los Angeles Local Section, submitted by Lewis H. Humphrey, local secretary, with the required signatures of ten members. The petition was unanimously granted by the Executive Council.

10a. *Co-operation with IVCF*

Discussion of some of the points in a letter of the secretary-treasurer to C. Hummel of IVCF led to agreement that full co-operation of A.S.A. with IVCF is approved. However, the suggestion made by W. Hearn that IVCF staff members might be granted automatic membership as associates in A.S.A. was rejected in principle. The policy of remission of annual dues at the secretary-treasurer's discretion was confirmed, but in the case of "home" missionaries, such as IVCF staff, it was agreed that each application for membership should be treated individually. It was felt that, in general, it is better for an applicant for membership to apply for remission than for it to be granted automatically.

11. *Recruitment of New Members*

This item on the agenda was considered as part of Item 9.

12. *Report of Editorial Committee Reading Wayne Frair's Manuscript*

The chairman of the committee, J. F. Cassel, reported on the current state of the committee's functioning. The handling of manuscripts with regard to the interests of both the author and the A.S.A. was discussed at length. It was agreed that an Editorial Committee could make suggestions for sweeping changes if necessary in their judgment, but that an author should then have the freedom to withdraw his manuscript from A.S.A. consideration or to remove his name as author if he does not approve of the changes made. For the A.S.A.'s publication policy, it was agreed that we do not wish to publish articles or books of a strictly polemic nature.

13. *Appointment of a Historical Committee*

President Hartzler recommended the appointment of the A.S.A.'s first five secretary-treasurers as a Historical Committee to collect, preserve, and publicize the archives of the affiliation. President Hartzler is to notify the following of their appointment:

M. D. Barnes — H. H. Hartzler
I. Cowperthwaite — R. L. Mixter
F. A. Everest

An historical paper is to be prepared by the Historical Committee for the twentieth anniversary (in 1961) of the founding of the A.S.A.

14. *Interview with Representatives of "Independent Couriers"*

Arrangement had been made by Mr. Carl L. Holmes of Westerville, Ohio, to present to the Executive Council his ideas for the formation of an organization of Christian professional organization which he has called "Independent Couriers." Mr. Holmes brought with him Mr. Jack Huseby of Columbus, Ohio, and Mr. Dave Breese of Wheaton, Illinois, and was allotted approximately one hour for his presentation. The Executive Council requested that a written presentation of the objects and bases for his organization be sent to the council, and instructed the secretary to send to Mr. Holmes information on DATA International, which the council felt already was accomplishing some of the goals of stimulating inventiveness among evangelical Christians, in which Mr. Holmes expressed particular interest.

15. *Consideration of Duties of an Executive Secretary*

Before interviewing a potential candidate for the position of executive secretary, the council discussed at length the type of work to be expected from a man in such a position. The responsibilities brought up included the following:

Serving as managing editor of *Journal* and *Newsletter*.

Maintaining an efficient business office with permanent address.

Working with Local Sections and helping to organize new ones.

Helping with arrangements for annual conventions.

Answering and routing incoming mail.

Traveling for recruiting purposes, taking an A.S.A. booth to other conventions, etc.

Maintaining useful lists of various kinds and compiling other information for the use of A.S.A. members and nonmembers.

Obtaining information for the Executive Council to help them in making policy decisions and exploring new areas for A.S.A. activity.

It was agreed that many of these functions could be performed by an efficient office secretary if she could work closely with a responsible A.S.A. officer. The secretary-treasurer pointed out the difficulties of having even a highly efficient business manager geographically removed from the responsible official. It was considered worth investigating to see if some Christian college could provide a permanent office in one of their buildings, so that an efficient office secretary under the direct supervision of an A.S.A. faculty member could perform most of these functions at a lower expense than employment of a full-time executive secretary would entail.

16. *Interview with Candidate for Executive Secretary*

The Executive Council had invited a young man to attend the meeting at A.S.A. expense to consider the possibility of employing him as a full-time Executive Secretary. The candidate requested that his name not be used publicly to avoid jeopardizing his present position.

The council was very favorably impressed with his personality, training, and qualifications for the position, since he has had experience in a scientific field (natural history) as well as editorial and public relations work.

The frank discussion of financial requirements revealed that it would take about $8,000 per year to employ this man full time, and to use him most effectively about $8,000 more ($800-2,500, travel expense; $3,000, secretarial help; $1,200, office rental; $3,000, printing, postage, and supplies). The candidate said he would consider beginning on a part-time basis, but did not wish to be in the position of having to raise his own salary.

18. *New Ideas for the A.S.A.*

This item was considered at various times throughout the course of the two-day meeting—particularly in the discussion with the candidate for the position of executive secretary. The problem of financing a move in the direction of a permanent office and executive secretary dominated the discussion to such an extent that other specific proposals were not recorded, except as mentioned under other items of the agenda.

19. *Other Items of Business*

The policy of sending copies of the full minutes of Executive Council meetings to fellows only and publishing abstracts in the *Journal* or *Newsletter* for the rest of the membership was confirmed.

20. *Adjournment*

The meeting finally adjourned at about 3:30 P.M., October 29.

PROGRAM FOR JOINT A.S.A.-E.T.S. MEETING IN SUMMER OF 1961

Place: Goshen College

Time: June 14-16, 1961

Theme: The Future of Theology and Science

Program:

Wednesday, June 14, 1961

1:30 p.m. Chairman: Dr. J. Barton Payne, Secretary, E.T.S.

Devotional Invocation: Dr. Robert B. Fischer, Electron-Microscopist, University of Indiana

Welcome: Dr. Paul E. Mininger, President, Goshen College

Papers:

1. "The Necessity for the Forward Look in Theology," Dr. Vernon C. Grounds, President, Conservative Baptist Theological Seminary

2:30 p.m. 2. "The Necessity for the Forward Look in Science," Correlationist, A.S.A.

Discussion

3:30 p.m. Coffee Break

4:00 p.m. 3. "Present Trends"

a. Biblical Studies
Dr. George A. Turner, Asbury Theological Seminary

b. Science
Dr. John R. Huizenga, Argonne National Laboratory

Discussion

7:30 p.m. Popular Meeting
Chairman: Dr. Henry D. Weaver, Jr., Vice-President, A.S.A.
"The Future of Human Relations"
Dr. C. William Hoglund, Practicing Dentist, Lombard, Illinois
Dr. David O. Moberg, Sociologist, Bethel College (Minnesota)

Thursday, June 15, 1961

9:00 a.m. Chairman: Dr. R. Laird Harris, Vice-President, E.T.S.
Devotions: Dr. W. Ralph Thompson, Old Testament, Taylor University
"The Relevance of Scientific Thought to Scriptural Interpretation,"
Dr. G. Douglas Young, Dean, Trinity Theological Seminary

9:45 a.m. "The Relevance of Scriptural Interpretation to Scientific Thought," Dr. James D. Bales, Christian Evidences, Harding College
Critique Panel: Dr. John C. Whitcomb, Old Testament, Grace Theological Seminary; Dr. Edwin Y. Monsma, Organic Science, Calvin College

11:00 a.m. Panel: Open Meeting
Previous participants
Dr. Allan MacRae, Old Testament, President, Faith Theological Seminary
Dr. Harold M. Spinka, Dermatologist, Chicago, Illinois

Lunch

1:30 p.m. "Science Looks into the Future" (Discussion following each speaker) Chairman; Dr. Harold Hartzler, Executive Secretary A.S.A.
1. Physical Sciences
Dr. James H. Kraakevik, Physicist, Wheaton College

2:30 p.m. 2. Social Sciences
Dr. Paul Peachey, History, Eastern Mennonite College

3:30 p.m. Coffee Break

4:00 p.m. 3. Biological Sciences
Dr. Irving W. Knobloch, Natural Sciences, Michigan State University

6:30 Joint Banquet—Dr. J. Oliver Buswell II, presiding, Dean, Graduate School of Theology, Covenant College and Seminary
Devotions: Representative of Calvin Theological Seminary
Speakers: Dr. Harold Hartzler, Executive Secretary of A.S.A.
Dr. Laird Harris, President of E.T.S.

Friday, June 16, 1961

9:00 a.m. "Implications for Education"—Chairman: Dr. Ralph Earle, Vice-President, E.T.S.
Devotions: Dr. Jared F. Gerig, Fort Wayne Bible College
1. Secular Education—Dr. John W. Alexander, University of Wisconsin
2. Christian Education—Dr. Woodrow Goodman, President, Marion College E.T.S. member

10:00 a.m. Brainstorming Session—Presidents

11:00 a.m. Business and Adjournment
Closing Devotions: "Admonitions of an M.D."—Dr. John S. Hyde, Practicing Physician, Oak Park, Illinois

Arrangements:

Lodging at Goshen College for the two nights, $3.75
One night only, $2.00
Seven meals for the conference, $4.85
Separate meals: breakfast, 40¢; lunch, 55¢; dinner, 65¢
Banquet, Thurs. evening, $1.75
For reservations, write Dr. Henry D. Weaver
Goshen College
Goshen, Indiana

(We have alternate speakers in mind in case some of the above cannot be present.)