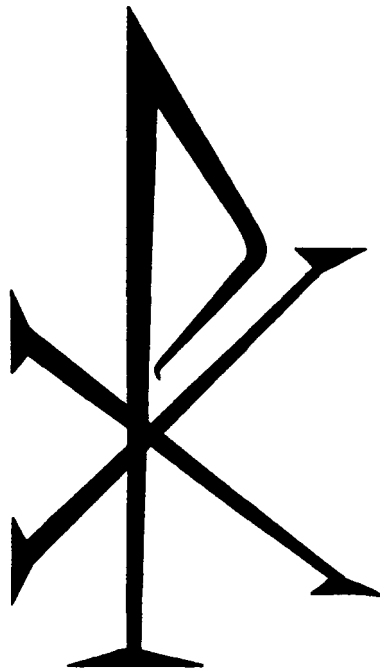


CREATION RESEARCH SOCIETY

1969 ANNUAL



Haec credimus:

For in six days the Lord made heaven and earth,
the sea, and all that in them is and rested on
the seventh. - Exodus 20:11

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TABLE OF CONTENTS

(Contents, or parts thereof, may not be reproduced in any form without
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	Page
Editorial Comments	3
Comments from the President	4
Does Science of Genetic and Molecular Biology Really Give Evidence for Evolution?	5
Walter E. Lammerts	
The Form and Structure of living Things	13
Frank L. Marsh	
"Ontogeny Recapitulates Phylogeny".	27
Wilbert H. Rusch, Sr.	
Research on the Classic Joggins Petrified Trees	35
Harold G. Coffin	
Chromosomal Changes-Mechanism for Evolution?	45
John W. Klotz	
The Empire Mountains-A Thrust Fault?	49
Clifford L. Burdick and Harold Slusher	
The Concept of Homology	55
Russell Artist	
Jack-in-the-Pulpit Preaches a Sermon	65
William J. Tinkle	
Comments on Scientific News and Views	67
Harold Armstrong	
Radiocarbon and Potassium-Argon Dating in the Light of New Discoveries in Cosmic Rays	71
Robert L. Whitelaw	
Book Review: ANIMAL DISPERSION IN RELATION TO SOCIAL BEHAVIOR	73
E. Norbert Smith	

EDITORIAL COMMENTS

At the onset of Volume 6 of the Creation Research Society publications, it is appropriate that tribute and heart-felt thanks be expressed to Dr. Walter E. Lammerts. At first alone, and then with the able assistance of such men as Dr. John N. Moore, Dr. Lammerts has edited these publications since their inception—the larger part of six years.

It was only upon his insistent request last year that the Board appointed a replacement for Dr. Lammerts in the position of Editor. Also it was only after Dr. Lammerts' sure promise that he would not abandon editorial responsibilities altogether that the present Editor was willing to attempt this monumental task. This is a heavy responsibility because Dr. Lammerts has established high standards of journalism, and has attracted an outstanding group of contributing authors. Under his able leadership, the *Creation Research Society Quarterly* and *Annuals* have flourished, and have become a respected scientific voice for Bible creationism.

It should be made clear that the new Editor will be relying heavily upon the scientific knowledge, reviewing skill, and downright good sense of Dr. Lammerts in days ahead. Our only consolation in his retirement from this post is that Dr. Lammerts will now have more time to produce papers of his own and to "scout" for papers latent among our membership. We may think of him thus, not as retiring, but as moving to a new and productive avenue of service for the Society.

* * * * *

Since the days of Sir Charles Darwin to our times, there have been many people who believed that there exist certain "classical arguments" which unquestionably support the evolution theory of origins. For a time, evolutionary explanations were recklessly accorded to data from such widely diverse areas as the fossil series, homology, "vestigial" organs, chromosome series, biogeography, recapitulation, etc. Everything seemed to fit so well that the theory was prematurely awarded the luxury of resounding success.

Yet, with little fanfare, each of these "classical arguments" has undergone serious re-evaluation and some have been completely discarded. Knowing this, one of our Board members believed that devoting an entire *Annual* to these "classical" problems would be like "beating a dead horse." He was right, but unfortunately these same outmoded arguments persist in textbooks, and laymen still believe them valid. Therefore, it has been deemed advisable to air the arguments openly here, to demonstrate their flaws, and to show in each instance that the scientific data fit better with special creationism.

Genetics and Molecular Biology

It is the bold assertion of some geneticists that modern developments invariably support the organic evolution concept. Concerning these same data, Dr. Walter Lammerts shows that molecular biology, far from being a support for the evolutionary superstructure, is a wonderful means by which the Creator maintains the various kinds of life.

Homology

Many science instructors glibly assert that "similarity means kinship." In his paper, "The Form and Structure of Living Things," Dr. Frank L. Marsh notes that such particulars as homology and convergence find ready explanation within the creationist framework.

The topic of homology is often stressed as a key evidence for the so-called "fact" of evolution. In his review ("The Concept of Homology") later in this volume, Dr. Russell Artist proves that similarities can be viewed as the product of creation according to common plan. In the course of his paper, Dr. Artist alerts readers to the dogmatism of evolutionary ideology in American school textbooks.

Biogenetic Law

It was Ernest Haeckel who popularized the idea that an embryo of a complex animal retraces the stages of its evolutionary development as the fetus grows. Professor Wilbert Rusch, Sr., not only enumerates the scientific shortcomings of this so-called "Law" but brings to his readers translations of original German papers which clearly show the fraudulent nature of Haeckel's drawings and arguments.

Fossil Forests

"How can you believe in a relatively young earth when buried forests and fossil beds of coal indicate great age?" We confront this question often, but will find help and answers in the research of Dr. Harold G. Coffin reported here.

Chromosomal Changes

If gene mutation is thought to be the "well-spring" of variability in evolution, then polyploidy and chromosome change in general are pictured often as the source of new genes.

Examining each type of chromosomal aberration, Dr. John W. Klotz concludes that none is the kind which would be required for any major evolutionary step. His thorough paper should do much toward dispelling the widespread notion that these changes lead automatically to evolutionary progression.

Geologic Column

Evolution theory always has as its corollary a series of long geologic ages, which are sup-

posed to have followed one another in a particular inviolable sequence. Yet there are some large areas of the earth's surface in which these strata are in a supposed "wrong order."

Dr. Clifford Burdick and Professor Harold Slusher investigated extensively just one such "wrong order" formation in the Empire Mountains of Arizona. Their study is astounding in that they find no physical indications that these rocks have been twisted, folded, or otherwise thrust into this condition. We must therefore conclude that the theory of evolutionary uniformitarianism has gotten the order wrong, and the rocks—as seen—are in the "right order" after all!

We are happy to present this piece of field research as it was financed in part by the Research Fund of the Creation Research Society. Accordingly, we wish to thank all parties who have so generously contributed to the Research Fund during the past two years so as to make this study possible. Since there is a balance in that fund, we hope that similar projects of high scientific caliber will be initiated and financed. We also invite additional contributions to the Research Fund in view of this concrete demonstration of what research dollars can do for creationism.

Along with these major articles within the theme of "classical evidences," the 1969 *Annual* presents several bonus features. Dr. William J. Tinkle's delightful article about the Jack-in-the-Pulpit poses some difficult problems for evolutionists right from the life cycle of a fascinating plant. Professor Harold Armstrong's informative column is a welcome source of information on many scientific topics. Professor Robert L. Whitelaw has provided additional ideas on evaluation of argon dating techniques. This volume closes with a timely book review by E. Norbert Smith.

Editors of Creation Research Society publications wish once again to invite the continued contribution of manuscripts from those authors who regularly support this endeavor. We wish also to encourage other members who have creationistic articles of scientific interest to submit such material. Since we wish to establish an expanding base of authors who think and research from the standpoint of creation and catastrophism, we particularly invite articles from new authors.

GEORGE F. HOWE

Editor

COMMENTS FROM THE PRESIDENT

With this *Annual*, the Creation Research Society begins the sixth year of publication. Walter Lammerts, who has done such an excellent job of developing and editing the journal during its first five years, is now turning over the editorship to the younger, but fully capable, hands of George Howe.

Dr. Howe is highly qualified for this responsibility in a number of ways—his excellent training (Ph.D. in Botany at Ohio State); his present position (Chairman of the Science Division at Los Angeles Baptist College); and, not least, by his firm knowledge and love of Scripture. That we can continue to expect an outstanding publication each quarter is abundantly evident in this first *Annual* edited by Dr. Howe.

In the meantime, Dr. Lammerts is not about to retire! In addition to continuing to work with George Howe on the quarterlies, he will do more of his own invaluable genetics research and writing for the Society. Furthermore, he is well along in the compilation and editing of a symposium volume of articles selected from the first five years of our publications. This volume should be a valuable means of making our work more widely and permanently available. I be-

lieve the impact of such a book, with articles grouped by subjects and brought up to date, and with appropriate explanatory editorial comments, can be tremendous.

This is therefore an appropriate time to evaluate our progress to date and to consider how best to improve our effectiveness in the future. There seems to be no doubt that the main function of our Society must be, as its name implies, that of *research*, together with publication of results of that research. Obviously we must be bound, in the interpretation, of our research data, by the divinely-revealed framework of history and cosmology, as given in Scripture. But this restriction, rather than hindering science, as evolutionist critics would allege, instead provides the only key with which men can ever hope to unlock the real meaning of the relationships in natural processes and to utilize them most effectively for the true benefit of mankind.

As the greatest scientists of the past have said—men such as Kepler and Newton, for example—true research is simply "thinking God's thoughts after Him." When seen in their true perspective, "the heavens declare the glory of God, and the

(Continued on Page 26)

DOES THE SCIENCE OF GENETIC AND MOLECULAR BIOLOGY REALLY GIVE EVIDENCE FOR EVOLUTION?

WALTER E. LAMMERTS*

By reference to beans, roses and corn, variation is shown to be limited and not unlimited as Darwin thought. Mutations are generally harmful. Even assuming a 1% advantage, which no mutation reported has actually shown, rate of accumulation of mutations in a species is so slow that it would take about 1,000,000 years for a species population to become uniform for one mutation. This makes them ineffective even in microevolution as means of accumulating the constant features distinguishing species. The giraffe is used to illustrate this fact.

Also biological species show remarkable variation in chromosome number and form. Translocation and inversions occur rarely and spontaneously in species populations. Most translocations in the fruit fly, *Drosophila*, are either invariable when homozygous or cause a reduction in fertility in one or both of the sexes. In plants, homozygous translocation are usually normal in fertility and vigor. However, none of them are more vigorous than the normal or standard type. Accordingly there is simply no way for them to become established as homozygotes in all the individuals of the population. Experimentally produced polyploids are variable in chromosome number due to quadrivalent formation and so their offspring have a variable chromosome number. Also they are reduced in fertility, so could not become established in nature, since natural selection would operate against them.

Some idea of the complexity of the DNA-RNA system is given. This remarkable interlocking system could not be the result of chance variation. Also reference to work with bacteriophage and tobacco mosaic virus shows that these organisms will not stand the slightest change in the nucleotide bases or their order in the very long and complex DNA molecule. Only the genius of a remarkably intelligent Being we worship as God could have designed such an efficient yet intricate system.

I

Variation and Mutation in Relation to the Evolution Theory

According to Charles Darwin, natural selection of advantageous variations leads to the formation of new species, genera, families, and indeed all the marvelous variation we observe in the realm of biology. He considered variation as essentially unlimited with those individuals most fitted to the environment being naturally selected. In the following generation, the same range of variability would occur again. Thus in the classical case of the evolution of the giraffe, quoting Darwin¹:

So under nature with the nascent giraffe, the individuals which were the highest browsers, and were able during dearths to reach even an inch or two above the others, will often have been preserved; for they will have roamed over the whole country in search of food. . . . These slight proportional differences, due to laws of growth and variation, are not of the slightest use or importance in most species. But it will have been otherwise with the nascent giraffe, considering its probable habits of life; for those individuals which had some one part of several parts of their bodies more elongated than usual, would generally have survived. These will have intercrossed and left offspring, either inheriting the same bodily peculiarities, or with a tendency to vary again in the same manner; . . . By this process

long-continued, . . . combined no doubt in a most important manner with the *inherited* effects of increased use of parts (the neck), it seems to me almost certain that an ordinary hoofed quadruped might be converted into a giraffe (Emphases added).

It should be noted that Darwin assumes (1) continuous variation, each generation showing the same *range* in variation of neck length, and (2) effect of continuous use or disuse. He even devised a theory of pangenesis, now disproven, to explain this presumed inheritance of the effects of use and disuse.

The inheritance of acquired characters is no longer believed by any competent biologist. There still seems to be some confusion as regards variation. Most major genetic factors such as tall vs. dwarf in the garden pea have modifying factors. Accordingly, slightly taller plants may be obtained by selection.

Since the pea and also the bean used by W. L. Johannsen are self-pollinated, they breed true, or as we say technically, are *homozygous* for most or all of their genes. Thus Johannsen grew one crop from the largest beans and another from the smallest, in separate plots of ground.

Then in each of the two fields he selected the longest and the smallest beans and planted them in four separate plots. Measurement of the bean in these plots showed **no greater variation** than was found in the first generation. Continued selection for four more generations showed that after the first generation, selection had no effect in either increasing or decreasing bean size.

*Walter E. Lammerts, Ph.D., is a geneticist and well-known rose breeder.

Roses, Corn Have Greater Differences

Roses and corn are cross pollinated, hence there is a much greater store of genetic differences. All individuals are *heterozygous* for most character distinctions, or do not breed true when self-pollinated. In fact because of the accumulation of harmful recessive genes, experimentally-forced self-pollination results in a population of plants, most of which are much weaker than the parental stock. Selection therefore to establish true breeding lines takes much longer.

Thus, in roses, there is a great variation in bud length from the short rather stubby bud of Crimson Glory to the lovely long bud of Charlotte Armstrong. Intercrossing of rose varieties with the longest buds results in a great increase in bud length in the next generation. Less effect is noted in the second generation and after five or six generations no further increase is found. Today roses are partly self-pollinated and partly cross-pollinated, so they are more variable than peas or beans.

Corn, however, is completely cross-pollinated. Hence a maximum amount of variation is found. Even so corn breeders made phenomenal progress in increasing yield during the first twenty years. By then the inbred lines used to produce the famous high-yielding hybrid corn seed had accumulated most of the major factors for high yield, so relatively little increase in yield is now possible.

Selection for high and low oil content in corn still continues after 50 generations. Starting with an average yield of 4.7% oil, the high oil content line is now about 15.6% and the low is 1%. Though the selections for low oil content have shown little change since the 35th generation, selection for high oil content has increased from about 11% in the 35th generation to 15% in the 50th. Evidently a very great number of rather slight factors for higher oil content exist in corn. However, the limit is obviously being reached.

All of our breeding experience with peas, beans, roses and corn indicates that contrary to what Darwin believed the variability potential of each species is definitely limited.

Mutations Are Favored Mechanism

On what, then, do present-day Neo-Darwinian evolutionists rely for the mechanism of evolution? The answer is mutations, which occur with varying frequency in plants and animals. Actually, as will be shown later, these result from a "mistake" in the process of gene reproduction or duplication of the DNA molecules which either are or "house" the genes determining the characteristics of plants and animals.

Now it is generally conceded that most mutations are harmful. Estimates of the number of

mutations that show no harmful effects vary from 1 in 1000 (according to one source²) to 1 in 5000, depending on the person making the estimate.

The odd feature of these estimates is that actual data on just how much *better* a mutation is under usual conditions are very difficult to locate. Timofeef-Ressovsky³ indeed did show that the viability of the mutation "eversae" in *Drosophila melanogaster* was 104% of the normal at 75-77°F. At lower temperatures it was only 98.3% of the viability of the normal fly.

A theistic evolutionist correspondent of mine once criticized my use of this quotation from Fraenkel-Conrat⁴: "One can assume that the protein coat of the common strain of virus as it evolved by natural selection is highly efficient, and that any mutation is likely to reduce the virus' ability," as evidence for the impossibility of explaining evolution by mutation. My correspondent felt that I had not paid attention to the words "is likely to."

Yet, neither in Fraenkel-Conrat's report nor Seymour Benzer's study⁵ of the rH mutants in the T₄ bacteriophage were any beneficial mutants reported! In fact Benzer located 250 of an estimated 350 sites, and all reported are defective.

But let us grant that mutations with a 1% advantage under usual environmental conditions are found. What are the chances of establishing this mutation in *all* the individuals of a typical large species population? Patau⁶, a keen student of population genetics, estimated that such a mutation would increase in frequency from 0.01 to 0.1 percent of the population only after 900,230 generations. Another 100,500 generations are needed to increase the frequency to 100 percent!

Serial Beneficial Mutations Incredible

Even geologically speaking this is a mighty long time when one is considering plants or animals with an annual breeding cycle. And when one begins to think of the incorporation of such changes in the presumed ancestors of the human race, this means about 18-20 millions years for the incorporation of one presumably beneficial mutation.

It is true that one can *postulate* the simultaneous accumulation of such mutations. But it is stretching credulity to postulate the fortunate chance that a *series* of beneficial mutations, leading to such progressive changes as the lengthening of a giraffe's neck, would all occur *at about the same time*.

Admittedly, mutations affecting any given characteristic occur strictly according to chance. Therefore, accumulation of beneficial changes would have to be sequential. Also, even with a feature as *relatively* simple as the height of a

giraffe, elongation of bone structure in both neck and forelegs have to be correlated with lengthening of muscles, and also strengthening of them. Truly, evolution of a giraffe would be a most time consuming process. Their breeding cycle is about 5 years, or 5,000,000 years per mutation and geologically speaking not much time was left after the presumed ancestor of the giraffe first appeared in the Eocene era.

Bacterial Studies Reported

With the discovery that strains of bacteria resistant to penicillin, aureomycin, or chloromycetin always showed up when these drugs were used to effect cures for various diseases, evolution-minded biologists believed that here at last real proof for beneficial mutations existed.

Soon it was discovered that these mutations did not arise as a result of exposure to the drugs. Rather they occur at a constant rate. Associated with the resistance, there is a decrease in viability under *normal* conditions. Hence they are soon "swamped out" and carried along in a very small number of individual bacteria.

When a strain of bacteria is exposed to antibiotics, either the mutation rate for these otherwise defective resistant mutations is so high that eventually one occurs, or an already established one is given the starting advantage of having no competitors. Soon the entire population in the sick human being is the resistant type, and new medication is necessary to effectively treat the disease.

C. P. Georghiou⁷ has discussed resistance of house flies to DDT and other chemicals. The results are parallel to those found in bacteria. The author writes:

It is now well established that the development of increased ability in insects to survive exposure is not *induced directly* by the insecticides themselves. These chemicals do not cause the genetic changes in insects; they serve only as selective agents, eliminating the more susceptible insects and enabling the more tolerant survivors to increase and fill the void created by the destruction of susceptible individuals.

In addition he observed that flies at a cattle feed lot and at a nearby poultry ranch showed little resistance to any organophosphates or carbonates, since they had not been sprayed very often with them. Yet *agricultural* crops in that area had been treated regularly. Evidently the resistant strain of flies, though able to maintain itself once established is *incapable of spreading* through the whole range of the species even in a given area such as Blythe, California, where this work was done. Surely the flies in the nearby agricultural area became resistant as a result of the frequent spraying of the crops, yet feed lots

and poultry farms had a low level of resistance. Also in no instance were 100% of the flies, *even in the areas most exposed to spray*, resistant to the chemicals used.

We may therefore conclude that resistant strains of various organisms simply do not become established in species populations, hence can hardly lead to permanent evolutionary change.

II

Can Translocation, Inversions and Polyploidy Explain Chromosome Variation in Species?

For many years it has been known that the genes determining various characteristics of plants and animals are located in rod-shaped bodies called chromosomes. As implied by the name, these structures absorb stain more readily than the rest of the cell or nucleus when various colored dyes are used on them.

Each organism has a characteristic number of chromosomes. Also the appearance of them varies greatly from species to species. Usually their minute structure is studied in plants by examining them in very early stages of cell division when the pollen grains are being formed. Then it can be clearly seen, when the pollen mother cells are examined under an oil immersion lens at 1500 diameters, that the hereditary factors are located in small bead like bodies called **chromomeres** located serially along the entire length of the chromosome. A great deal of mapping of these chromosomes has been done in corn and tobacco, correlating hereditary characteristics of the plants with either the presence or absence of special chromomere sequences.

Most studies of species differences as regards the precise arrangement of the genes have been done in the fruit fly, *Drosophila*. Details of the chromomere arrangement are very difficult to study during reduction division, or formation stage of eggs and sperm in the fruit fly. Fortunately the chromosomes increase greatly in length in the salivary glands, where they are clearly defined cylindrical bodies.

The size, shape and staining reaction of the discs or striations found in the chromomeres vary sequentially along the length of the chromosomes. However, they show a remarkable constancy for each species, and reflect in their order of arrangement the known order of gene arrangement as determined by genetic analysis.

Chromosome Breakage Diagramed

Very rarely chromosomes break spontaneously. X-ray or neutron radiation greatly increases breakage. If two breaks occur in a given chromosome, the broken piece may become inverted end for end before reuniting with the rest of the chromosome. Thus, if the original chromosome

is a b c d e f g, breakage in two places may be indicated as follows: ab cde fg. The newly reconstituted chromosome if the broken segment c d e is inverted 180° will be a b e d c f g and is called an **inversion**.

Similarly breakages may occur in two different chromosomes and the segments reciprocally transferred from one to the other. This phenomenon may be shown schematically as follows:

_____	- - - - -
Chromosome 1	Chromosome 2
_____	- - - - -
Translocated	Translocated
Chromosome 1	Chromosome 2

When gametes are formed by an individual heterozygous for a reciprocal translocation, about 50% of the gametes will be inviable since they will lack either part of chromosome 1 or chromosome 2. Only gametes having both chromosomes of the normal type, or both translocated 1 and translocated 2 will be viable.

Fruit Fly Species Compared

Now let us compare two species of *Drosophila*, namely *D. miranda* and *D. pseudo-obscura*. Externally these two species are remarkably similar. *D. miranda* is somewhat larger in size, darker in coloration, with less distinct grayish stripes on the thorax and slightly wider cheeks. But internally the chromosomes are profoundly different as shown in Figure 1.

Genes which are next to each other in one species are often far apart in the other, or may even be located in other chromosomes. This is considered as indication that inversions and translocation have occurred. Many chromosome sections are so dissimilar that no resemblances in chromomere structure could be found at all. Dobzhansky⁸ suggests, "that some chromosome sections have been so thoroughly rebuilt by repeated inversions and translocation that their disc patterns in the salivary chromosomes no longer resemble each other and no pairing of the homologous genes takes place."

As regards the rest of the chromosomes, Dobzhansky and Tan⁹ estimate that a minimum of 49 breakages and rebuilding by inversion and translocation are needed to account for the origin of these species from a common ancestor. This magnitude of differences in chromosome pattern is typical of that found in many "closely related" species. In tobacco Elvers¹⁰ has shown that practically no homologous sections are found in the chromosomes of the hybrid *Nicotiana glutinosa* X *N. tomentosa*.

Chromosome Arrangement Explained

Now what is really involved in attempting to account for differences in chromosome arrange-

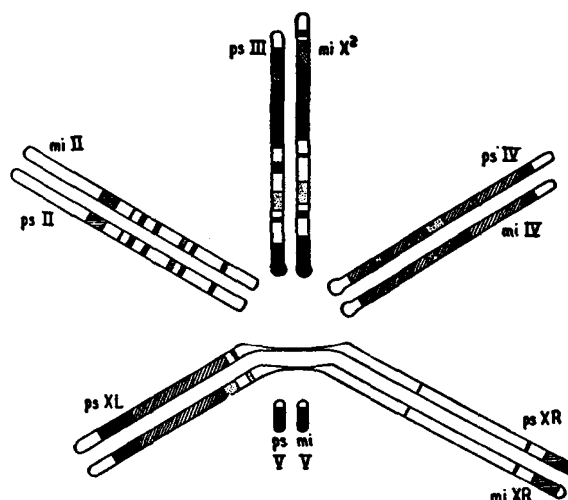


Figure 1. Comparison of chromosomes of *Drosophila pseudoobscura* and *D. Miranda*. Sections having the same arrangement of genes are white. Inverted sections are cross-hatched; translocation stippled; sections completely dissimilar are in black. ps = *D. pseudoobscura* and mi = *D. miranda*. The chromosomes in the salivary glands are actually much more elongated relative to their diameter.

ment in externally similar species having the same chromosome number? Most of the specialists in *Drosophila* research believe that the gradual sequential accumulations of inversions and translocations would account for the differences.

However, many chromosome breakages are accompanied by slight deficiencies or losses of essential genetic factors. When the sex cells or gametes carrying such deficiencies unite, the resulting individual fly lacks an essential bit of hereditary material in both the maternal and paternal chromosome. In practically all cases it either dies very early in life or is relatively weak. Though some translocation have been established in homozygous condition the fertility of either males or females is lower than the wild type or normal fly.

The situation is quite different in plants where homozygous translocation established in corn by Burnham¹¹ showed no external differences from the normal plants and were fully fertile. Similar results have been reported for sorghum.¹² A wheat rye hybrid translocation and its derivative Transec "enjoy a fairly normal phenotype which is a reflection of the fact that both involve the loss of genetically unimportant wheat chromatin."¹³

Four reciprocal translocation homozygotes have been obtained in the watermelon, in hopes of getting seedless melons by crossing them with the normal strain.¹⁴ Except for a slight amount of reduction in pollen fertility they were quite

normal. A number of translocation homozygotes such as Sonora and S2303 have also been reported in wheat.¹⁵ Though not discussed presumably these varieties are normal in vigor and fertility.

The interesting feature of the inversions and translocation referred to above is that none of them is reported to be *superior* to the standard type in either vigor or fertility when in homozygous condition. As discussed above, mutations with even a 1% advantage would become fully established in 100% of the population only after about 1,000,000 generations. How then could translocation and inversions having **no selective advantage** ever become established and thus form new species as distinctive as *D. pseudo-obscura* and *D. miranda*?

The spontaneous occurrence of both inversions and translocation is very low, that is between 1 in 100,000 and 1 in 1,000,000 fruit flies. The heterozygotes are reduced in fertility; thence, the chances of establishing translocation and inversions in homozygous condition are very low. However, it has been experimentally determined that inversion heterozygotes (and possibly translocation ones also) usually show hybrid vigor, and thus are superior to the homozygotes in vigor.

Dobzhansky has shown that the heterozygous inversion obtained by crossing the standard with the CH strain has an adaptive value of 1 or 100%, as compared to 90% for the standard (ST) and 40% for the CH strain.¹⁶ Furthermore the frequencies of the various inversions varied with the altitude in the Sierra Nevada Mountains near Mather. At the lowest elevations the ST chromosomes are the commonest, but at 10,000 feet the Arrowhead strain (AR) is most frequent with CH greater in frequency than ST.

Uniform Population vs. Natural Selection

The main feature of these observations is that natural selection does not make the population uniform for any one of the inversions in any of the observed locations. Yet, uniform populations in which each fly is homozygous for a particular inversion are precisely what are needed as evidence that inversions can be appealed to as the cause of chromosome differences in gene arrangement in species. For species are remarkably uniform as regards the order of arrangement of the genes as shown by the discs in the salivary gland chromosomes.

Bruce Wallace indeed makes the above claim in his book *Chromosomes, Giant Molecules, and Evolution*.¹⁷ He gives the distinct impression that the inversion races of *D. pseudo-obscura* are uniformly characteristic of the various geographical races and occur therefore as true breeding homozygotes. If this were true, it would indeed

be a strong argument for the origin of the much more complex species differences, even though the exact mechanism for the natural establishment of homozygous inversions has not been demonstrated.

However his thesis breaks down completely when we realize from Dobzhansky's experiments that the heterozygotes are usually more vigorous; hence, natural selection would never establish a new species by the sequential accumulation of homozygous inversions. In fact the fifth chapter, "Reconstructing Inversion Sequences," in Wallace's book so carefully avoids the problem of establishing inversions and translocation in a population, that one wonders if omission of the problem might not be deliberate!

Looked at from the creationist viewpoint the remarkable complexity of the chromomere or disc arrangements which distinguish one species from another are clear evidence of the Creator's amazing ability to give individuality to each of His many creations, which we as scientists are only beginning to appreciate.

Chromosome Doubling Considered

Interspecific hybridization followed by doubling of the chromosomes of the hybrid has often been appealed to as the means by which species having multiples of a basic number have evolved. Such, for example, are the wheat series having 7, 14, and 21 pairs of chromosomes.

Much has been made of Karpechenko's famous hybrid of the radish and the cabbage, each of which have 9 pairs of chromosomes. Chromosome doubling in the F_1 hybrid is claimed to have resulted in a true breeding cabbage-radish hybrid having 18 pairs of chromosomes. However as I discussed in detail in the 1964 *Creation Research Society Annual* (p. 50), later work by Richaria¹⁸ and Howard¹⁹ showed that even in the fourth generation the chromosome number varied from 33 to 37 chromosomes and the plants varied in fertility from 5 to 42%!

Also discussed in the current 1969 *Annual* by Klotz,²⁰ *Primula kewensis*, usually reported in evolution oriented books as having regular 18 pairs, actually forms several groups of four chromosomes or quadrivalents. Accordingly plants vary in chromosome number from 34 to 37.

My own *Nicotiana rustica* $\times$ *paniculata* amphidiploid showed the same chromosome variability. In fact all experimentally produced polyploids show this variable behavior. They can therefore hardly be compared to such naturally occurring polyploids as wheat which regularly has 21 pairs of chromosomes, or tobacco (*N. tabacum*) which has 24 pairs and are fully fertile.

III

Complexity of DNA-RNA System, a Clear Indication of Design in Nature

Only in recent years have biochemists found out precisely what the factors or genes governing the heredity makeup and physical development of an organism really are. Thanks primarily to the work of Watson and Crick we now know that the genetic code is based upon the order of arrangement of two purines, adenine and guanine, and two pyrimidines, cytosine and thymine. Any one of these when united with phosphoric acid and deoxyribose sugar makes up a nucleotide.

These nucleotides are arranged in two strands twisted about one another in the form of a double helix or coil. In this coil adenine is always paired with thymine and guanine with cytosine. On one side of this double coil the nucleotides are arranged in any order. However once that order is established the other strand is determined, that is, an adenine nucleotide must *always* pair with a thymine, and the guanine with a cytosine. The interconnections are simply endless repetitions of sugar-phosphate-sugar-phosphate.

As explained by Duane T. Gish²¹ the simplest code by which the 20 amino acids used in making proteins could be specified involves at least three nucleotide pairs, such as ATT, GCA, TCG, ACC. (A = adenine, C = cytosine, T = thymine, and G = guanine.) Thus, if we postulate that only one nucleotide governs the use of one amino acid, only four amino acids could be coded.

Likewise any two nucleotides could code only 16 amino acids since there can only be 16 combinations of two nucleotides (AA, AT, AC, AG, TA, TT, TC, TG, CA, CT, CC, CG, GA, GT, GC, GG). Combinations of any three nucleotides can actually specify 64 amino acids, far more than the 20 actually used.

Actually experiments indicate that several different triplets of the DNA may be used to code the same amino acid. Also some of the triplets may be used in such important factors as timing of the union of various amino acid sequences.

Now the "message" evidently begins at a fixed point at one end of the gene and as shown above is read three bases at a time. Thus if for some reason the reading starts at the wrong point the message would fall into the wrong set of three and so would be incorrect. Thus for each correct reading of the code there are two incorrect ones.

Code Translation Explained

How is the code actually translated into action? Briefly, this is effected by the complementary RNA which differs from DNA only by having ribose instead of deoxyribose sugar. RNA is found in the cytoplasm of the cell. The actual

location of the protein synthesis is at the ribosomes which are small granules in the cytoplasm. Thus, the RNA is a reverse copy of its DNA template and acts as a messenger, passing into the cytoplasm and effecting a particular pattern on the ribosomal surface.

Other sorts of RNA, already free in the cytoplasm, pick up individual amino acids and carry them to the ribosomes. This type of RNA is called transfer-RNA. There is a distinctive form of transfer-RNA for each of the 20 different amino acids. The amino acids are then arranged *according to the order* of the surface pattern previously set up by the messenger-RNA. They are then linked together into a polypeptides chain, part of a protein molecule, and these polypeptides when united form the protein. Very briefly stated, this is the way DNA specifies, and RNA supervises, the formation of whichever proteins are needed by the organism.

When the complex interrelationship of DNA and RNA are carefully considered it becomes rather obvious that *any tampering* with the code is likely to have serious consequences. In this connection a brief review of Seymour Benzer's work with T₄ bacteriophage referred to above is in order. The advantage of using bacteriophage is that in a 20 minute experiment by the use of a single test tube, a quantity of data can be obtained which would require the entire human population of the earth!

Phages are virus organisms having a hexagonal head, and a complex tail used for attaching themselves to a bacillus wall. Within the head is a long-chain molecule of DNA having a weight about 100 million times that of hydrogen. After attachment, the DNA alone moves into the bacillus cell and takes over the reorganization of the cell so as to manufacture 100 or more copies of a complete virus. The bacterial cell then bursts open and liberates these virus organisms, each of which attacks another bacillus.

It is estimated that the bacteriophage DNA contains about 200,000 base pairs. Each base pair is one letter of a minimum three letter word which specifies which of the 20 amino acids is to be linked up into the polypeptides chain. Sometimes an entire "paragraph" of such code words is needed to specify the sequences of amino acids needed for *just one* polypeptides chain and several such chains make up a complex protein.

"Typographical" Errors May Occur

"Typographical" errors may occur in the replica of the DNA molecule. Transpositions, deletions, additions, or inversions may occur. As Seymour Benzer says, "In a daily newspaper the result is often humorous. In the DNA of living organisms, typographical errors are never funny and are often fatal." (Emphasis added)

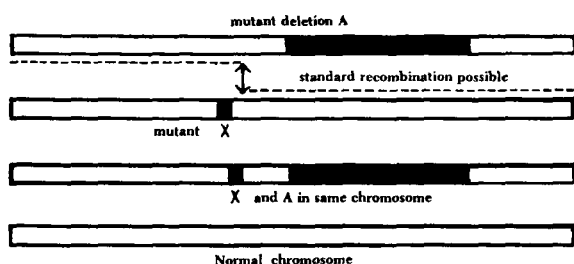


Figure 2. Showing how deletions are used to test location of mutants. Point mutation "x" will recombine with deletion A since it is several nucleotides to the left of it. If located within the length of the deletion it will not show recombination with it.

However these "typographical" errors or mutations can be used to analyze a small portion of the information carried by a T_4 bacteriophage, and thus reveal the amazing complexity of not only the DNA code but the processes of cellular activity as well.

One group of mutants called rH mutants can be identified quite easily by the appearance of clear regions they form on the surface of a culture in a glass dish where phage particles have multiplied and destroyed the bacterial cells. The shape and size of these clear regions are hereditary characteristics of the phage that can be easily identified and scored. A clear region or plaque produced in several hours will contain about 10 million phage particles, the progeny of a single phage particle.

The T_4 phage can produce plaques on either host strain B or K. This standard form gives rise to mutants easily recognizable by a distinctive plaque on B cultures. But the mutants cannot form plaques on bacteria strain K. This is the "key" to the whole mapping technique used by Benzer; for an rH mutant can grow on strain K only if the cell is simultaneously infected with a particle of the standard type. Now the function of the standard type phage has been traced to a small portion of the T_4 phage genetic map known as the rH region.

The various different-appearing plaques are due to mutants which arise spontaneously in this area. They may be crossed with each other by adding them to a liquid culture of B cells. This gives the progeny an opportunity to recombine portions of genetic information. If the two mutants resulted from typographical errors in different parts of the DNA molecule, some individuals of the standard type will be regenerated. (see Figure 2) A sort of *crossing over* occurs. These reconstructed standards will produce plaques on the K strain, whereas the original two mutants could not. In this way single recombination among billions of offspring can be detected. This allows the resolution of rH mutants only one base apart in the DNA molecule chain.

Recombination Mechanism a Problem

The exact mechanism of recombination is not known. It seems that two defective DNA molecules may break apart and reunite to form one non-defective molecule which then is replicated. Or it has been suggested there is "copy choice" so that only good portions of the two mutants are copied. This seems to be granting quite a remarkable power of selectivity to some "curative" agency in the T_4 phage cell.

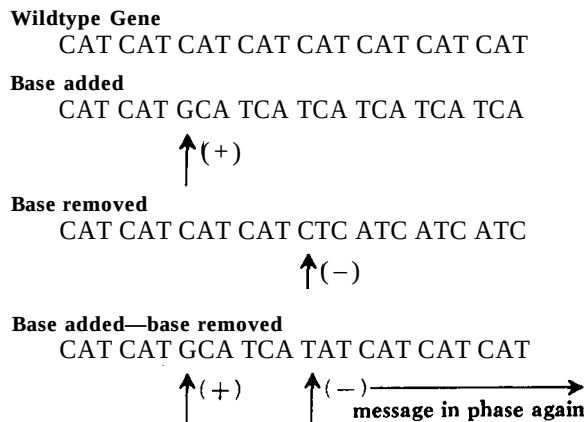
The results of long and elaborate study of hundreds of non-reverting rH mutants shows that *all* can be represented as containing deletions of various sizes in a single linear structure. By contrast, the rH mutants mentioned above behave as if their alterations were localized at single points. By testing against the non-reverting segments or deletions at this particular area of the T_4 phage DNA molecule, all mutants located within a given segment will not recombine when tested against it.

By use of about 80 such non-reverting segment mutations, the rH point mutations may be assigned to the proper one. Finally those localized in one small segmented deletion length or segment are tested against each other. Those showing recombination are obviously at different sites, and then each site is named after the mutant indicating its location. Finally the *order* of the sites within a given segment can be established by measuring the recombination frequencies. Of an estimated 350 sites about 250 have been located and all are defective.

Why No "Good Mutations?"

Why then are "good" mutations needed by evolution not found? The reason is clearly shown in a paper by F.H.C. Crick.²² He shows that the sites discovered by Benzer correspond to changes in the DNA base nucleotides. Mostly the defects are the result of adding or deleting one base, or sometimes a small group of bases. Such addition can be produced at random by compounds called acridines. As described above the code reading starts at the beginning of one gene and is read three bases at a time. Hence the addition or deletion of a base makes the gene completely non-functional.

Experimentally this means that, if a mutant due to the addition of a base is combined with another due to the addition of a base, the combination is still non-functional. Likewise this is true of a minus combined with a minus. But if a plus is combined with a minus the function is restored. This is because starting at one end of the rH region of the B cistron (or gene), the message would be read correctly until the extra mutation-causing base is reached. Then the message would not make "sense" until the minus mutation or missing base is reached, after which



The imaginary message is CAT, CAT . . . Adding of a base shifts the reading to TCA, TCA. Removing a base makes it ATC, ATC. Addition and removal puts the message in phase again. The reading is from left to right in triplets of 3 nucleotide bases.

Figure 3. Showing effect of mutations

the message would come back into phase again or make “sense.” This is possible because parts of the rH part of the B cistron are not critically important, hence the message can be garbled for a short distance and still be functional. If the distance is too long, the combination will not function. This is shown in Figure 3 adapted from Crick’s paper.

Fraenkel-Conrat reports substantially the same thing in reporting on about 200 chemically induced mutants of the tobacco mosaic virus. Some mutants render the RNA incapable of even forming the protein coat of the virus, others make it more capable of being harmed by the digestion of enzymes.

Genetic Code Is Complex

The picture emerging is that the genetic code is marvelously complex and will stand very little in the way of alteration either by addition, subtraction, or change of any of the nucleotide bases. Only because the rH region was *relatively* unimportant in function was it possible to accumulate the large number of mutations, making possible the detailed analysis of this rather minute portion of the T₄ phage DNA molecule. Yet even here most portions of the code message are of such vital importance that even a *short* portion out of phase causes a completely non-functional message, hence the mutations do not survive.

In discussing the functioning of the DNA system relative to the organism resulting from it Marcel Schutzenberger makes a very pertinent criticism of Neo-Darwinism.²³ He says,

According to molecular biology, we have a space of objects (genotypes) endowed with

nothing more than typographic topology. These objects correspond (by individual development) with members of a second space having another topology (that of concrete physico-chemical systems in the real world). Neo-Darwinism asserts that it is conceivable that without anything further, selection based on the structure of the second space brings statistically adapted drift when random changes are performed in the first space (the DNA system—W. E. L.) in accordance with its own structure. We believe this is not conceivable.

He suggests that algorithms in which the very concept of syntactic correctness has been incorporated, are needed to fill the gap.

As creationists, we believe that the marvelously intricate DNA system, and its RNA counterpart, are God’s mechanism for providential care. “For in Him we live and move and have our being.” (Acts 17:28). The marvel of it all is that this complexity is based on essentially only five elements: carbon, hydrogen, nitrogen, oxygen, and phosphorus. No one could predict from the physical characteristics of these elements that they could ever be combined to form the intricate series of reactions we know as life.

As molecular biologists continue to learn even more as to exactly how organisms develop by the expression of the DNA code, should they not have a feeling of reverent awe for a Being who could plan all of this, and who continues daily to make it work? Here indeed in a fine field for some of our younger creation-minded students to enter. For here they are truly seeing God at work as He daily maintains and preserves all creatures.

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(Continued on Page 26)

THE FORM AND STRUCTURE OF LIVING THINGS

FRANK L. MARSH*

Creationists and evolutionists have vastly different concepts of comparative anatomy. The evolutionist holds that the more closely basic types of living things resemble each other physically in body line or chemistry the closer is their blood relationship. In contrast, the creationist holds that because the Creator spoke all the basic types into existence from the dust of the earth on Days Three, Five, and Six of the literal Creation week, there is no genetic relationship between them. Any similarity in anatomy, for instance, is due to one Creator with a master plan.

Regarding man, the truth of the literal Genesis account of his origin is attested by the Lord Jesus Christ in Matthew 19:4-6. That the Creator ceased at the end of Creation week to form new basic types of organisms is stated in Genesis 2:2 and verified in nature. The discontinuity among both living and fossil forms constitutes real evidence of the creation of basic kinds. According to the natural record, from the day of their creation, all Genesis kinds have continued to bring forth only after their kinds. Variation has never been known to accomplish more than the production of a new variety of a basic type already in existence.

I

Introduction

The scientist who accepts the origin of plants and animals depicted in Genesis 1 and 2 has a vastly different concept of comparative anatomy than one who believes that all living things have developed from one or a few single-celled organisms. Most evolutionists hold the concept that *all* organisms are blood related, and that the more closely living things resemble each other physically in body line or chemistry the closer is their blood relationship.

Contrastingly, most creationists believe that there is no blood relationship between basic types, and that any resemblance among these created kinds was the result of a materialized plan once existent only in the mind of the omniscient, omnipotent, omnipresent, transcendent Creator. To the impartial mind, if there be such a wonder in the natural world, and if we remain purely theoretical, these doctrines are equally logical and reasonable. Albeit only one is in harmony with the assertions of the Bible.

II

Origin of Form and Structure

What was the origin of this form and structure with which comparative anatomy is concerned? According to the Hebrew Scriptures all kinds of plants and then animals appeared instantaneously in all their various and intriguing forms as the result of the Creator's fiat to the earth to produce them.

In Genesis 1:11, 12 the created forms of plants are designated as grass (*deshe*, whose root signifies "to be damp"), herbs (*esebh*, herbage), and trees (*ets peri*, trees of fruit). These three broad groups evidently are intended to cover all vegetation. The first group very possibly does not include grass as we know it, but may refer to such forms as mosses, liverworts, lichens, and other carpeting kinds of the earth than grass.

The translation of the Greek Septuagint notwithstanding, members of the second group are obviously distinct from those of the first as borne out by 2 Kings 19:26 and Isaiah 37:27, where they are again mentioned separately in an enumeration. Also members of the second group are described as *mazria zera*, or "seeding seed." It would thus appear that members of this group are prominent as seed bearers,

It is this group, *esebh*, which is stated in Genesis 1:29 to have been given to man along with fleshy fruits and nuts as his food. The King-James - Version - (KJV) - of - the - Bible translation "herb of the field (Revised Standard Version-RSV—"plant of the field"), which is used in Genesis 3:18 to describe a part of the food given to man after his sin, is from this same *esebh*. *Esebh* is also used in Deuteronomy 11:15 to describe the food of cattle. Thus this second group appears to include all plants between mosses, liverworts, lichens, ferns, and other non-seed-bearing plants, and the woody shrubs and trees.

Ets peri, trees of fruit, the term covering the third group, is a singular collective that stands for woody plants bearing dry nuts and cones, and fleshy fruits such as berries, drupes, pomes, et cetera.

These three broad groups do not coincide with modern classifications of plants, nevertheless they are apt because without getting technical, for the man on the street they paint the picture of the origin of *all* vegetation,—the lowly forms, the taller herbaceous forms, and the woody shrubs and trees.

All Basic Plant Kinds Created

Genesis 1:11, 12 states very clearly that in the span of a single day consisting of a period of darkness and a period of light, i.e., a solar, 24-hour day, the Creator brought all the basic kinds of plants into existence. It is important to notice that this vegetation included seed-bearing plants which evolutionists affirm to be the most highly

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and recently evolved forms. This special revelation of natural truth was given to man so that he may *know* that every distinct kind of plant that ever lived on the earth was formed on Day Three of Creation week.

It is profitable right here to point out that, with regard to the plants, not only does Genesis describe the origin of basic types or kinds, but it also makes clear what would be the appearance of the succeeding generations of each kind. Occasionally it is argued that Genesis 1:11, 12 merely states that the Creator formed the plants in their various basic types but says nothing about their reproductive behavior. This interpretation seems to infer that in future generations at least some of the basic kinds could have eventually produced other basic kinds which would be so different from the original created forms as to become new basic types.

However, in consulting Bible commentators it will be found that the large majority state that these verses describe not only the origin but also the reproductive behavior of the created types of plants. That this is the correct interpretation of the Hebrew is made clear in the new RSV, 1953, of the Bible. This revised version has the advantage of possibly even better Hebrew scholarship and more original manuscripts than was the case with the KJV. In the 12th verse of Genesis 1 in this RSV we read, "The earth brought forth vegetation, plants yielding seed according to their own kinds." Thus because of their fiat origin and of their reproductive behavior there was no natural way for evolution of new basic types to occur.

Some "Bible-believing" students of origins, those who could be called theists, will agree to the last sentence above with regard to *natural* processes, but hold that now and then down through millions of years the Creator caused organisms to bring forth unnaturally, i.e., supernaturally, so as to produce new basic types, and in this way derived the more complex from the simpler. That God *could* have done this the Bible-believing Christian will agree, but in the same breath he will point out that the Holy Scriptures know no such derivative type of origins.

III

Attempts at Classification Systems

The statement that the Creator commanded the earth to bring forth the plant "after its kind," and that the earth *did* bring forth the plant "after its kind," apparently means in part that He formed plants after some orderly plan. That this plan was not discovered by such plant taxonomists as either Adolf Engler, Charles Bessey, or John Hutchinson is quite clear. These taxonomists based their systems of plant classification,

upon which American floras and manuals were founded, on efforts to answer such evolutionist questions as the following, listed by G. H. M. Lawrence,¹ the Cornell taxonomist:

How are these plants related, . . . from what are they descended, . . . which characters are those of ancestrally more primitive plants and which ones are derived from them, . . . which characters have longest remained unchanged, . . . have characters arisen only once or have some arisen many times independent of one another?

These early botanists brushed aside the inspired account of distinctly separate beginnings of plant kinds and concluded instead that all basic types of plants are genetically related. The term "phylogeny," race history or development of a kind of organism, appeared in the literature as attempts were made to place together those families thought to be more closely related genetically, with assumed derivative groups following those taken for granted to be ancestral.

However, understandingly disappointing to these developmentalists, none of these efforts has produced a truly phylogenetic system. The bald truth here is that all the discoveries of plant paleontology have not revealed that which evolutionists are seeking; namely, evidence that truly primitive forms once existed. Therefore, the taxonomist is frustrated in not knowing which characters are primitive and which advanced. An acceptance of Genesis would have saved a vast amount of work through its revelation of the natural truth that there is neither "primitive" nor "advanced," but rather all basic kinds appeared simultaneously upon the earth.

In botany this attempt to follow the *ignis fatuus* of evolution has resulted in the three systems mentioned above, plus the system of Pulle of Utrecht, that of Skottsberg of Stockholm, and on to a total of at least a score of different classification systems which result in a great deal of confusion among those who would classify plants. The situation would suggest a return to a point of view at least very similar to that of Linnaeus—the noted father of taxonomy, a creationist. Even with *complete* avoidance of the concept of genetic relationship existing among basic kinds, almost endless interesting groupings and subgrouping of plants can be made based purely upon comparative anatomy.

Right here possibly I should call attention to the fact that although it may appear that I have wandered from the area of form and structure into that of taxonomy, I am still on the subject of comparative anatomy. Plant classification systems are based entirely upon the form and structure of the plants, and according to our philosophy of comparative anatomy will be our procedure in the science of classification.

IV

Orientation for Bible-believer

The Bible-believing student of comparative anatomy of animals turns first to Genesis for the orientation necessary in laying the foundation of this subject. The translation of the Hebrew found in KJV, Genesis 1:20, is unclear in that it appears to state that both water animal and flying forms were brought forth *by the waters*, but in Genesis 2:19 we read that "every fowl of the air" was formed "out of the ground."

The Hebrew expression *sharats sherets*, translated in the KJV as "Let the waters bring forth," when accurately translated reads "Let the waters swarm with swarms. . . ." And with regard to the flying forms, Genesis 1:20 (RSV) correctly translates, "let birds fly above the earth." The Greek Septuagint states it thus, "every creature that flies with wings."

In other words, in Genesis 1 no statement is made regarding the material used in the formation of water animals and flying forms. However, it is made clear that on Day Five all water animals and flying forms were brought forth in all their kinds and were present abundantly at the close of Day Five. That they were shaped into discrete kinds appears to be a very important point.

Every water animal and flying form, whether starfish or mollusk, sponge or porpoise, jellyfish or whale, hummingbird or teratornis, butterfly or pterodactyl, all kinds were patterned according to their respective distinct morphological differences. No room is left for any supposition that these discrete kinds were derived from other kinds which were of more simple morphology.

The use of the expression *wayyibhra*, "and he created," Genesis 1:21, seems puzzling at first reading. Why should God *make* plants and *create* water animals and flying forms? The word for create may be used here for at least two reasons. First, verse 21 says that God caused animals to swarm in the waters without saying they were formed from any material. Therefore, a form of *bara*, to create, was used. Second, *bara* is used where the idea of novelty is to be conveyed (see Isaiah 41:20; 48:6, 7; 65: 17; Jeremiah 31:22). To bring into existence such remarkable creatures which breathe and are animated and can go where they wish is worthy of the term *bara*.

V

Original Dry-land Animals

In Genesis 1:24, 25 is recorded the origin on Day Six of the dry-land animals. In the origin of these creatures, as in the case of the plants on Day Three, we have a mediate creation. Instead of directly calling land creatures forth by His word, the Creator temporarily enables the earth

to produce them. The "why" we may not perceive, but we do know that they came from the dust and upon death return to the dust again. The command to the earth is *totse*, "cause to come forth." This command is quite identical with the statement in verse 12 regarding the earth "causing" the plants "to go out."

In the Scriptural account of the origin of land animals we are told that they appeared in three groups, each group name being in the singular, collective. First are the *behemah* or "domestic animals," which are often called cattle. The word *behemah* comes from a root meaning "to be dumb," thus giving dumb brutes. This characteristic does not serve to set any certain group apart, however, because all animals lack the power of articulate speech.

The second group are the *remes*, a word taken from a root which means "to move about lightly," or "to glide about." The translations in both the KJV and the RSV, "creeping things," is too narrow because it does not leave room for the larger land reptiles and amphibians. It would appear that *remes* includes everything that moves on the ground as snakes, or close to the ground as spiders and lizards.

The third group is *chayyath ha' a'rets*. The original comes from the root *chay*, "to live," suggesting vital energy and activity, then the modifying phrase "of the earth" is added. The members of this group are in a sense different from the other two groups because they have freedom of movement and may be designated as "wild beasts of the earth."

This classification of land animals was never intended to satisfy a taxonomically inclined biologist, but for men and women not trained scientifically it is satisfactory in that it gives a general, varied picture which is sufficient to call to mind all types of land animals. A point given the highest emphasis in the account is the fact that the Creator, obviously with a plan in mind which included all kinds of land animals, commanded the earth to produce these basic kinds. This part of the account closes, verse 25, with the assertion that all these kinds which were planned in the mind of God did take form instantaneously by His power without genetic relationship on Day Six. "And God saw that it was good."

VI

Origin of Human Beings

In a discussion of physical form and structure man most surely should be included. The account of man's origin occupies two verses in Genesis, verses 25, 26 of Genesis 1. The singular dignity of man and his position as the crowning work of creation is evidenced, first, by the divine council held before his formation; second, by the fact that he alone of the entire creation clearly

was patterned after his Maker.

The narration rises to a solemn chant in the words (RSV), "So God created man in His own image, in the image of God He created him; male and female He created them." The Lord Jesus Christ accepted this account of man's origin as simple history. In Matthew 19:4-6 (parallel reference Mark 10:6-8) He makes five allusions to the literal Genesis account of the origin of man.

The threefold use of *bara*, "create," in Genesis 1:27, is significant here. *Bara* is appropriate first, because, as in verse 1, something is brought into being which did not formerly exist; second, because, as in verse 21, something is being endowed with life and a soul; and third, because a creature with the endowments of man formed in God's image is entirely new.

It seems to come as quite a shock to some people to learn how like at least the higher beasts man is in his physical body. Albeit Genesis does tell us, Genesis 2:7, that man was made of the same substance as the animals, the dust of the ground. Furthermore, his food, Genesis 1:29, was quite identical to that of the beasts of the field.

He moved in the same physical environment, and in his living and in his work the mechanics of his activities was much like those of the higher animals. Thus man's comparative anatomy today does not coerce him into acceptance of a bestial origin, but rather harmonizes completely with the Biblical account of special creation.

VII

Creation Is Finished

It is clear in Genesis that God commanded the earth to bring forth plants (Genesis 1:11) and animals (Genesis 1:24). Just how long this command was to remain in force was apparently unclear in the minds of theologians of the Middle Ages. Whether it was failure to read the entire account of Creation week, or whether it was the result of confusion caused by an effort to accept both Aristotle and Genesis at the same time, it may be difficult to determine.

But history does tell us that these theologians, taught in the church universities (the only universities which were in existence during the Middle Ages) that spontaneous generation was a natural fact. The teachers in these universities, the schoolmen or scholastics as they were called, reasoned that God had commanded the earth to bring forth living organisms, so in their day the earth was understood to be obeying that command faithfully.

We marvel that these Bible students pondered origins as presented in Genesis yet in some strange way seem to have missed that part of the account found in the first two verses of Gene-

sis 2. Here we read, "Thus the heavens and the earth were *finished*, and all the host of them. And on the seventh day God *ended* his work which he had made (declared his work on which he was engaged finished); and he rested on the seventh day from all his work which he had made." The Septuagint expresses it thus, "And God *finished* on the sixth day his works which he made, and he ceased on the seventh day from all his works which he had made."

Thus we find that the Genesis account of the beginning of plants and animals not only very clearly portrays the work of the Creator in forming them in all their basic kinds on Days Three, Five, and Six, but, with equal clarity, it asserts that the Creator *ended* His work, a work of formation of basic kinds. Thus through divine revelation the Bible believer knows two most basically important facts about the world of living things: (1) God by fiat created the basic types in the beginning, and (2) By the fact that on Day Six God concluded His work of creation of basic types, there has been no addition of new basic kinds since Creation week through either spontaneous generation or megaevolution.

Through special revelation we know that God *performed* a great work, and that He *ended* that work. Since Creation week, except in a few very unnatural instances, e.g., possibly in the preparation of a great fish to swallow Jonah (Jonah 1:17) the earth's complement of basic types of plants and animals has not been augmented, but rather only diminished through the extinction of certain forms which could not adjust to new and more difficult living conditions following Noah's Flood.

VIII

Bible and Natural Diversity Harmonize

The present-day Bible-believing biologist is impressed most forcefully with the complete harmony which exists between the assertions of Genesis and the testimony of nature. Today we see the face of the earth teeming with a great diversity of plants and animals. Structural similarities may appear in many groups, and yet each basic kind stands as clearly cut as an island in an archipelago, with no connecting, interlinking bridges. Quite a number of years ago Theodosius Dobzhansky,² evolutionist zoologist in Columbia University, called attention to this in the following well-chosen words:

Organic diversity is an observational fact more or less familiar to everyone. . . . Indeed, a more intimate acquaintance with the living world discloses a fact almost as striking as the diversity itself. This is the discontinuity of the variation among organisms.

If we assemble as many individuals living at a given time as we can, we notice at once

that the observed variation does not form any kind of continuous distribution. Instead, a multitude of separate, discrete, distributions are found. In other words, the living world is not a single array of individuals in which any two variants are connected by unbroken series of intergrades, but an array of more or less distinctly separate arrays, intermediates between which are absent or at least rare.

This is the very picture given us at the close of Creation week. The land areas were verdant with plants in all their basic kinds from the lowly carpeting forms to the lofty trees, from the mighty redwood to the lichens on its bark and the delicate herbaceous forms blossoming prettily at its base. All kinds of animals swam in the waters, burrowed in the ground, crept, walked, and moved lightly over the land, climbed the trees, and flew through the air.

Organic diversity seemed the pattern of life, and yet as Dobzhansky observed, throughout the whole of animate nature is clearly visible the phenomenon of discontinuity. Man, chimpanzees, cattle, horses, dogs, cats, pigeons, roses, waterlilies, petunias, and sunflowers, each strikingly discontinuous from all others in its respective kind. Dobzhansky wrote me that because of this very discontinuity it is impossible to demonstrate evolution (megaevolution) among living plants and animals. To find a demonstration of megaevolution he said one must go to the fossil record.

Fossil Record Refutes Megaevolution

Albeit as one studies the reports of specialists in fossils he finds a unanimity of testimony which negates Dobzhansky's opinion. Because of the importance of this point, let us sample some of the assertions of the experts. With regard to plant fossils we read:

Chester A. Arnold³:

It has long been hoped that extinct plants will ultimately reveal some of the stages through which existing groups have passed during the course of their development, but it must be freely admitted that this aspiration has been fulfilled to a very slight extent, even though paleobotanical research has been in progress for more than one hundred years. As yet we have not been able to trace the phylogenetic history of a single group of modern plants from its beginning to the present.

G. Ledyard Stebbins, Jr.⁴:

Evolutionary conservatism and stability are much easier to demonstrate by means of fossil evidence than is rapid progress or the differentiation of the modern families and orders.

With regard to animal fossils, we read:

George G. Simpson⁵:

The facts are that many species and genera,

indeed the majority, do appear suddenly in the record, differing sharply and in many ways from any earlier group, and that this appearance of discontinuity becomes more common the higher the level, until it is virtually universal as regards orders and all higher steps in the taxonomic hierarchy.

The face of the record thus does really suggest normal discontinuity at all levels, most particularly at high levels, and some paleontologists (e.g., Spath and Schindewolf) insist on taking the record at this face value. Others (e.g., Matthew and Osborn) discount this evidence completely and maintain that the breaks neither prove nor suggest that there is any normal mode of evolution other than that seen in continuously evolving and abundantly recorded groups. This essentially paleontological problem is also of crucial interest for all other biologists, and, since there is such conflict of opinion, nonpaleontologists may choose either to believe the authority who agrees with their prejudices or to discard the evidence as worthless.

George G. Simpson⁶:

In spite of these examples, it remains true, as every paleontologist knows, that *most* new species, genera, and families, appear in the record suddenly and are not led up to by known, gradual, completely continuous transitional sequences.

D. Dwight Davis⁷:

But the facts of paleontology conform equally with other interpretations that have been discredited by neobiological works, e.g., divine creation, innate developmental processes, Lamarckism, etc., and paleontology by itself can neither prove nor refute such ideas.

Alfred S. Romer⁸:

The chances of obtaining a completely graded series (if one existed) are hence obviously vastly less than in the case of more normal phyletic evolution. "Links" are missing just where we most fervently desire them, and it is all too probable that many "links" will continue to be missing.

Norman D. Newell⁹:

From time to time discoveries are made of connecting links that provide clues to the relationships, as between fishes and amphibians, amphibians and reptiles, and reptiles and mammals. These isolated discoveries, of course, stimulate hope that more complete records will be found and other gaps closed. These finds are, however, rare, and experience shows that the gaps which separate the highest categories may never be bridged in the fossil record. Many of the discontinuities tend to be more and more emphasized with increased collection.

No Link Across Discontinuity

Thus we see that the same discontinuity which exists among living forms, and which Dobzhansky declared correspondingly made a demonstration of megaevolution impossible among these forms, also exists among the fossils. These gaps between fossil groups of organisms are not a figment of wishful thinking on the part of the creationist. But rather, the paleontological record, instead of demonstrating evolution as evolutionists repeatedly assert it does, manifests the very picture of fixity within the loci of the basic types, and manifests the absence of intergrading forms or connecting links that one would expect to find in nature if the Genesis account of origins were true.

We recognize that this discontinuity among the fossils does not demonstrate special creation of basic types, but it is in complete harmony with such an origin. The evolutionists, on the other hand, are constantly put to it to exercise more and more faith in their theory as it becomes progressively more obvious that intergrading forms necessary to suggest megaevolution are completely absent in just those places where they are needed most to bolster the theory.

It is of interest to observe that when evolutionists speak of discontinuity in the fossil record they occasionally say or infer that there are some cases among the fossils where connecting links between basic types do exist. But it is important to natural truth to understand clearly here that these situations cannot be shown actually to bridge between two basic types.

To illustrate, the *Archaeopteryx* is commonly given as the connecting link between birds and reptiles. Actually it would take many more forms than this one fossil curiosity to build the required bridge. The fact that the *Archaeopteryx* had some structures in common with both birds and reptiles does not necessarily mean more than does the fact that man has an eye very similar to that of the squid, and a humerus and radius and ulna in common with birds, whales, and bats.

Common origin indeed, but I would suggest that that origin was in the mind of a Creator with a master plan. Thus it is most likely that many supposed connecting links are, along with the groups they "connect," all members respectively of separately created basic types.

IX

"After Their Kind"

The Bible-believing scientist is very aware that according to Genesis there was a unit in the living creation specified as the kind (Hebrew, *min*). As we have already noted, according to the record, when the Creator commanded the earth to bring forth first plants and then animals,

it was not as if He were casting a net into a murky, unknown sea wondering the while what chance-developed forms might appear in it as it was drawn in.

The record states, in Genesis 1:11, 24, that the command to the earth was to produce these organisms *after their kinds*. In other words these forms were first conceived in the mind of God, and then at the fiat to the earth to bring forth, the Spirit of God (Genesis 1:2) working with the dust of the earth (Genesis 2:7, 19) produced from it the living forms patterned according to the plan.

Does it not seem reasonable to assume that if an omniscient God first planned the basic kinds, then produced these very kinds in the earth, it reasonably could have been in His plan that they continue in the earth as enduring entities? I would not go so far here as did creationist Georges Cuvier (1769-1832), founder of modern comparative zoology, and say that because God planned and produced these kinds they could not suffer extinction.

But, I would suggest that as long as these basic types could carry on, each would continue to be one hundred per cent the basic type it was created. At least it would be an astonishing thing if the Creator were meticulously to plan and produce all the delightfully variable basic forms and yet create them in such a way chemically that they could cross indiscriminately, and vary so widely in a few generations as to obliterate completely the original beautiful pattern of creation.

It does seem possible that today we should be able to look about us and at least in almost numberless cases recognize those original basic types which have endured to our day. "Kinds" were created. What sort of entities were they? The imprecise Hebrew word *min*, kind, appears ten times in the singular and/or plural form in Genesis 1. In the remainder of the Old Testament it appears twenty-six times more.

In Leviticus 11 (RSV) we find *min* applied respectively to the falcon, the raven, the hawk, the heron, the locust, the bald locust, the cricket, and the grasshopper. In Deuteronomy 14 (RSV) it is applied to the raven, the ostrich, the night-hawk, the sea gull, the hawk, the little owl, the great owl, the water hen, the pelican, the vulture, the cormorant, the stork, and the heron.

In Leviticus 19:19, *min* is used in so limited a sense as to refer to breeds of cattle as "kinds." In this same verse "kinds of seed," and "kinds of stuff" in a garment, are referred to. The remaining appearances of *min* are as follows: 1 Chronicles 28:14, "instruments of every kind; Nehemiah 13:20, "sellers of all kinds of ware"; Ecclesiastes 2:5, "all kinds of trees"; and Ezekiel 27:12, "all kinds of riches."

"Min" and "Baramin" Considered

Although *min* is an imprecise word, still in its thirty-six appearances in the O.T. it is never used so broadly as to suggest that the originally created kinds may have been groups as extensive and inclusive as to refer to the hairy, the scaly, or the feathered animals. It actually is used quite specifically, in fact so specifically at times as to refer to breeds of cattle, or to distinguish a "locust" from a "bald locust," a "little owl" from a "great owl." In the light of this usage it seems valid to assume that there is no single category in modern taxonomy which corresponds to the Genesis kind.

As we have noted above, the testimony of Genesis is that, with regard to the plants, "The earth brought forth vegetation, plants yielding seed according to their own kinds."—Genesis 1:12 (RSV). In other words, interestingly the designated distinguishing characteristics of the Genesis kind was physiological (chemical, i.e., potentially genetical) rather than merely morphological. It seems reasonable that we may assume that the same was true regarding the animals.

Because our modern taxonomies have largely been built upon morphology interpreted evolutionistically while the Genesis kind seemed to me to be in physiological unit, in 1941 I suggested¹⁰ that the Genesis kind today be called *baramin* (coined from *bara*, created, and *min*, kind—plural form *baramins*) (discussed more fully in Marsh^{11,12}) and that the laboratory test of the baramin be the achievement of *true fertilization* between the sex cells of the mated individuals.

In other words, if on the fertilization of the egg, both male and female chromosome complements took part in the formation of the first two blastomeres, then the mated individuals were members of the same *baramin* (i.e., assumedly, Genesis kind). Some creationists, however, believe that just as in mankind, only those varieties and "species" which are fully interfertile may safely be considered as genetically related.

After studying hybridization during the twenty-eight years which have passed since 1941, I still suggest true fertilization as a concrete test of the Genesis kind among sexually reproducing organisms in our present day. Plants and animals apparently have remained true to the law of their creation and we look about us today upon an intriguing scene of striking, **clear-cut discontinuity**.

X

Fixity in Nature Discussed

Perhaps it would be well here, in our consideration of modern form and structure among living things, to pause a bit longer on the point

of fixity in nature. Bible-believing scientists generally agree that fixity is implied in the Genesis account-of origins. Differences of opinion might arise with regard to the level at which fixity has existed.

During the Middle Ages the schoolmen in the church universities taught the amazing doctrine that according to Genesis there could be no variation from generation to generation among plants and animals. According to this scholastic view reproduction was quite similar to the minting of coins in which the coin is very like the die which stamps it.

This narrow, extreme interpretation of the meaning of a creation after their kinds was still taught in Cambridge when Charles Darwin was a theological student there in the late 1820's. Apparently Darwin left the interpretation of Genesis to the professors in theology at Cambridge, and started on his five-year voyage around the world, 1831-36, with the belief that according to Genesis God had created plants and animals and set them in the earth in the very forms of their 1831 appearance and in the location in which he found them in 1831.

However, as Darwin proceeded with his careful study of the flora and fauna of islands and continents, the fact was forced upon him that not only had organisms moved over the earth, but, while engaged in this migration, they had also changed somewhat in their appearance. To illustrate, most of the islands of the Galapagos group were populated each with a different variety, or even "species" of tortoise and finch. The whole picture was not one of fixity as to location and form, but rather one of migration with variation.

These careful observations troubled Darwin deeply because he thought they were contrary to Genesis. After years of mental conflict over this problem, he finally decided that Genesis must be wrong. In 1844, in a letter to his friend the botanist Joseph Dalton Hooker, he wrote,¹³

I have read heaps of agricultural and horticultural books and have never ceased collecting facts. At last gleams of light have come, and I am almost convinced (quite contrary to the opinion I started with) that species are not (it is like confessing a murder) immutable.

Inaccurate Interpretation of Genesis

Even in our day it is generally understood by the man on the street and by most scientists that Darwin disproved Genesis. Actually all he disproved was the **inaccurate** interpretation of Genesis **by the schoolmen**. The tragedy here for both the religious world and the scientific world lies in the failure of Darwin to recognize that his *observations* were completely in harmony with Genesis.

Genesis does teach a fixity in the living world. However, many scores of years of careful biological research by innumerable scientists has shown that this fixity is higher than the individual level, i.e., it exists at the level of the basic kind, best illustrated perhaps by our own species, mankind.

In all their wishful endeavors in scientific study, even evolutionists will admit that not one instance of a basic type, like a cat, producing a new basic type, like a dog, is known. We have kinds of cat, but the fixity of Genesis is at the higher level of the cat kind, and not at the lower level of kinds of cats.

Variation does occur abundantly **within** kinds, but no coercive, compulsive evidence can be produced to show the production of even one new basic kind. The very most that Darwin could discover was that new varieties of tortoises had apparently developed on the various islands of the Galapagos group, and apparently new varieties and even new "species" of finches.

However, Darwin failed to recognize the tremendously important fact that the tortoises were still tortoises and the finches still finches, field evidence which helps us to understand the true fixity that exists in the world of living things. In his demonstration of variation within well-marked limits of the basic kind, Darwin, instead of disproving Genesis, as he thought, actually witnessed to its veracity.

One basic kind is unlike all other basic kinds because of its own peculiar internal chemistry, the DNA of its genes. If different kinds are present we know these different chemistries are present also and effectively isolate one kind from another by bridgeless chemical abysses.

XI

Evolution Micro-, Mega-, Macro-

It is interesting that apparently the first use of the word "evolution" in biological literature was made by the Swiss creationist naturalist Charles Bonnet (1720-1793). He was a proponent of the encasement or preformation theory of embryonic development of man. According to this view, at the time of creation all future generations to live upon the earth were formed at the same time the first individual was caused to appear.

Thus in the germ cells of either Adam or Eve, depending upon whether the theorist was a spermist or an ovist, were created in successively smaller globules of protoplasm, all future generations, each encased in the generation that was to precede it. When the right time came, the tiny homunculus would gradually unroll into its adult form by a process of "evolution." Thus we find that the first use of the word "evolution" apparently was in connection with one of the most ex-

treme concepts of special creation yet to be championed.

In our day the issue of origins of types is considerably clouded for the man on the street, and even for some biologists, by the appearance in the literature of the two terms microevolution and *megaevolution* (also called *macroevolution*). Then when the reader learns that believers in special creation accept "microevolution" but refuse "megaevolution," the confusion deepens. It is important that the two be defined.

Microevolution is the term applied to the demonstrable production of new varieties or breeds *within* any basic type.

Megaevolution, on the other hand, is the term applied to the doctrine which holds that, if given enough time, basic types can eventually, through natural processes, produce new basic types.

Generally when "evolution" is referred to, *megaevolution* is meant. To illustrate, a belief in *megaevolution* teaches that man has developed upward through the beasts and is genetically related to them, i.e., physically at least, man is a noble beast. In other words, *megaevolution* refuses a literal Bible because according to the Scriptures man was formed from the dust (Genesis 2:7), in the image of God (Genesis 1:27), and consequently is the son of God (Luke 3:38). Scripturally man has received not even one molecule of hereditary DNA from the animals.

Thus, by and large, it is unfortunate that demonstrable variation has been named a sort of evolution, because the special creationist who accepts all demonstrable variation does not accept the theory of evolution. He can accept microevolution because variation has never been shown to do more than produce a new breed, variety, species, or group of individuals, within a basic type which was *already on hand*. A cow may bring forth an Aberdeen-Angus, an Africander, an Ayrshire, a Brahman (Zebu), a Brown Swiss, a Devon, a Galloway, a Gaur, a Gayal, a Guernsey, a Hereford, a Holstein-Friesian, a Jersey, a Shorthorn, or even a Catalo, but this is only microevolution because these are all undisputably merely breeds of the cow kind.

A fertilized corn ovule may develop into dent corn, flint corn, sweet corn, pop corn, starch corn, or pod corn and still accomplish only microevolution because these are all unquestionably merely varieties of the corn kind. Microevolution may even go so far as to make a new "species" possible by selective breeding as demonstrated by Kozhevnikov,¹⁴ or to change a race into a new biological species as explained by Dobzhansky.¹⁵ As far as demonstrable evidence goes reproduction and reproductive behavior of every type can never accomplish *megaevolution*.

Microevolution Is Not Megaevolution

A common practice of evolutionists is to marshal many illustrations of microevolution and represent that all this process needs to accomplish megaevolution is just enough time. This assumption can never be shown to be true, because one of the most completely demonstrated principles of biology is the one which states that all processes of variation among plants and animals can do no more than produce another variety within a basic type which *was already in existence*.

This extremely basic and important principle has been overlooked by biologists due to their obsession of megaevolution. The following caution by evolutionist G. A. Kerkut¹⁶ is apropos here:

It might be suggested that if it is possible to show that the present-day forms are changing and evolution (microevolution) is occurring at this level, why can't one extrapolate and say that this in effect has led to the changes we have seen right from the Viruses to the Mammals? Of course one can say that the small observable changes in modern species may be the sort of things that lead to all the major changes, but what right have we to make such an extrapolation? We may feel that this is the answer to the problem, but is it a satisfactory answer? A blind acceptance of such a view may in fact be the closing of our eyes to as yet undiscovered factors which may remain undiscovered for many years if we believe that the answer has been found.

Two very influential books in recent years have been the beautifully colored Life Nature Library volume, *Evolution*, by Ruth Moore and the Editors of *Life*,¹⁷ and the even more beautifully colored and produced volume, *Atlas of Evolution*, by Sir Gavin de Beer.¹⁸ The impressive demonstrable evidence which fills these volumes is *microevolution only!!*

The script which directs the mind to megaevolution is purely philosophical. If you will believe the narrator is telling the truth you can become an evolutionist. It will have to be an act of faith, because actually every example given makes still more clear the great biological truth that all variation, naturally or artificially produced, can result in *nothing basically new*.

What is the significance of similar form and structure? Does it indicate genetic relationship? No. The Bible-believer, through a faith supported by the very real discontinuity of living forms in the living world and among the fossils, sees a work of special creation of basic types which are related only through having originated in the mind and by the command of the same Creator.

XII

Logical Is Not Biological

It is a point of interest to the creationist that the evolutionist begins by building his doctrine upon the truism in biology that "like produces like." From the assertions of Genesis, the creationist knows of the nearly simultaneous origin of all the basic types of plants and animals, and experience has shown both creationist and evolutionist that these basic types bring forth after their kinds.

Both would be flabbergasted if a sparrow were to produce a warbler, or if a rose produced a geranium. Reproductive isolation, even among sympatric kinds, is the natural way of life. As far back as records go, no basic kind has ever been known to produce a new basic kind.

Nevertheless the evolutionist pushes on past natural fact and insists that the only assumption he makes is no more nor less than a *logical extension* of what biologists consider a truism or self-evident fact, namely, that fundamental structural resemblance signifies genetic relationship; that generally speaking, the degree of closeness of structural resemblance runs parallel with closeness of kinship. The evolutionist realizes that if he cannot rely upon this assumption which he garners from the area of comparative anatomy, an assumption which he may call the principle of homology, he can make no sure progress in any attempt to establish the validity of the concept of evolution.

The developmentalist as well as the creationist relies upon the fact of heredity in everyday life. He plants a certain kind of seed and expects to get a certain plant. When breeding a certain kind of dog he expects offspring of the same breed. The production of like by like is a natural law of biology. When working with the realities of nature we know that there is no exception to the fact that a basic kind can never do other than produce more of its own kind.

And yet, evolution flies in the face of nature and builds upon the unnatural assumption that at many times in the past, basic kinds have produced something basically new. That is the only way new basic kinds could arise, and yet nature has not the mechanism to perform such unnatural acts.

Informed scientists know that the production by a basic kind of plant or animal of a new basic kind may be a *logical extension* of a truism in biology, but it is not *biological*.

Thus the evolutionist theorizes from simple to complex or specialized by recourse to assumed unnatural and apparently impossible behavior, while the creationist sees the basic types taking form in one literal week through supernatural acts of a transcendent Being. The very real dis-

continuity throughout nature supports only the view of the creationist.

XIII

Resemblances and Genesis Kinds

Do form and structure furnish a key to membership in Genesis kinds? No closer kinship can be imagined than that which exists between identical human twins. Careful statistical studies to determine the exact degree of their resemblances to one another have been made on over two hundred sets (see Newman¹⁹), revealing the rather startling fact that on the average they showed a coefficient of correlation of over .93 (i.e., 93 per cent) identical. The only structural resemblance belonging to this order of closeness is that existing between right and left halves (i.e., antimeric) of a single individual, such as the two sides of our face, or our two hands.

The next degree of resemblance is between brothers and sisters, who are only fifty per cent identical. Cousins of various grades have proportionately lower and lower degrees of resemblance in exact keeping with their relative degree of kinship. Thus it may be expected that among the descendants of any original kind, similarity of form and structure to the extent of distinguishing, for example, a cow kind of animal from a horse kind, will certainly exist.

How can we distinguish a horse from a cow? The evolutionist and the creationist both resort to a cluster of bodily characteristics in each case as distinguishing marks of membership in these respective kinds.

According to Genesis, resemblances among members of the bovine kind may indicate blood relationship, but resemblances between members of the bovine kind and the equine kind, for instance, are not indicative of genetic continuity between them. The evolutionist, employing in a broad way what he calls the principle of homology, takes in his words, "a short step in logic"²⁰ beyond actual performance in nature, and assumes that two somewhat similar basic kinds have been derived one from the other or both from a common ancestral form. In other words, he feels so strongly in the matter of physical resemblance as to declare Genesis wrong when it states that all basic types were created independently of each other.

Nevertheless, even very intelligent, well-informed, and self-satisfied scientists must realize that blood relationship is not the *only* logical, reasonable explanation of physical resemblance. Is it not equally reasonable that the Creator could form a man and a chimpanzee so alike anatomically as to make it possible to work out both of their minute anatomies from the same dissecting manual, without having to derive them from a common stem ancestor?

It is explained to us that it is *logically* impossible to draw the line at any level of organic classification and say that structural resemblance is the product of heredity up to such and such a level, but that beyond this arbitrarily chosen point heredity ceases to operate. It would be wise to introduce this statement by saying, "To the evolutionist it seems logically impossible . . ." and so on, because human logic is very possibly imperfect, and the facts of creation very likely may not coincide with it.

For that very purpose, in this matter, the Bible was given to man to guide in the formulation of his philosophy, and behold human logic is wrong if it demands that resemblance is the key to genetic relationship. The omniscient Creator stands in need of no apologist in those instances where His works do not check out with human logic.

XIV

Resemblances and Evolutionist "Footwork"

It is an interesting diversion to the creationist to see the skillful mental footwork of the evolutionist as he attempts in some cases to argue that resemblance indicates genetic relationship while in other cases it does not. This is the area of homologous structures, analogous structures, convergence or parallelism of form, and adaptive radiation.

Homologous structures are defined by evolutionists as those that are similar in anatomical detail and in their mode of embryonic origin, irrespective of whether they perform the same or different functions. Of course homologous structures are demonstrable and are as real to the creationist as to the evolutionist. However, the evolutionist's conclusion that homologous structures represent the same hereditary units and have been derived from the same or similar ancestors is pure speculation, and because in principle it is contrary to Genesis it is refused by creationists. Such structures reveal the ingenuity of the Creator in adapting the same basic anatomical pattern to different uses.

Structures which are superficially alike in form or in function, usually in both, though anatomically quite different, are said by the evolutionist to be analogous. These structures can be shown in the laboratory to be entirely different in their embryonic derivation. Examples here are furnished by the three aquatic vertebrates, the shark, the ichthyosaur, and the porpoise, all of which have, or had, the same fusiform body, median, paired, and caudal fins, and all swim, or swam, in the same way.

Because one is a fish, one a reptile, and one a mammal, the evolutionist holds that they do not have the same genetic continuity. In such examples the evolutionist sees what he thinks are

strong evidences of descent with modification, while the creationist is delighted with the ingenuity of the Creator in adapting different animals, on the same day of creation, to the same specific environment.

Creationists and evolutionists should be pleased whenever they can agree upon the same interpretation of certain natural facts. The phenomenon of analogous structures is one of these uncommon instances. Both agree that structural resemblance of this type does not indicate blood relationship even though superficially they are quite similar. Because of this superficial resemblance, evolutionists refer to such cases as illustrating, in H. F. Osborn's words, "the law of convergence or parallelism of form."²¹ The thought is that these different lines of organisms have gradually adapted themselves through time to the same environment until they have finally reached a stage of physical resemblance which might seem to indicate genetic relationship,—an interestingly different conclusion than that reached by evolutionists regarding homologous structures.

Additional examples of "**convergence**" are found in the fact that running animals generally have in common, long legs, and a tendency to stand on the toes. The toes may be reduced, as to one toe in the horse. Climbing animals are all provided with clinging appendages of some sort, including such structures as hooked claws, prehensile fingers or tail, suction pads on the feet, and other similar adaptations. Burrowing animals as a rule have an extra-heavy shoulder girdle and strong fore limbs with heavy gouging claws.

The evolutionist adroitly speculates that such resemblances do not indicate blood relationship within each ecological group, but he still pleads for evolution in the speculative assertion, "Analogous structures, while not considered as evidences of kinship, are strong evidences of descent with modification, for their very existence implies that they have changed from a former condition to one in which they are adapted to a new medium."²² This illustrates well what imaginative interpretation can do among demonstrated facts.

Adaptations: Primary and Secondary

In the matter of adaptive radiation there is always the problem of just how far it can be demonstrated in nature. The creationist accepts demonstrated facts, but in this area where does demonstration end and speculation begin? Often we see in organisms a remarkable capacity for individual adjustment to special conditions. Not only may the organism be amazingly well fitted for the average conditions of its environment, but, likewise, it may be able to adjust itself to

relatively wide variations from the optimum condition.

In making these adjustments the organism may respond with changes in its physical body, such as assuming white pelage in winter, or grow a thick, rough coat of long hair in cold weather and a short-haired, smooth coat in summer. Or some plants will grow entire leaves when well-watered, and develop only spines when growing under dry conditions, as in the European gorse.

Thus to a certain point adaptive radiation may occur. Possibly Darwin's finches on the Galapagos Islands are an actual case of such radiation in which one kind of bird has become adapted to special environmental factors, until its varieties came to occupy all the ecological niches of the islands from ground to tree and eating both plant food and insects.

But it is extremely vital to keep in mind that adaptive radiation has not been demonstrated to produce more than varieties or breeds within their respective kinds. These birds that Darwin studied on the Galapagos, whether eating cactus seeds on the ground or amazingly pursuing worms in a tree limb with a cactus thorn^{23,24}, had accomplished nothing more than new varieties of one finch.

The demonstrable facts do not verify the concept that because all tetrapods (land vertebrates, except snakes) have the same three bones in their forelimb they must have experienced adaptive radiation into their present form and structure from a primitive form by changes in proportion, fusion of parts, or loss of parts. The statement of Genesis that God created the basic kinds in one literal week rules out all such imaginings.

All *primary* adaptations, such as the fitness of the fish for the aquatic environment, and the squirrel for the arboreal environment, were made in the beginning. *Secondary* adaptations, more or less minor adjustments since creation, accomplish nothing more than possibly to produce new varieties in basic kinds already in existence.

That the area of comparative anatomy is declared by evolutionists to be "one of the most important fields of evidence for evolution,"²⁵ is truly no recommendation for the doctrine of evolution. That "short step in logic" necessary to invoke assumed natural forces which can produce morphological changes adequate to the job of bringing a new basic type into the natural world carries megaevolution out of reality into the world of make believe.

Like *does* beget like, but in actual performance this truism holds only so far as true genetic continuity can control the quality and quantity of likeness. Endless cases of objective proof demonstrate that blood-related likeness ends with the periphery of the locus of the basic kind.

On the other hand, where pigeons and chickens resemble one another the explanation lies not in even distant blood relationship, but in the fact that at creation the Creator chose to place in each respective complement of DNA those specific chemical adjustments which would produce these similar characteristics. This point of view does not arise through mere speculation, but rather from the record about the origin of kinds of organisms recorded in Genesis 1 and 2.

XV

Diagrams and Classification

The great problem of classification of plants and animals still stands as a mighty challenge to the biologist. References to this science always appear frequently in a discussion of form and structure, because they constitute the basis for all classification systems attempted so far. The father of modern taxonomy, the creationist Carolus Linnaeus, during the most active period of his life, *assumed* that the groups he called species were the created units, and for convenience in his work with plants he used the sexual parts of flowers in a purely artificial classification system.

He experimented with map-like diagrams, but he found that no arrangement he could make would always place similar forms together and separate dissimilar forms. For this reason such diagrams never gained much popularity as summaries of taxonomic data.

In their pursuit of a means of expressing their findings diagrammatically, taxonomists next tried to arrange living forms on a ladder-like figure—a ladder which attempted to include everything from amoebae to archangels, based on the *assumption* that the adaptation of living things is progressive so that any particular animal should be preceded by one somewhat lower in the scale of life and followed by one somewhat higher in this scale. This worked fairly well for the fishes, the amphibians, and the reptiles.

However, the series cannot continue on with the birds and mammals because the majority of birds are in every respect quite as “high as the majority of mammals, thus requiring two rungs at the same level of the ladder. This type of dilemma is repeated frequently not only among higher forms, but even more frequently in the lower levels of classification.

Third Type of Diagram Proposed

This need for parallel rungs at many levels soon suggested a third type of diagram, one in the form of a tree. This invention delighted evolutionists because they *conceived* that, as in the case of the tree, a development of organisms had occurred from one, or a very few, simple sources, the growth being accompanied by branching and differentiation.

Albeit they recognized that unlike the growth

of a tree, the processes of branching and differentiation were not amenable to direct observation. Faith and imagination had to supply all of the phylogenetic tree except its branches and twigs. For that reason the evolutionist's tree of life is really a great intellectual curiosity, or even monstrosity, because the very real basic types appear on this “tree” with no demonstrable, i.e., real, connection or support.

Developmentalists experience considerable confusion and difference of opinion as they try to attach the real branches at the assumed proper places on some assumed main branch or on the assumed trunk. The creationist would suggest that they drop this losing game and place a Creator in the central vacuity of their tree of life as the originator of all basic types.

The demonstrable discontinuity in the world of living things dooms the evolutionist's tree of life, at least in the sense that all the basic kinds have developed from a distant common ancestor and are therefore blood related. It would appear that the field for the development of a classification system based upon the truth of Genesis is still wide open.

Creationists do not speak of *one* phylogenetic tree, but they do consider a whole forest of smaller or simpler trees. Each tree would represent one basic type, and in some cases at least a considerable tree appears, as clusters of forms whose individuals will hybridize are studied. The cabbage, for instance, apparently may have varied so widely within its basic type as to shape into a very intriguing tree. The same is true more or less with most of our domesticated plants and animals. What a delightful complexity if we were to unravel the phylogenetic tree of even one of our choice roses!

XVI

Comparative Anatomy and Archetypes

Certainly a discussion of comparative anatomy from the point of view of the special creationist would be seriously lacking if no mention were made of Linnaeus' theory of archetypes. The term “archetype” springs from the Latin *archetypum*, which refers to an original pattern or plan from which an object is made or formed. Appearing as a synonym is the word *prototype*.

Linnaeus' theory of archetypes assumed that the Creator worked from a series of plans, the archetypes, which were limited in number. These archetypes fell into clear-cut, classifiable categories. In his system of classification he recognized only classes, orders, genera, and species. The class would correspond to a major archetype while the various orders within a class would be lesser archetypes, and so on down the hierarchy.

This theory seems very reasonable, and yet one which, if employed by the Creator, was by no

means used in every case. Among mammals it is possible to explain that often both males and females have nipples because of a creation which employed archetypes. Possibly a wider application of a model may appear in animals which have either a nictitating membrane or a fold (called the *plica semilunaris* in man) at the inner angle of the eye. However, pitfalls lie all about in this area.

Speculation takes over when we study such instances as the fact that although the dandelion produces abundance of pollen, still this pollen is all sterile. Is this due to the adherence of the Creator to a plan which required that certain flowers shall have both stamens and pistils even if the anthers produce only inviable pollen, or has mutational change occurred here since creation?

In the case of certain blind cave fishes the creationist Louis Agassiz was of the opinion that the Creator had created them blind and placed them in caves in that condition where we find them today.²⁶ In that case the non-functional optic nerves which are present in certain of these fish (*Amblyopsis*, *Typhlichthys*, and *Troglichthys*^{27,28}) would be mere extraneous structures due to the Creator's adherence to a type which required optic nerves. Or is it not more likely that in such instances the eyes, including the distal portions of the optic nerves, have suffered from mutation at some time since creation?

Cautionary Word About Archetypes

When pondering the matter of archetypes care must be used not to fall into the dogmatic position of evolutionists who affirm that, if special creation occurred then the Creator *must* have used archetypes throughout, and if He employed such models then He would be obliged to use them *in every pertinent case*. Man should be very cautious in conjuring up supposed courses of procedure which he assumes a Creator would be required naturally to follow if basic types arose by special creation. This evolutionist activity of building up straw men and then gleefully tearing them apart must present a rather pathetic picture to an omniscient Creator.

In our study of comparative anatomy we are delighted to find instances where the Creator appears to have employed archetypes rather broadly. But at the same time we are pleasingly diverted to discover in another animal a surprise use of some other invention of form or structure for the same purpose, a different structure which appears to exist for the sole end of introducing variation.

Nature is replete with the employment by the Creator of so many ways of providing motion for animals immersed in water, for locomoting over dry surfaces, for moving freely through the trees, for flying through the air, and on *ad infinitum*. General plans such as archetypes present

a restful, stabilizing organization in nature, and at the same time the variations which appear at every hand add a zest to nature study which prevents ennui and tedium.

The more one familiarizes himself with the structural forms of plants and animals the nearer he draws to the conclusion that the Creator takes great delight in variation. A creation of man in the image of God seems to include an endowment with the capacity of thoroughly enjoying this delightful diversity supplied so bountifully in the form and structure of living things.

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(Continued from Page 4)

firmament showeth His handiwork (Psalm 19:1), and furthermore, this "declaration" of God in His created cosmos can never contradict the subsequent and more specific declarations of His written Word.

Some people have questioned the concept of "creation research," since creation is no longer occurring (as stressed both by Genesis 2:1-3 and by the Law of Energy Conservation), and therefore is not subject to experimental investigation. The term of course is intended rather to describe research demonstrating the *fact* and purposes of special creation and the falsity of alternate theories of origins, and thus is a very appropriate name for our activities.

Several articles in this *Annual*, in fact, report results of important original research supporting and illuminating the truth of Biblical creationism. One of these—the thrust-fault study of Burdick and Slusher—was made possible by the first grant from our C.R.S. Research Fund. We hope this is only the beginning of a greatly-extended ministry of this sort. New research proposals, with supporting cost estimates and justification,

are invited from our members; and new contributions to the Research Fund for such purposes are also solicited.

In addition to doing and publishing such research, we need to explore better ways of making the results known, especially to the scientific world and to leaders in the Christian world. Such things as gift subscriptions of the *Quarterly* to scientist friends, libraries, church leaders, and others, might well be promoted on a larger scale than has been possible to date. I would be happy to receive any suggestions along this line, and to pass them on to the Board of Directors for consideration.

There are undoubtedly many present and prospective members who have good research ideas, as well as the needed talents and training, for fruitful research in some aspect of creationism but who for various reasons have not yet implemented them. I would encourage you to "get going," in confidence that the Lord will surely guide and use such efforts. The time may be short and the need is great.

HENRY M. MORRIS
President

(Continued from Page 12)

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"ONTOGENY RECAPITULATES PHYLOGENY"

WILBERT H. RUSCH, SR.*

The history of the so-called "law of Recapitulation" is briefly examined from its inception down to Ernst Haeckel who finalized it as the "Biogenetic Law." Because of many short-comings discovered since Haeckel's day, the idea of "Recapitulation" is no longer generally recognized as a "Law" and some modern texts on evolution omit all reference to the topic. Some post-1960 textbooks, however, still present the illustrations of supposed embryological stages by Ernst Haeckel as support for the theory of evolution.

Original criticisms of the honesty of Haeckel's arguments and illustrations are presented here, based on translated excerpts from the original German reviews by L. Rutimeyer, professor of science at the University of Basel, and early critic of Haeckel. These original sources indicate that Haeckel's woodcut series illustrating ova and embryos were fraudulent. Articles by Wilhelm His, Sr., embryologist and anatomist of the University of Leipzig, also demonstrate that Haeckel's works contained distortions that were evidently perpetrated with the direct intent to deceive.

It is suggested that future editions of science texts eliminate all use of Haeckel's questionable materials. Perpetuating these distorted drawings as true representations of the embryos in question and as having weight in the argument for evolution is certainly regrettable.

Introduction

The concise dictum expressed in the article title is known as the "Law of Recapitulation" as well as the "Biogenetic Law." Many years before Darwin advanced his theory of evolution, the superficial resemblance of the young of higher animals to the adults of lower animals had attracted the attention of zoologists. Various views, often very naive, had been advanced to account for these resemblances.

Although Needham¹ mentions that Aristotle had some thoughts on this matter, T. H. Morgan² considers Kiehmeyer to have been the first to have expressed a view on recapitulation, when in 1793 he noted the resemblance of the tadpole of the frog to an adult fish. Meckel (1781-1883) seems to have been the first to suggest that higher animals repeat or recapitulate in their development the adult stages of various lower animals.

Karl Von Baer (1792-1876) differed from Meckel's view when he concluded the following: 1) in the development of an organism from the egg, the general characters appear before the special characters; 2) from the more general characters, the less general, and finally the special characters are developed; 3) during its development an animal departs more and more from the form of other animals; and 4) the young stages in the development of an animal are not like the adult stages of other animals lower down the scale, but are like the young stages of those animals.

While examining a couple of embryos he had preserved in a spirit solution, von Baer was unable to determine whether they were reptilian, mammalian or bird. However, among older specimens, the resemblance between the early

stages diminished. It should also be noted that von Baer only compared embryos of the same **phylum** with each other, and stated that there are no grounds for comparisons between embryos of different phyla.

Despite von Baer's criticism of Meckel's view, Darwin and the Darwinians incorporated into the theory of evolution the concept that the embryo of higher forms recapitulated the series of ancestral adult forms through which the species had passed supposedly. This belief was concisely stated as "ontogeny recapitulates phylogeny" or "the development of the individual repeats the development of his race."

Haeckel Elaborated on Darwin's Ideas

Darwin's interpretation was elaborated and elevated to the status of a law by Ernest Haeckel (1834-1919), which he named "the Biogenetic Law" (Biogenetische Grundgesetz). Haeckel, as the Huxley of Germany, was Darwin's most enthusiastic supporter and salesman, and he wrote a number of books dealing with evolution in general and with man in particular.

In all these works, his Biogenetic Law occupied a position of extreme importance. For example, it is well known that Haeckel felt that since nearly all metazoa pass through a gastrula stage, therefore the adult ancestor of the metazoa was a gastrula, or gastraea as he called it. The Coelenterata of today were held to be the present-day representatives of this gastraea.

Such was Haeckel's persuasiveness that embryologists for many years after him examined embryos primarily to establish evidence of phylogenetic relationships. As a result, in most cases, recapitulation was considered to be sufficient cause for the various stages in embryological development. Many agreed with Haeckel's view that phylogeny was the mechanical cause of ontogeny.

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Even Smith-Woodward,³ a paleontologist addressing the Linnean Society in 1923, proclaimed himself “convinced that whenever he is able to trace lineages he finds evidence of the recapitulation of ancestral characters in each life-history” and “he is equally convinced that the phenomena he observed when tracing lineages can only be explained by assuming that acquired characters are inherited.”

Specific Difficulties Noted

However, difficulties began to appear, of which Huettnner has pointed out the following. It was noted that mammals never have a true blastula or gastrula. Some organs apparently do not develop in the proper order required by the law. For example, in the mammalian embryos, the tongue develops before the teeth. It is also known that “environmental conditions will change the orderly sequence of differentiation in the embryo,” which drives one to the conclusion that “recapitulation is subject to change.” These and other difficulties have led to the general abandonment of the Biogenetic Law by modern biologists.

However, a more serious aspect of the Biogenetic Law is represented by the fraudulent activities that Haeckel engaged in to substantiate and support it. These were first drawn to my attention as having a solid basis in fact by Dr. W. R. Thompson when in 1956 he wrote the following in his “Introduction” to Darwin’s *Origin of Species*:

“A natural law can only be established as an induction from facts. Haeckel was of course unable to do this. What he did was to arrange existing forms of animal life in a series proceeding from the simple to the complex, intercalating imaginary entities where discontinuity existed and then giving the embryonic phases names corresponding to the stages in his so-called evolutionary series. Cases in which this parallelism did not exist were dealt with by the simple expedient of saying that the embryological development had been falsified. When the “convergence” of embryos was not entirely satisfactory, Haeckel altered the illustrations to fit his theory. The alterations were slight, but significant. The “biogenetic law” as a proof of evolution is valueless.

Today the “biogenetic law” itself is generally discredited as a law. A number of modern texts on evolution no longer refer to the idea at all. When Garbowski⁶ once wrote: “Most of what is generally ascribed to the action of the so-called ‘Biogenetic Law’ is erroneously ascribed to it; because everything that is undeveloped and incomplete must be more or less alike,” he was pointing out another inherent weakness in the

whole argument of Haeckel. Many biologists agree with the current evaluation of the law by Ehrlich and Holm⁷:

This generalization was originally called “the Biogenetic Law” by Haeckel, and it is often stated as “ontogeny recapitulates phylogeny.” However, this crude interpretation of embryological sequences will not stand close examination. Its shortcomings have been almost universally pointed out by modern authors, but the idea still has a prominent place in biological mythology.

However, it is necessary to investigate the validity of Haeckel’s illustrations on which the law is based, since these illustrations are still published as one of the diagrammatic “evidences” for evolution in some contemporary textbooks. Despite the regrettable activities of Haeckel that are dealt with in the following, inspired no doubt by his enthusiasm for evolution, it should also be remembered that Haeckel was an excellent morphologist. For example, his monograph on the Radiolaria is considered to be one of the great works on this subject, as is his publication on the calcareous sponges.

Haeckel Resorted to Distortions

But it still remains true that, in attempting to prove his law, Haeckel resorted to a series of dishonest distortions in making his illustrations. Branding them as dishonest is not too harsh, since Haeckel mentions where he originally procured some of his drawings, without mentioning the alterations he made. This left his readers under the misapprehension that the drawings of these embryos were unchanged from the original sources. These appeared in two of Haeckel’s works, one being his *Natürliche Schöpfungsgeschichte* (*Natural History of Creation*) and the other, his *Anthropogenie*.

The first edition of Haeckel’s *Natural History of Creation* was published in 1868. In it Haeckel stated that the ova and embryos not only of different vertebrate animals, but also of man, are at certain periods of their development, all perfectly alike. In proof of this assertion he inserted side by side, on page 242, three woodcuts purported to be of ova of man, monkey and dog, respectively, each enlarged 100 times. As one can see from the photocopies taken from Haeckel’s work, the three eggs look identical (Figs. 1, 2 and 3). This would indeed be a very striking proof of a common origin for the three.

On page 248, three woodcuts of embryos are found, supposedly those of dog, chicken and tortoise (Figs. 4, 5 and 6). Again one can observe for himself the complete lack of difference between the three. Accompanying text on page 249 pointed out that, in neither case was any difference discovered between the three, which

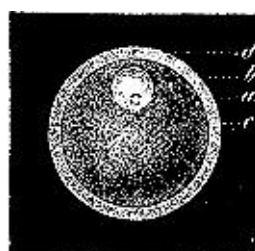


Fig. 6.

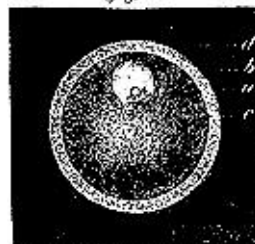
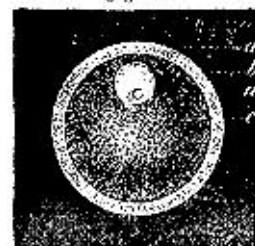


Fig. 7.



Figures 1, 2, and 3. Haeckel's drawing of ova of dog, monkey and man (same woodcut printed 3 times).

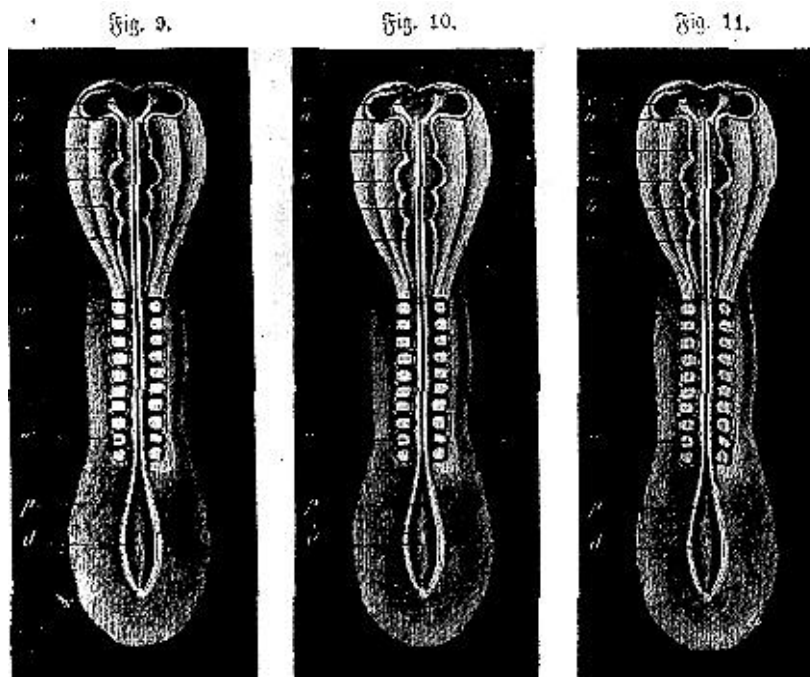
everyone looking at the illustrations would certainly take to be a fact. This statement caused some sensation in the ranks of the embryologists and anatomists of that day and soon led to a thorough examination by some investigators.

The result of this examination was rather startling. L. Rutimeyer,⁸ professor of zoology and comparative anatomy at the University of Basel, stated the following in a review of two of Haeckel's works, one being his *Natural History of Creation*:

Referate

- E. Haeckel, *Über die Entstehung und den Stammbaum des Menschengeschlechts*, Berlin, von Virchow und Holtzendorff, 1868.
- E. Haeckel, *Natwrlliche Schopfungsgeschichte*, Gemeinverständliche wissenschaftliche Vorträge über die Entwicklungslehre im Allgemeinen und diejenigen von Darwin, Goethe und Lamarck im Besondern usw. Berlin, 1868.

Both publications are essentially expansions of several parts of a previous work of the same



Figures 4, 5, and 6. Haeckel's drawings of embryos of dog, chicken and tortoise (same woodcut printed 3 times).

author (*Generelle Morphologie der Organismen*, 2 volumes, 1866). However, these works are aimed at the general public. The previous work assumed that those who could grasp the assumptions of the author, and follow his reasoning therefrom, would be in a position to judge the validity or lack of validity of the propositions presented.

These works of Haeckel's propose to follow the scholarliness demonstrated in the works of Darwin, Goethe and Lamarck, who are mentioned in the title. These works have been called a kind of new literature, that up till now has been difficult to classify. Haeckel claims these works to be both easy for the scientific layman to follow, and scientific and scholarly. No one will quarrel with the first evaluation of the author, but the second quality is not one that he seriously can claim. These are works, clothed in medieval formalistic garb. There is considerable manufacturing of scientific evidence perpetrated. Yet the author has been very careful not to let the reader become aware of this state of affairs. . . . But the most important illustrations from a critical standpoint, are those inserted into the body of the text. These original illustrations, which are few, are really new. Particularly the drawings on page 240, and above all, the woodcuts on page 248, are worthy of critical attention.

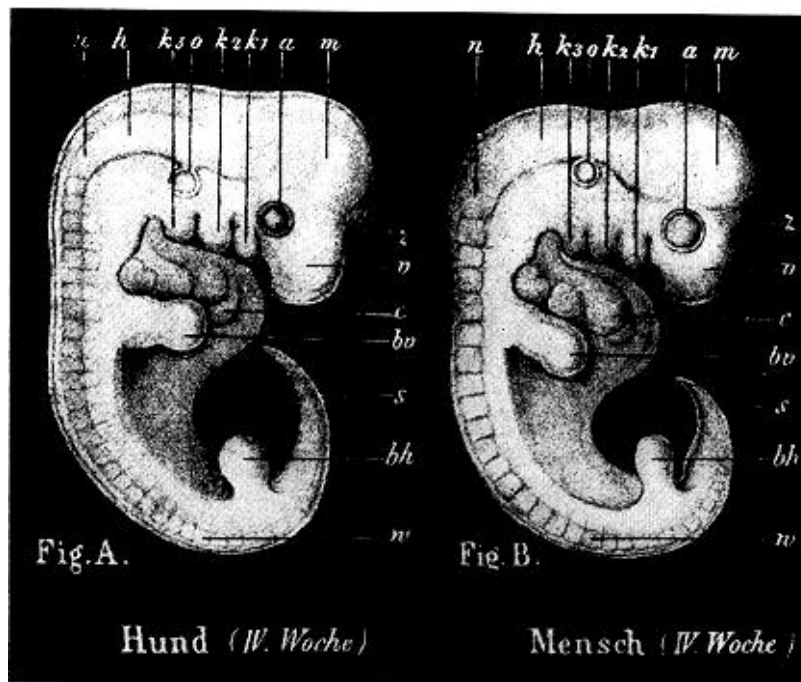


Figure 7. Haeckel's drawings of dog embryo and human embryo, each in the 4th week (From *Natural History of Creation*). Note alterations from originals, Figures 8 and 9.

That we have originals here, no one can deny. Yet one might expect that a research worker will not make models and generalizations for speculative purposes as has occurred with Haeckel's drawings on page 240, particularly when such wide-ranging conclusions are to be built on them. Under such circumstances, greater scrupulousness and conscientiousness are required. But on this page we find comparisons of the drawings of a dog embryo (4th week) taken from Bischoff, a human embryo taken from Ecker (4th week) (see Figure 7 and compare with originals, Figures 8 and 9), and a tortoise taken from Agassiz. Rather than being accurate, these drawings have been generalized to prove the author's point. But much worse is found on page 248, where the same woodcut is printed three times as separate illustrations, with a different title under each printing (Figures 4, 5, and 6). These are labeled as the embryos of a dog, a chicken, and a tortoise. When these are marshaled before the reader as being factual, this can only be termed as playing fast and loose with science as well as the reading public. When a microscopist of ability such as the author writes what is purported to be a scientific "schöpfungsgeschichte," but doesn't point out the schematic nature of his illustrations, and then in his text states as he does on page 249, "when the embryos of the dog,

chicken and tortoise in figures 9, 10 and 11 are compared (see Figures 4, 5, and 6), one finds that one is not in a position to tell the difference" it is then in place to protest.

(Editor's Note: The above excerpts are taken directly from a translation made by Prof. Rusch of the article in question, since, to his knowledge, no English translations are available.)

Today, the question might well be asked, Who was Rutimeyer, of whom few scientists today have even heard? What qualified him to pass judgment on the work of such a well-known "giant of biology" as Haeckel, particularly when in almost all American references to Haeckel's work, such activities of his are not even hinted at?

As stated before, Rutimeyer was professor of zoology and comparative anatomy at the University of Basel. In addition, he was a regular contributor and correspondent of the *Archiv für Anthropologie* and his name appears on the title page of each volume published about that time. To the best of my knowledge, the review of Rutimeyer was never published in America, nor have I ever encountered any reference to it in any English language publication. Two residents of British India, Assmuth and Hull, produced a little known work entitled *Haeckel's Frauds and Forgeries*. This was published by the Bombay Press in 1911 or thereabouts. However, it does not seem to be available in this country.

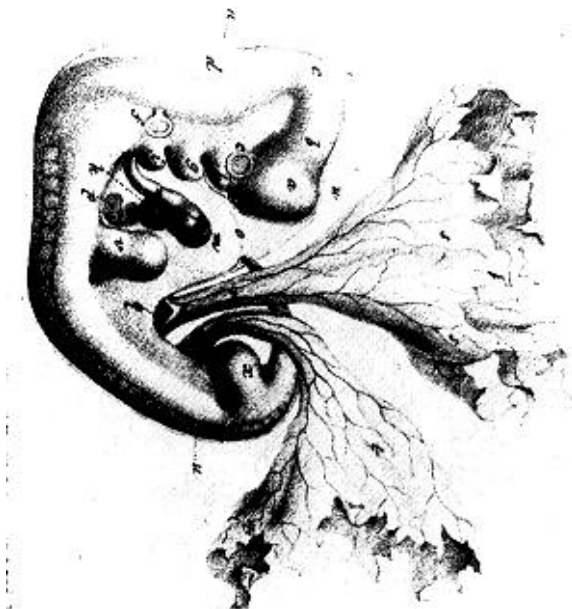


Figure 8. Original drawing of dog embryo (4th Week) taken from Bischoff.

His, Sr., Corroborates Rutimeyer

Rutimeyer was apparently the first scientist to discover Haeckel's misrepresentations and report them. In any case, Rutimeyer did not stand alone. William His, Sr. (1831-1904) was a famous comparative embryologist and professor of anatomy at the University of Leipzig. He was the first to insist, contrary to the majority opinion of his day (including that of Haeckel), that the course of embryological development was influenced by the physiology and activities of the cells, rather than by the mechanical activities of folding and migrations of the structures.

A check of university libraries will reveal many a card for embryological works of Wilhelm His, Sr. He was the author of the first great work which stands as the foundation of our modern knowledge of human development, *The Anatomy of Human Embryos*, published in 1880.

He also perfected the technique of making serial sections so important to embryo study. Along with Born, he perfected the wax plate method of making accurate scale reconstructions from such sections. Thus His appears to have been thoroughly qualified to pass judgment on matters embryological. (To avoid confusion, it should be mentioned that he had a son, Wilhelm His, Jr. (1863-1889) who was also a noted comparative embryologist. His, Jr., discovered what is called the Bundle of His, more commonly referred to as the A-V bundle.)

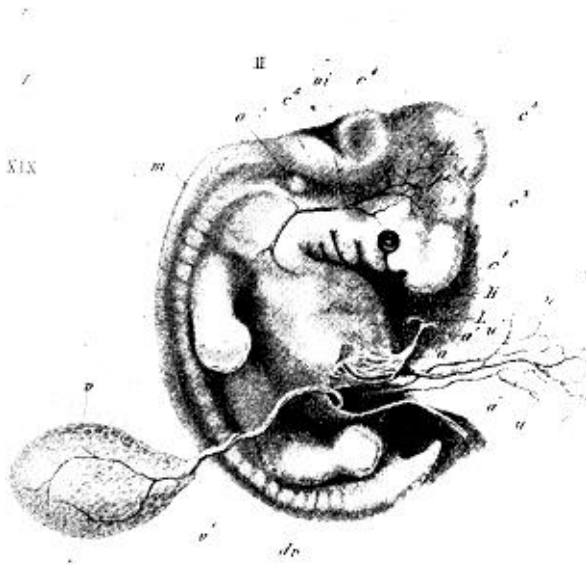


Figure 9. Original drawing of human embryo (4th week) taken from Ecker.

Among the works of Wilhelm His, Sr., is a collection of letters to Carl Ludwig on the celebration of his 25th anniversary as a teacher. These letters were published in Leipzig under the title *Unsere Koperform und das Physiologische Problem Ihrer Entstehung*. The fourteenth letter, entitled "Das Biogenetische Gesetz," deals with Haeckel's activities. Here His refers to the 5th edition of Haeckel's *Natural History of Creation*. As previously stated, Haeckel used Bischoff's illustrations of a 25-day-old dog embryo and Ecker's 4-week-old human embryo.

Haeckel Manufactured Evidence

W. His refers⁹ to the liberties Haeckel took with these illustrations to manufacture evidence for his law, viz., pointing out that he had added 3.5 mm to the head of Bischoff's dog embryo, took 2 mm off the head of Ecker's human embryo, reduced the size of the eye 5 mm, and doubled the length of the posterior. In this case, to say nothing about figures freely invented, even copies are altered so as to give false support for the hoped-for identity of forms.

As he proceeds, His refers to Haeckel's *Anthropogenie*. Referring to page 272, he notes that two figures of human embryos are shown with the allantois clearly visible although this is the blastula stage, and, as a competent embryologist, he points out that this structure is never seen in that stage.

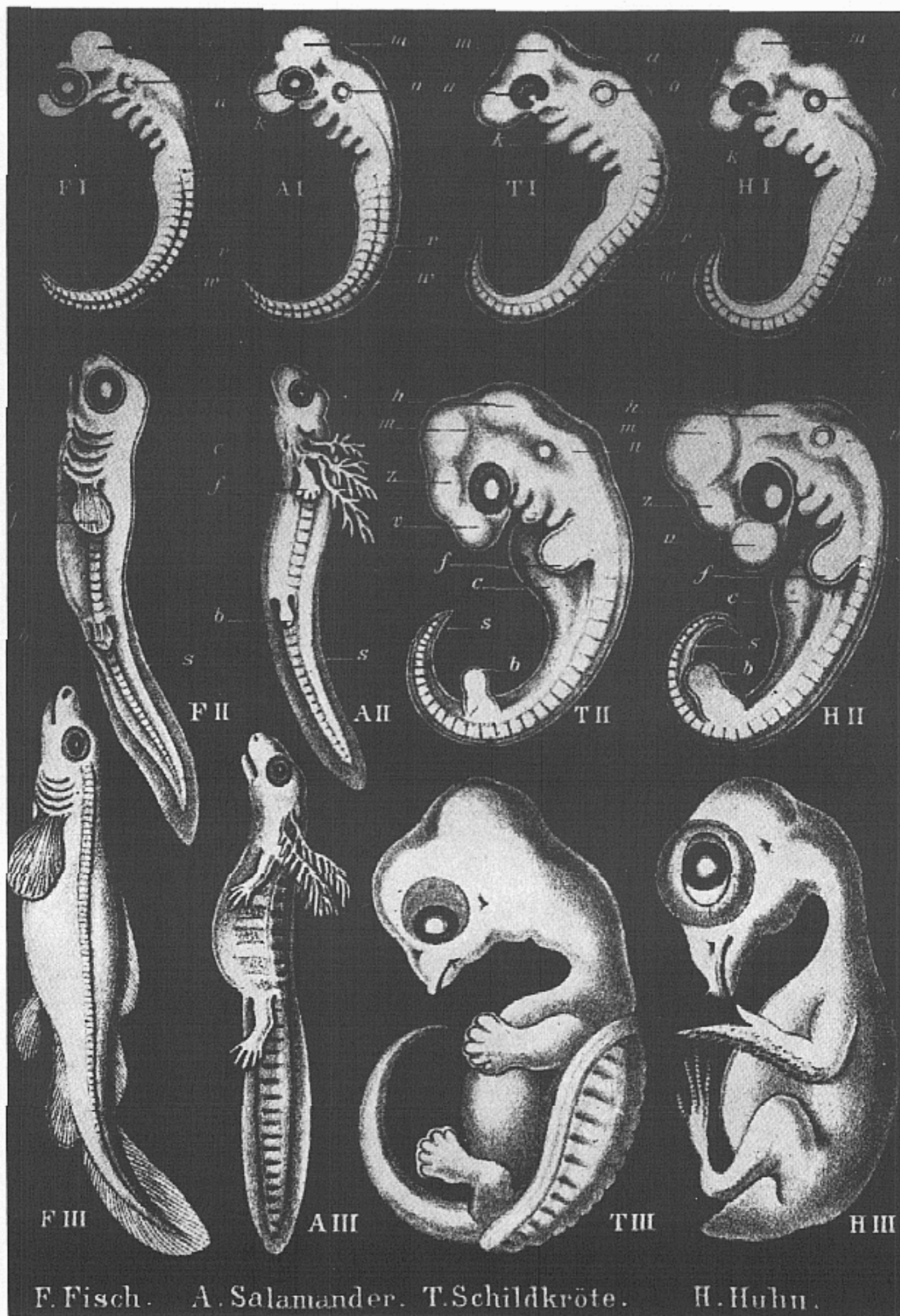
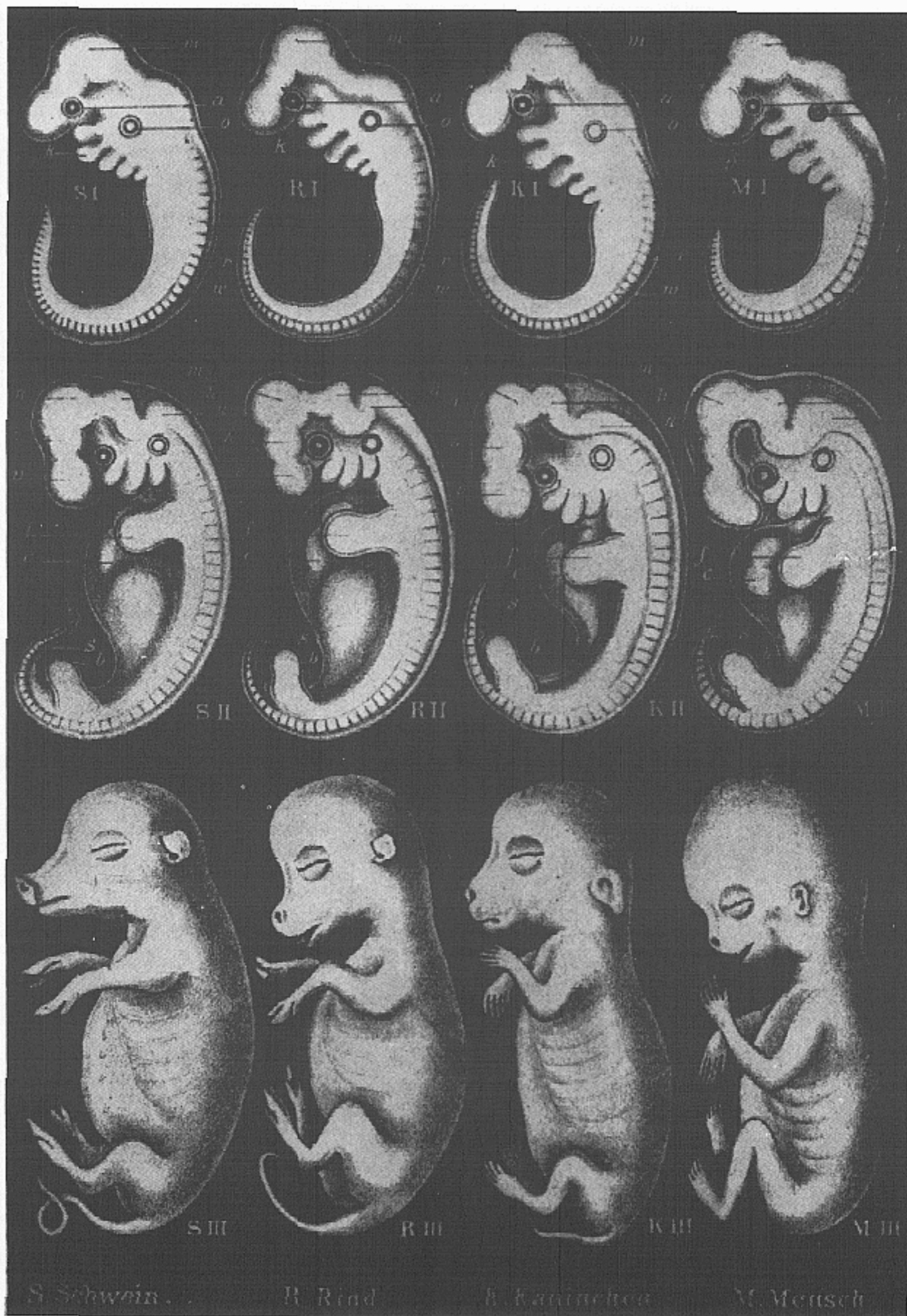


Figure 10. Table IV found in Haeckel's *Anthropogenie*.

Figure 11. Table V found in Haeckel's *Anthropogenie*.

In this same work, His points out where Haeckel on pages 256 and 257, Tables IV and V, put together not less than 24 figures made up of 3 stages of eight different animals (see Figures 10 and 11). His condemns the whole set as being gross distortion, not consistent with the facts. Yet he points out that the figures are placed together with the intention, clearly expressed in the text, to prove factual similarity of the stages.

On page 253, Haeckel states that there is not a shred of observable difference between the human embryo and the embryo of any other vertebrate in the stage represented by the top row of figures. However, His¹⁰ outrightly condemns Haeckel on this point as straying from the truth in both his text and his drawings.

Conclusions

In conclusion, His points out that Haeckel was located at Jena, where the excellence of the optical equipment available there left Haeckel with no excuse for his distortions. Haeckel could not plead lack of drawing ability, since many methods, e.g. camera lucida, were available to provide for exact reproductions. His' conclusion is that one who engages in such blatant fraud, forfeits all respect, and so even though others praise and honor Haeckel, His feels Haeckel has eliminated himself from the ranks of scientific research workers of any stature.¹¹

Although other scientists of the day protested against Haeckel's misrepresentations, as well as his "Biogenetic Law," e.g. Albert Fleischmann,¹² as documented by Rutimeyer and His, Haeckel continued to publish them, and operated under the principle that the best defense is attack. His makes reference¹³ to the fact that Haeckel vilified those who exposed him without answering the charges, being particularly vicious in the case of Rutimeyer.

However, despite the severe criticism by His and others, the set of 24 figures, referred to by His, appeared in many works in those days and thereafter. Among such works was a two volume publication entitled, *Darwin and After Darwin* by George Romanes, published in 1892. On pages 153 and 154 of Vol. I, Haeckel's drawings are presented, with the legend title underneath giving credit to Haeckel, stating¹⁴ they were taken from his *Natural History of Creation*. However, actually they appear in Haeckel's *Anthropogonie!*

Most current biology works no longer use Haeckel's fraudulent drawings. Unfortunately, however, there are some post-1960 texts that still do, which is the justification for this article; titles of examples are listed as references 15, 16, 17, 18, 19.

A charitable view would be that those who have used these illustrations are unaware of the history and judgment behind them. In one text,²⁰ the caption under the drawings states that they were taken from Romanes. Even so, these drawings are still Haeckel's works, as can be seen by a comparison with Figures 10 and 11.

One hopes that future editions will eliminate the use of such questionable material. Perpetuating these distorted drawings as true representations of the embryos in question and as having weight in the argument for evolution is certainly regrettable.

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RESEARCH ON THE CLASSIC JOGGINS PETRIFIED TREES

HAROLD G. COFFIN*

A re-examination of the Carboniferous section of Joggins, Nova Scotia, does not support the prevailing theory that the petrified trees and coal deposits are *in situ*. Ten evidences that support the allochthonous emplacement of the trees and rapid sedimentation include the absence of soil zones, unusual plant fossils within the hollow stumps, remarkable preservation of delicate fossils, diagonal trees, abundant presence of the marine tubeworm, *Spirorbis*, and polystrate trees. Seven observations that favor a similar interpretation for the *Stigmaria* "roots" associated with coal include the negative geotropism of the appendages, isolated sections of *Stigmaria* with radiating "rootlets," unusual orientations of *Stigmaria* and appendages, and the remarkable similarity of *Stigmaria* to the creeping stems of *Lycopodium*. A tentative model of allochthonous organic sedimentation is proposed.

Introduction

Along the upper end of the Bay of Fundy, and on the outer east coast of Nova Scotia, a classic phenomenon of great interest is seen. Upright petrified stumps embedded in the cliffs have been exposed by marine erosion. It is a singular experience to walk along the beaches and see trees up to five meters tall and one meter in diameter standing out from the cliffs in what appear to be their original positions of growth. (Figure 1)

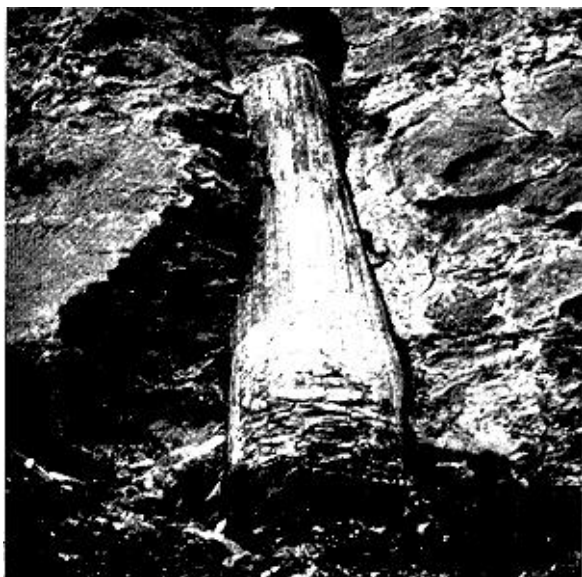


Figure 1. A beautiful petrified tree (*Sigillaria*) originating in shale and extending up into sandstone. Joggins, Nova Scotia.

Coal is mined along the Bay of Fundy and in other Upper Carboniferous deposits of Nova Scotia. Petrified trees arise from the upper surfaces of some of the coal seams or are distributed in the strata between seams.

Charles Lyell visited¹ the cliffs near Joggins in 1842. A young Canadian scientist, William

Dawson, accompanied him during a later visit, and went on to make a comprehensive study² of the Carboniferous of Nova Scotia. They followed the stratigraphy worked out by William E. Logan,³ the first director of the Geological Survey of Canada. Richard Brown⁴ recorded some of the unique features of the coal measures of the Sydney, Nova Scotia, area and helped settle the controversy concerning the relationship between some of the common fossils associated with coal, namely the *Stigmaria* roots and *Lepidodendron* trees.

Trees most commonly involved are the lycopod genera *Sigillaria*, *Lepidodendron*, and the coniferous *Cordaite*s; the first two are often upright whereas the latter one is not. (Figure 2) The roots of the upright lycopods have been shown to change in morphology to become unquestioned and typical *Stigmaria* roots.⁵ I also found one example near Sydney Mines that clearly demonstrated this relationship between the *stigmariae* and the lycopod trees.



Figure 2. Two *Cordaite*s petrified logs in prostrate position. None were found upright. Joggins.

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Figure 3. Erect lycopod stumps were hollow and filled with sediments when buried, Joggins. Note that the sandstone bed passing along the top is not found inside the tree.

The trunks of the two giant club-moss genera apparently were hollow or had soft pulp centers because all the vertical stumps were filled with sediments and only the outer wood or bark remained as a thin film of coal. (Figure 3) Horizontal trees of this type were almost always flattened.

*Cordaite*s, a coniferous tree somewhat resembling the Parana Pine of the Southern Hemisphere, was not hollow. It had long spatulate or lanceolate leaves with parallel striations on the surface which caused early taxonomists to misplace it among the Monocotyledon.

Two Possible Viewpoints

In the early days of geological investigation and observation, keen students of the earth such as Nicolaus Steno and John Woodward largely accepted the Genesis Flood as a reality and interpreted the structure of the earth's surface and the organic evidences found within as the result of this event. When coal was definitely established to be plant debris, the mode of its emplacement in the sediments was generally assumed to be the result of drift on the waters of the Noachian Deluge.

A new view was voiced in the writings of Hutton and Playfair, and crystallized under Lyell. Under these and other opponents of catastrophism, the autochthonous* concept of coal formation became dominant and has remained dominant except for some weakening of the view under the impact of Henry Fayol's clear and

*The term "autochthonous" refers to coal formation from indigenous plant remains which grew in the place where coal is found (i.e. in situ). The term "allochthonous," refers to coal formation from plant remains which have been transported by some force from place of original growth to present location.



Figure 4. *Stigmara* with radiating appendages. This *Stigmara* was traceable a few feet to the right where it joined an erect tree. Point Aconi, Cape Breton Island, Nova Scotia.

forceful presentations for drifting which he produced near the end of the nineteenth century.⁶

Among the factors which served as strong arguments for *in situ* accumulations of plant remains were the reports and studies⁷ of erect trees and spreading roots and rootlets (*Stigmara* and appendages) apparently found in place in the ancient soils. Despite serious anomalies connected with the uniformitarian interpretation of the vertical trees, the spreading roots and rootlets, and the surrounding sediments, the trees and stigmarae, probably more than any other factors, cemented the thinking for autochthonous coal formation. (Figure 4) This view of coal origin necessitates abundance of time for geological processes to function at uniform rates. Thus this belief was a major contributor to the establishment of the geologic time scale. Few other formations appeared to have as many and as convincing evidences of *in situ* conditions as did the Carboniferous.

Dawson considered each level of trees to represent a ground surface or soil level. Taking also the *Stigmara* root zones and the coal seams to be soil levels, he recorded 85 such horizons and felt this to be the minimum number of soil levels revealed along several miles of sea cliffs in the Joggins region.⁸

The growth of forests and the establishment of soils for at least 85 levels, required the rhythmic rise and fall of the land for the burial of each level. Incomplete cyclothems are continuous through more than 14,000 vertical feet in the Joggins area.⁹ The difficult requirement for the land surface in the same locality to be suitable for the exacting conditions of bog formation following many of the emergences from the sea was considered justified by the evidence.

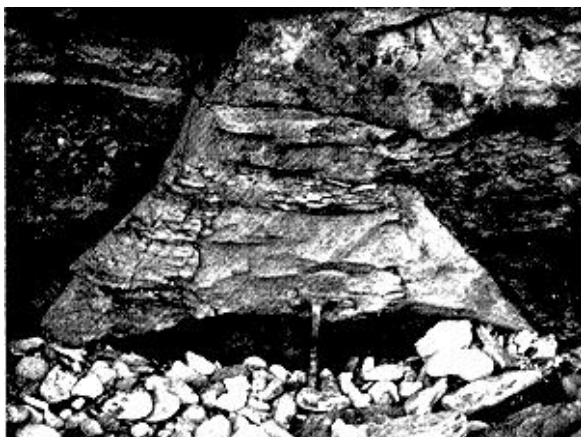


Figure 5. This petrified stump is filled with coarse sandstone but surrounded by shale except at the top. Hammer at base gives scale. Point Aconi, Cape Breton Island.

Ten Evidences for Allochthonous Origin

Although the autochthonous origin of the coal, trees, and *Stigmaria* roots at Joggins has been assumed since Dawson's research, substantiation of this view appears difficult. Evidences in favor of an allochthonous origin and rapid sedimentation are enumerated below:

1. The coniferous *Cordaites*, although mingled with erect lycopod trees, has not been found erect. (Figure 2) If the trees are in growth position the solid, more durable trees, rather than the hollow fragile ones, would be expected to remain standing in the midst of invading seas and depositing conditions.¹⁰

2. Just under 70% of the hollow vertical tree trunks contain sediments unlike or having different bedding than the surrounding matrix. Often the type of sediment lying just above the broken-off stump top also fills its hollow cavity. A few examples had internal sediments unrelated to any overlying or surrounding strata. (Figure 5) It could be postulated that the original matrix was completely removed and replaced by another, or the stumps were moved to a new location after infilling, but neither of these possibilities is comparable with the *in situ* theory.

3. A distinctive soil level is usually missing. (Figures 1, 3, 5, 6, 20) Only a small number of the vertical trees arise from coal. The majority originate in shale or sandstone which exhibit no change in texture or organic content. Several trees in the same stratum may arise from different levels—none of which qualify as ancient soil zones.

Petrified stumps arising from a coal surface almost never send roots into the coal, but spread their roots out onto or just above the coal. A modern peat bog exposed in cross-section near Sydney Mines by eroding seas has had at least



Figure 6. Overlapping erect trees only a few feet apart. Glace Bay, Cape Breton Island.

two living forests growing on its surface in post-Pleistocene times. These forests were killed and the stumps buried by accumulating peat. The tops of the stumps of the most recent forest protrude above the present peat bog surface.

Such a situation seems not to have been attained in the coal seams and petrified trees. Stumps of trees that grew in or on peat, now coalified, should be easy to recognize if the trunks extended into the sediments above the coal.

4. The presence of overlapping erect trees seems to preclude the amount of time needed for their normal growth in their present positions. (Figure 6) The major portion of the lower trunk would have protruded above ground during the entire life of the upper tree if both are in growth position. The hollow interiors of both were filled when sandy mud buried them. The trees are three meters apart and the nearly horizontal bedding, easily traceable between them, negates the suggestion that they grew simultaneously on an even surface.

5. A variety of organic remains are found in the sediments within the stumps, including forms unexpected for trees *in situ*. Leaves, needles, fruits, twigs, and branches would fall into hollow upright stumps; but the presence of sections of *Stigmaria* roots and *Calamites* stems is less understandable without recourse to an allochthonous theory of origin. (Figure 7) Three examples of *Stigmaria* and one of *Calamites* inside hollow stumps were found by the author in the North Sydney area, and Brown¹¹ makes reference to one.

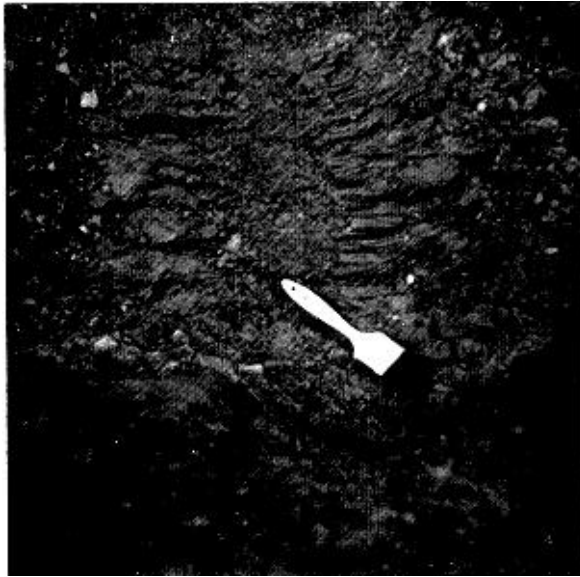


Figure 7. *Stigmaria* with radiating appendages positioned in the sediments inside an erect tree. Sydney Mines. Cape Breton Island

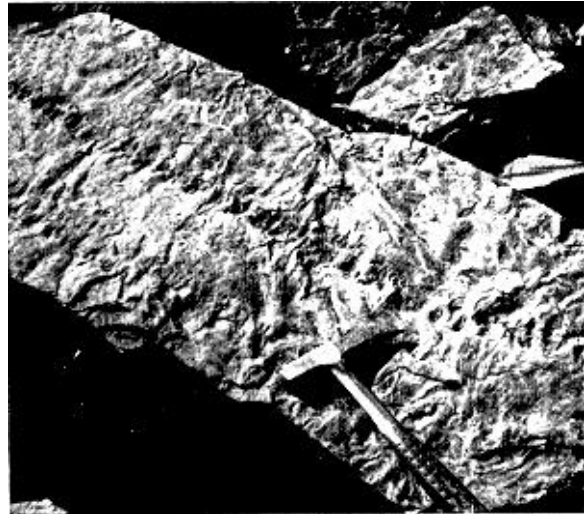


Figure 8. Tracks on sandstone. Joggins.



Figure 9. Diagonal tree in sandstone near Alder Point, Cape Breton Island.

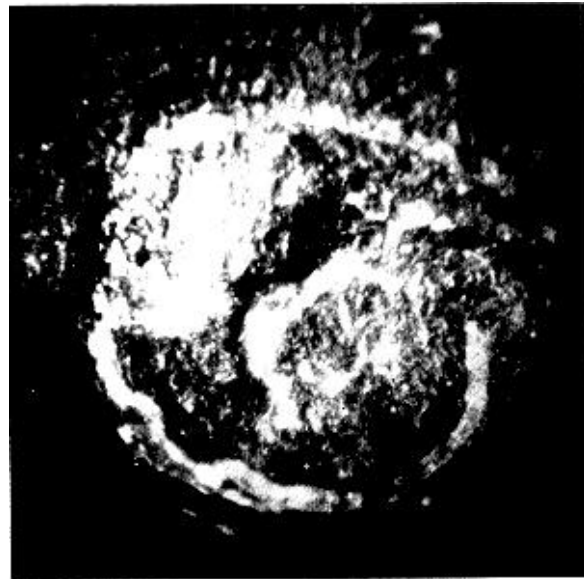


Figure 10. Cross section through the small tubeworm, *Spirorbis*, in organic sediments at Joggins.

Bones of several species of amphibians or reptiles have been found inside the vertical stumps.¹² The carcass or bones of an amphibian or reptile within a hollow stump before erosional removal of the stump, would travel with the stump and be buried in sediments when the stump was buried. Swimming animals might seek out floating rafts of trees and plant debris during a flood. Animal tracks, also seen in the

Joggins sediments, fail to provide useful insights because they could be produced under a variety of situations and conditions.¹³ (Figure 8)

6. Remarkably beautiful preservations of delicate organic structures are found. Foliage which accumulates on a modern ground surface seldom remains intact for more than one or two seasons. Just below the surface, vegetable matter has lost much of its original form and identity by decay.

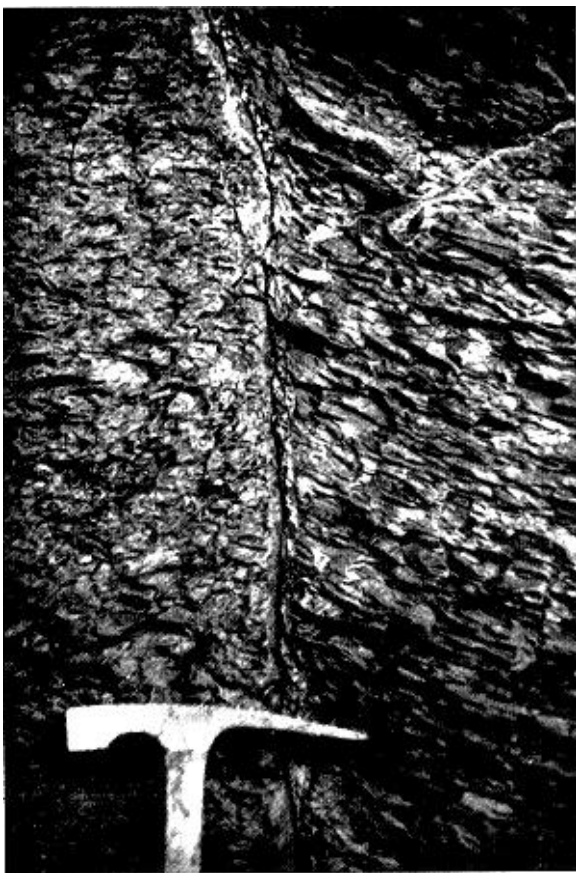


Figure 11. Longitudinal section through standing tree in shale. Shale on left inside tree; shale on right banked up against outside of tree. Sydney Mines.

Especially problematic would be such fragile structures well preserved below the roots of vertical trees in growth positions. The trees mentioned under item 4 above, exhibited this feature well.

7. Diagonal petrified trees, tipped 45 or more degrees are occasionally seen in the cliffs. (Figure 9) The roots are at right angles to the stumps and not parallel to the bedding. Such trees speak of rapid burial or transport *in toto* along with the sediments.¹⁴

8. A marine tubeworm *Spirorbis* (Figure 10) is frequently attached in abundance to vegetable matter in the coal and to the prostrate and erect trees, both inside and outside the hollow stems. The postulated limnic habitat for Carboniferous *Spirorbis* is highly questionable and goes against almost every facet of evidence available.¹⁵ The presence of this annelid almost forces the conclusion that the trees were exposed to deep marine intrusions or floated in saline water.

9. Sediments often bank up against the vertical stumps and have a saucer-like bedding within



Figure 12. Minor unconformities in bedding near Joggins.

the hollow interiors. (Figure 11) This settling of sediments along with well-preserved fossils suggests rapidity of depositing processes.

10. The vertical lycopod stumps often penetrate two or more strata, one of which rarely may be a coal seam. Polystrate trees, 11.5 meters or more tall,¹⁶ would necessitate rapid fallout of sediments at least that deep in that location to prevent decay of the upper parts of the stumps.

Most of the sandstones are cross-bedded, contain ball and pillow structures, show local unconformities, cut and fill phenomena, or are ripple marked; all features of rapid water flow or movement. (Figure 12) Sand itself is not transported without a substantial current.

Shales, on the other hand, do not show clearly current and flow evidences. The fine nature of the sediments of which shale is composed probably would not settle out except in water that was relatively quiet or deep enough to allow materials to sink below surface agitation.

In addition to these two sediment types and the gradations between them, there are occasional strata of conglomerate especially in the lower part of the Carboniferous. These are composed of pebbles and flat cakes of shale that appear to have been ripped up from a partly dried but unindurated shale bed on which the conglomerates were laid.

The cyclothems of Nova Scotia are mostly incomplete. Throughout much of the over 14,000 feet of Carboniferous strata, sandstone and shale alternate and the thickness of the individual beds vary greatly. (Figure 13) Although plant remains are scattered through most of this depth, coal as such is missing from much of the sequence.

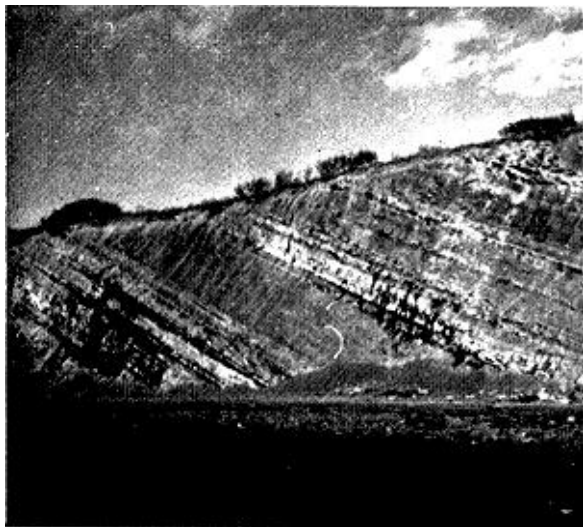


Figure 13. Cliffs near Joggins showing rhythmic sedimentation.

I know of no count of the total number of cyclothems in this Carboniferous deposit but the number must be in the hundreds. Hundreds of emergences and submergence of the land is an unreasonable explanation. An explanation of the unsolved problem of the formation of cyclothems bears directly, of course, on the issue of the autochthonous versus allochthonous deposition of plants and coal.

Upright Fossil Trees Interpreted

If the *in situ* position of these stumps is questioned, their upright orientation in the strata calls for some explanation. Trees and logs floating in an upright position are not rare under certain conditions. Saturated timbers that have gotten away from log booms and have drifted for some time in the waters of Puget Sound in the Northwest, often float upright with their tops barely visible at the surface of the water. Loggers from British Columbia and Alaska say trees or stumps ripped out of the ground by ocean storms or logging operations frequently float upright. I have noticed and photographed recent stumps sitting upright along the beach or among piles of driftwood along the Bay of Fundy where they were left by high tides or storms.

Francis¹⁷ reports, “. . . it is natural for short stems attached to heavy roots or trees to float upright, with the roots downwards, when transported by deep water, particularly if the roots enclose a ball of clay or gravel.”

Ager¹⁸ makes the following comment:

E. D. McKee (personal communication, 1963), has told of palm trees being swept from a Pacific atoll during hurricanes and coming to rest in considerable depths of water in an upright position because of their heavy, stone-

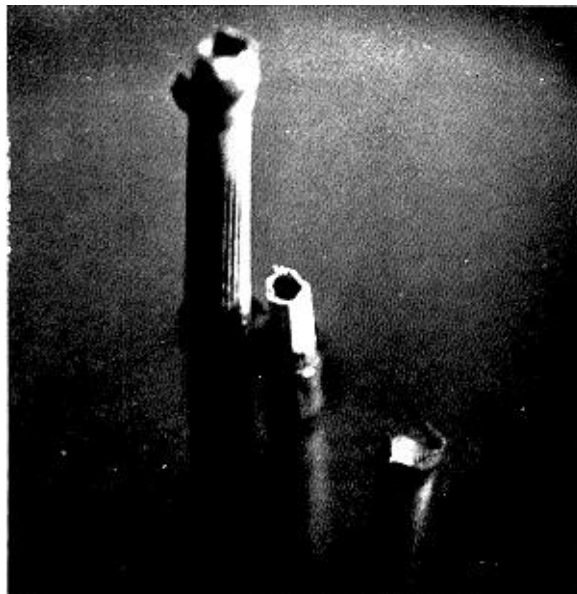


Figure 14. Cluster of *Equisetum* floating upright.

laden roots, so that even trees in position of life may not be completely beyond question.

While sailing along the coast of New Guinea the Challenger Expedition ran into long lines of driftwood brought down perhaps by flooding rivers. The following appears in the report:

Much of the wood was floating suspended vertically in the water, and most curiously, logs and short branch pieces thus floating often occurred in separate groups apart from the horizontally floating timbers. The sunken ends of the wood were not weighted by any attached masses of soil or other load of any kind; possibly the water penetrated certain kinds of wood more easily in one direction with regard to its growth than the other, hence one end becomes water-logged before the other.¹⁹

Travelers from the Amazon region of South America report frequent observance of trees floating upright down the river, especially following high water and floods.

Upright trees have been uncritically taken as *a priori* evidence of unchanged growth position but much caution is advised against such automatic assumptions. Stevenson,²⁰ in his monograph on the formation of coal beds, decides that upright trees are not important in settling the problem of autochthonous or allochthonous origins of coal.

Results of Flotation Experiments

Flotation experiments have been undertaken by the author with *Equisetum* in an attempt to clarify the vertical position of *Calamites* stems. Some findings: (a) Clusters of horsetail stems attached to the same roots float upright because



Figure 15. Individual stems of *Equisetum* suspended from the surface or standing upright on the bottom. To facilitate obtaining a sharp focus, the stems were moved to near the front of the tank, but they are not leaning against the glass or each other.

of the heavy rootstock and associated soil. (Figure 14) (b) Individual stems floated horizontally for some days until they became saturated and swung into an upright position suspended from the surface of the water. (c) As saturation increased, they sank and rested on the bottom of the tank in a vertical position. (Figure 15) (d) Eventually a few days later they fell over to lie prone. Contemporaneous sedimentation would have incorporated many of them upright in the sediments.

The *Calamites* stems in Nova Scotia strata are generally single. They are probably not in growth position but have been buried by the elastic deposits in a way similar to that suggested by the flotation experiments.

Henry Fayol²¹ undertook flotation experiments for several years in an artificial pond. This comprehensive research gave percentages for the vertical and horizontal floating of living trees similar to those for prone and erect petrified trees in the coal measures of Central France. His results with *Equisetum* were the same as those of this investigator.



Figure 16. Appendages extending up and down from a *Stigmara*. This *Stigmara* has been flattened as is true for many. Sydney Mines.

Seven Points of Interpretation

The problem of the *Stigmara* and associated appendages has long puzzled paleobotanists. There are aspects dissimilar to anything seen today that make it impossible for researchers to be unanimous in their conclusions on the stigmariæ. However, few question the *in situ* position of the structures even though the true nature of their function is not known. Rootlet-bearing stigmariæ have been traced several feet toward *Lepidodendron* or *Sigillarian* trees where they become the flaring roots of the trees. Thus the stigmariæ and their rootlets assume a position like roots to a tree.

Present thinking on *Stigmara* is aptly summarized by Arnold,²²

The true morphology of stigmariæ and its relation to the stem, remains, even after more than a century of research, one of the great unsolved problems of Paleobotany. . . . Modern research has thrown little additional light on the *Stigmara* problem and the remains are generally ignored by present-day paleobotanists.

The following points concern interpretation of the stigmariæ as true roots *in situ*. If the stigmariæ are not assumed to be in growth position, the dead end of the present state of knowledge is bypassed by a new approach that holds promise of a solution to the problem.

1. Appendages extend from *Stigmara* in parallel orientation. (Figure 16) These "rootlets" follow each other around bends and corners in a manner untypical of normal rootlets which pursue an independent course through the soil. Occasionally all of the appendages may be confined to the same horizontal plane on which the *Stigmara* rests.

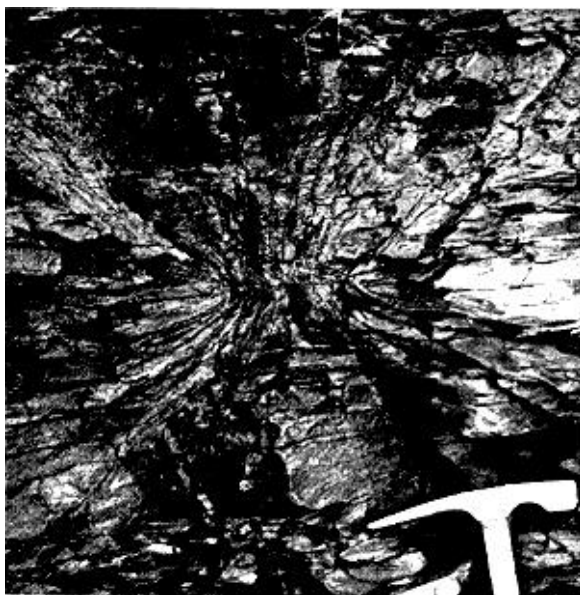


Figure 17. Cross section through *Stigmara* showing radiating appendages. Sydney Mines.

2. Appendages usually radiate from the *Stigmara* in all directions into the rock; consequently, many of them have an upward orientation which would be termed negative geotropism if they are in position of growth. (Figure 17) Yet a nearly universal characteristic of normal rootlets is positive geotropism.

Furthermore, if these are true roots that grew where now located, some of the appendages were positively geotropic, some were negatively geotropic, and some were not sensitive to gravity; but no noticeable difference in morphology is apparent. "Rootlets" which extend upward are usually longer and less bent than those penetrating downward. This feature has significance when comparison is made with the living *Lycopodium* (see item 4 below).

3. Stigmarae do not have the dendritic branching and resulting taper in diameter typical of roots. Long sections often have the same diameters at the two ends as illustrated by one somewhat flattened, 20 meter length found by this investigator near Sydney Mines with diameter measurements of 6.5 cm by 10 cm at both ends.

4. Stigmarae have remarkable resemblances to the creeping stems or rhizomes of the modern clubmoss *Lycopodium*. In both, appendages which are poorly equipped with vascular tissues are attached in spiral arrangement. Both have little or no taper and have large fibrous vascular cylinders. The lower scale-like leaves around the creeping stems of *Lycopodium* are shorter and assume a more acute angle of attachment;

whereas, the upper ones are longer and extend nearly perpendicularly from the stems.

As mentioned above, this feature is also true for stigmarae and "rootlets." (Figures 18 and 19) Thus it is probable that the "rootlets" of *Stigmara* are not "rootlets" at all but slender leaf-like appendages. Several paleobotanists have been impressed with the possibility that stigmarae are giant rhizomes or creeping stems.²³

An evidence for *in situ* burial that requires more detailed consideration is the report of plant parts such as roots growing into or penetrating the tissues of trees, before carbonization. Among the examples cited in the literature are: (a) *Stigmara* "rootlets" penetrating from one level down into the trees of a lower level,²⁴ (b) *Stigmara* protruding through the wall of a stump,²⁵ and (c) *Stigmara* "rootlets" growing into the tissue of *Stigmara*.²⁶

My study of the stigmarae indicates that "rootlets" and plant fragments are often found in the sand or shale inside the stigmarae even though these structures are seldom more than 10 cm in diameter. These phenomena may be interpreted as intrusions by growth from outside, but the scattered and fragmentary nature of the plant structures and the presence of bedding, obviously water laid, inside the stigmarae leave this interpretation open to question.

In no case was I able to find any actual penetration of the carbonaceous wall of the *Stigmara* by "rootlets" or other plant structures that might have grown into it. The possibility of stigmarae and "rootlets" being rhizomes or creeping stems casts some shadow on the ability of *Stigmara* "rootlets" to grow into other *Stigmara* in a manner one would expect of true rootlets.

Even if growth penetration is a correct observation, it is not overly relevant because whether the coal and plant specimens are autochthonous or allochthonous, penetration by growing plant parts could be a reality. In the latter case, the growth into partly decayed or soft tissues by a rootlet or underground stem would have taken place before the forest was rafted to the position of burial.

5. Quantitative measurements of orientation of 69 stigmarae in locations near Sydney Mines and Joggins indicate a strong parallel orientation. Measurements were taken in shale and sandstone directly above and below coal seams. These stems, often visible for several feet, have the typical radiating appendages assumed to indicate *in situ* plants.

Orientation measurements of stigmarae in coal have been taken and with similar results.²⁷ Thus stigmarae below, in, and above coal seams

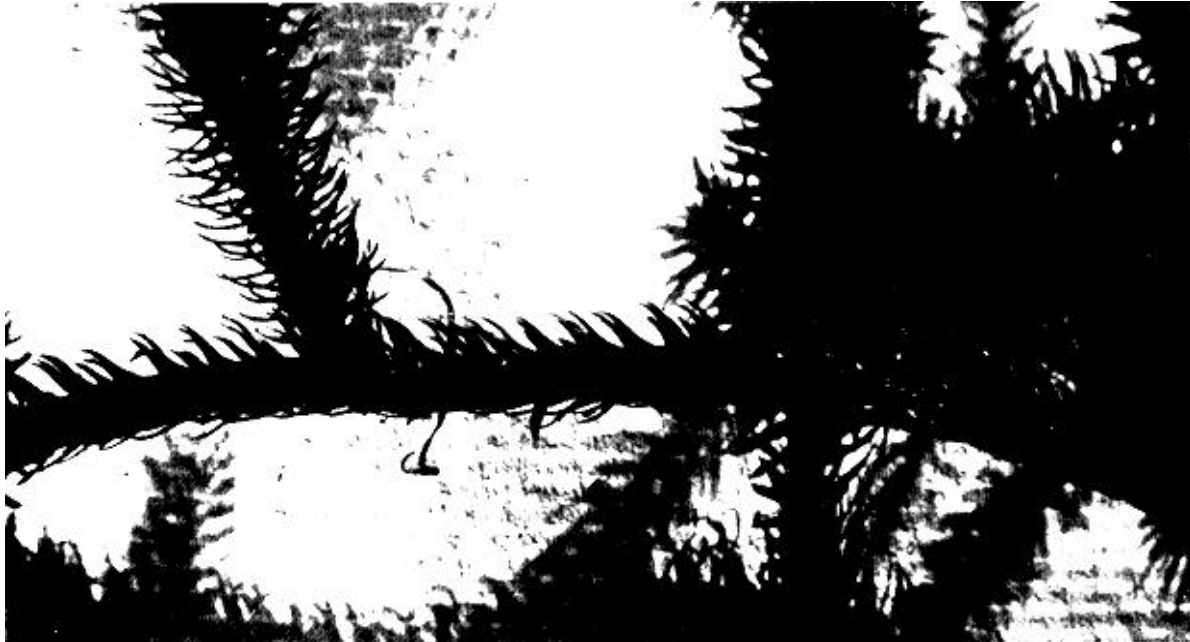


Figure 18. Creeping stem and upright shoots of *Lycopodium*. Note that the scale-like leaves are spirally arranged around the stem and the lower ones do not extend as broadly from the stem as do the upper ones.

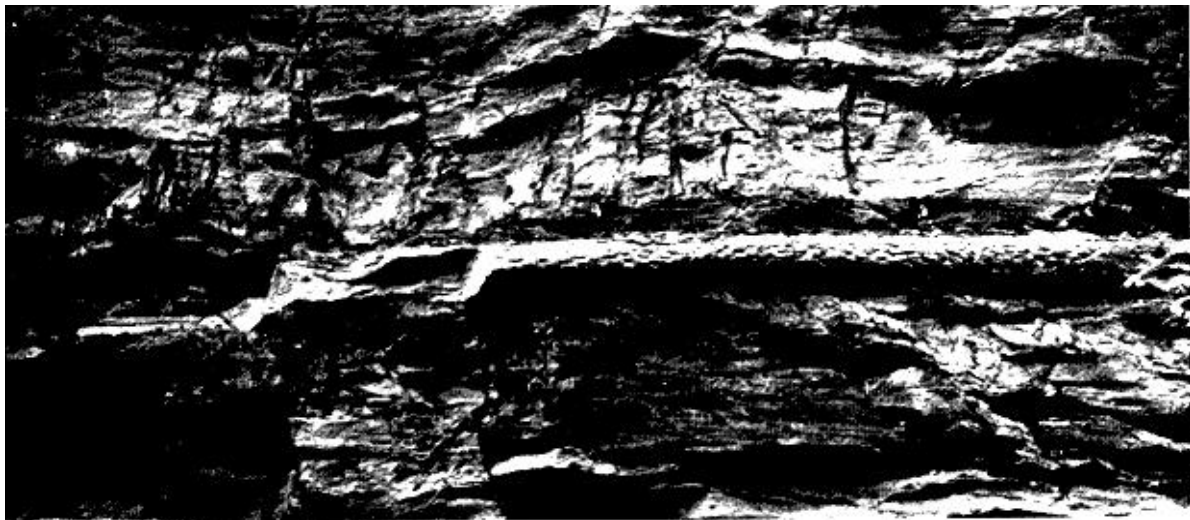


Figure 19. A section of *Stigmaria* with radiating appendages. These appendages are poorly developed compared to others but note that those extending upward are clearly visible; whereas, those extending downward are rare or absent. Spirally arranged pits or points of attachment of the appendages are visible. Sydney Mines.

have similar patterns of positioning. Yet the parallel orientation, which agrees with current direction as determined by cross-bedding and ripple marks, strongly speaks against their being in position of growth. Parallel orientation for roots of living trees growing unrestricted in sand or soil would certainly be unexpected.

6. *Stigmaria* are found in limestone, crude coal composed mostly of mussel shells, and other

odd sediments which would not be considered suitable soils for the growth of roots.

7. Isolated sections of *Stigmaria* unattached to upright lycopods and with radiating appendages are found. Most notable of these are the ones found inside erect stumps. (Figure 7) It would appear that the appendages were stiff and their radiating position little affected when the sections were dropped or moved about in soft sediments.



Figure 20. A lycopod tree with unusual features best ascribed to an allochthonous burial (see text). Point Aconi.

Excellent Natural Object Lesson

One short section of cliff near Sydney Mines, constitutes a good case history which includes several of the points brought out above. A large, upright petrified tree (probably *Sigillaria*) originated in the same bed where compass measurements established the parallel orientation of stigmariae with each other and with the dominant current. (Figure 20) Thus, if the stigmariae were not in growth position, it is doubtful that the tree would be.

The erect tree passed through a bed of shale 1.5 meters thick which contained abundant quantities of exquisitely preserved fern leaves—good evidence of rapid sedimentation. The upper one meter of the tree was filled with sediments approaching that of crude coal. No one meter bed of coal existed outside the tree, but there was, however, directly above the broken top a 7 cm seam of this dark gray deposit.

Apparently the last meter of the hollow tree was filled with this material when it was washed out over the surface. In this case it is obvious that the thin organic layer lying directly over the tree cannot be a growth level but was a water-laid deposit.

The Nova Scotia Carboniferous sediments are rather typical of the Paleozoic coal measures of North America and Europe. Thus the objections to *in situ* theory for the coal deposits of Nova Scotia apply in some degree to the Carboniferous in general. However, before broad generalizations beyond Nova Scotia are made, research must be undertaken in other areas.

Tentative Model of Deposition

A completely satisfactory hypothesis of the depositing conditions involved in the laying down of the vegetable and organic debris that has become coal and the positioning of the erect trees and the parallel *Stigmaria* sections cannot be presented without much more research, but a brief and tentative model is as follows:

Plants were torn up by erosion and transgressing seas. As the stumps floated in the water they became saturated and slowly swung into an upright position. Clusters of horsetails washed out into the sea and floated vertically until they became saturated and sank. Individual stems tipped upright after a period of soaking. While plant flotsam was drifting, tubeworms and mussels fastened themselves to the floating mass, and fishes swam among the debris.

Eventually the stumps and *Calamites* sank down into the muds at the bottom or were stranded on a mud flat when the tide retreated. Continuing fallout of sediments from the water above or tidal movements and wave action caused sediments to accumulate around and in the stumps. This occurred repeatedly in a sinking basin, thus producing many superimposed strata containing erect stumps and other plant remains.

Following deposition, the whole area was warped, causing a tilting of up to 20° in some parts of the basin. Later still, glaciers scoured the tilted surface and left erratic boulders, glacial till, eskers, and other evidences. With the rising of the ocean when continental glaciers melted, the Bay of Fundy and the Atlantic Ocean cut back the cliffs and exposed the interesting fossils and coal seams of Nova Scotia.

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(Continued on Page 70)

CHROMOSOMAL CHANGES—MECHANISM FOR EVOLUTION?

JOHN W. KLOTZ*

Polyploidy (an increase in the number of whole chromosome sets) is defined, illustrated, and explained. Mechanisms of polyploidy are discussed and the effects are examined for any possible role in progressive evolution. Although polyploidy may introduce changes in size, osmotic pressure, fertility, and other factors, these same changes are often unfavorable to the polyplod and are not the kinds of changes required for major evolutionary steps.

Aneuploidy (addition or subtraction of a single chromosome) is shown to be the basis of several disorders in the human body. Rather than adding extra genetic material from which to evolve new traits, aneuploidy is usually harmful to the species, and not creative in its effect.

Rearrangements of chromosome parts (translocation and inversions) are also seen to be generally harmful.

Although the various types of chromosomal changes may produce some striking modifications in the organism, they can hardly be regarded as important evolutionary mechanism.

What about chromosomal changes as a mechanism for "big jump" evolution? Is it possible that the changes demanded by progressive evolution have come about in this way? Is this a possible mechanism for euglena to man development?

At first glance, chromosomal changes would seem to be a rather promising mechanism. There is no doubt that new variations in some respects comparable to species can arise through chromosomal changes. Moreover, changes in the number of chromosomes or in the arrangement of the genes within the chromosome do bring about profound effects—in many cases greater than the effects brought about by point mutations (changes in DNA).

Change Through Polyploidy

One of the most promising mechanisms for change of a considerable magnitude is polyploidy—an increase in the number of chromosome sets, so that whereas the normal individual has $2n$ chromosomes, the polyplod individual will have $3n$, $4n$, $6n$, or $8n$. There is no question that polyploidy is a means of producing what are ordinarily regarded as new species, and it is for this reason that evolutionists have been intrigued with the possibility of polyploidy as a mechanism for evolution. Goldschmidt went so far as to suggest that chromosomal changes are the only mechanism by which changes of the magnitude demanded by evolution can take place.

New species produced by polyploidy generally meet many of the criteria which have been set up for a good species. They either do not interbreed with their parent forms, or the resulting hybrids are partially, to completely sterile. They are fertile when bred among themselves, though rarely are they as fertile as the parent forms from which they have been derived.

In some cases the polyplod is derived from a single species—in this case it is referred to as an *autopolyplod*. In other cases two separate species serve as the parent of the new form—in these the forms are referred to as *allopolyplods*.

Mayr¹ tells us that polyploidy is the only proven mechanism of instantaneous speciation in sexually reproducing organisms; and, Stebbins² says that polyploidy is one way and perhaps the only way in which an interspecific barrier can arise in one step and thus give an opportunity to a new line to "evolve" independently and to diverge from the parental type.

There is no doubt that this mechanism is the common way in which new species have arisen: there are probably several hundred instances in the literature in which new species have arisen either by allopolyploidy or autopolyploidy. Many of these have been produced in the laboratory, either by exposing the organism to radiation, or by treating it with some chemical substance such as colchicine (an alkaloid drug derived from the corm of *Colchicum autumnale*, the autumn crocus). The latter drug interferes with metabolism and cell division with the result that two sets of chromosomes go to a single daughter cell.

We do not know what causes polyploidy in nature, and it is difficult under field conditions to determine the parents of a given plant or animal which we are examining. Presumably many cases of natural polyploidy are due to an abnormal meiosis which results in production of either diploid eggs or sperm. If a diploid egg is fertilized by a monoploid sperm the resultant organism is *triploid*; if a diploid egg is fertilized by a diploid sperm, the resulting organism is *tetraploid*.

Two Possible Natural Polyplods

One form which is believed to be the result of natural polyplod is rice grass or cord grass, *Spartina townsendii* H. and J. Groves, which was

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first collected in 1870 at the edge of Southampton Water in England. Since that time it has spread over much of the south coast of England and to France. It seems to have arisen as a cross between *S. stricta* Roth, which is a European species, and *S. alterniflora* Loisel, an American species. The latter was apparently introduced from America with a shipment of merchandise. *Spartina townsendii* is fertile and breeds practically true.

Spartina alterniflora has a chromosome number of 70, *S. stricta* has a chromosome number of 56 and *S. townsendii* has a chromosome number of 126. It appears, therefore, to be a tetraploid which carries a complete chromosome set from both parents. It should be pointed out that the evidence for the origin of *S. townsendii* is circumstantial, and **no experimental production** of this species has been reported.

Another species believed to have developed as a natural polyploid is *Primula kewensis* which is thought to have arisen from a spontaneous cross at Kew, just outside London, between *P. verticillata* and *P. floribunda*. Both parent forms have a chromosome number of 18. The hybrid between the two proved to be only partly fertile and was cultivated vegetatively for a number of years until a shoot appeared which proved to be fertile. The fertile form usually has 36 chromosomes—apparently a pair of each set of chromosomes from each parent. It might be noted that this form would have died out completely had it not been cultivated vegetatively; it could not have maintained itself without human interference and care.

Also there are a number of irregularities about the chromosome behavior of *P. kewensis* which would make it quite unable to survive under natural conditions. Thus according to C. D. Darlington,³

In *Primula kewensis*, corresponding chromosomes of the diploid parents, *P. floribunda* and *P. verticillata*, are not sufficiently different to inhibit their pairing in the diploid hybrid. Such a lack of differentiation is associated with two abnormalities in the tetraploid: (1) chromosomes of opposite parents occasionally pair (in quadrivalents or bivalents) and pass to opposite poles. The progeny therefore differ in the proportions of the chromosomes of the two species present. Moreover, owing presumably to this pairing being accompanied by crossing over, the normal type can never again be recovered from its aberrant offspring. (2) Quadrivalents are formed which sometimes divide unequally (as in the auto-tetraploid *Datura* and *Primula sinensis*) giving therefore, gametes with 17 and 19 chromosomes instead of 18, and progeny with 34, 35,

and 37 chromosomes instead of 36. These differ from the normal tetraploid both owing to a change in proportion within the set of nine and owing to a change in the proportionate influence of the two species. Such plants, particularly those with 34 chromosomes, which have 2 chromosomes of one type and 4 of the other 8 types, are *less fertile* (Emphasis added) than the normal tetraploid.

Natural selection therefore would not only eliminate the 34 chromosome plants, but also *P. kewensis* since its overall fertility is reduced by these aberrant offspring.

Effects of Polyploidy

What are the effects of polyploidy? This is the crucial question so far as any consideration of polyploidy as a possible mechanism for progressive evolution is concerned. Does it bring about changes of the nature which would be demanded by progressive evolution?

It is generally observed that experimentally produced polyploids are larger than their diploid relatives; and, it is for this reason that polyploids are much sought after by seed men who hope to produce larger flowers and fruits. Gigantism may not be a permanent effect—in the course of time some polyploids become smaller in size.

It has also been suggested that polyploids are better able to stand severe climates, but Stebbins does not believe this is necessarily the case.⁴ It is true that the number of polyploids increases as one goes north or to higher altitudes, and it is also true that polyploids have a wider geographical range than what is assumed to have been the range of their diploid ancestors. Stebbins believes that these observations are either without significance or are by no means universal.⁵ It is generally agreed that polyploids possess a wider range of tolerance for climate and edaphic conditions; they can stand wider ranges of temperature and water supply than can their presumed diploid ancestors.

Polyploidy tends to decrease osmotic pressure though this does not always happen and cannot be regarded as a generalization. This particular characteristic would be unfavorable since a plant with a high osmotic pressure is able to get more water from the soil than a plant with low osmotic pressure—desert plants typically have a high osmotic pressure and plants that grow in wet places usually have a low osmotic pressure.

Losses of Viability and Fertility

Autopolyploids generally show a lower growth rate than do their assumed diploid ancestors. They flower later than do the diploids. Both these characteristics would seem to be unfavorable. However, polyploids flower over a longer

period of time and this presumably is a favorable characteristic. In polyploids the amount of branching is reduced and the leaves are generally thicker. Under some conditions these might be favorable characteristics; under other conditions, unfavorable.⁶

One particularly significant characteristic of polyploids is the fact that they usually have a lower reproductive rate than their diploid relatives. This is especially marked in triploids, but appears also in tetraploid. In one study with barley triploids, Kerber⁷ reports an average fertility of 11.6%). Stebbins reports that the reduction in pollen and seed fertility in autopolyploidy as compared with their supposed diploid ancestors ranges from 5% to 20% in some maize to almost 100% in one of the cottons.⁸

Such losses of viability and fertility is significant when we consider the suggestion that polyploidy is supposed to be an important mechanism for evolution. Yet, the importance of polyploidy seems much reduced if it results in the formation of inviable and partially sterile forms. Any significant reduction in reproductive rate will necessarily be harmful so far as survival is concerned.

It is generally agreed that in most cases polyploids can survive only if the individual is capable of perpetuating itself in some other way. Tetraploid plants can survive, for instance, if they reproduce by clones, stolons, rhizomes, bulbs, or "winter buds." Polyploid forms may survive in animals in hermaphroditic and parthenogenetic species.

It should be noted that in some instances polyploids do appear to regain their fertility after several generations. It appears that some eventually become stabilized and are able to reproduce at a normal rate. However, until this condition is reached, vegetative reproduction is almost a "must."

Another important difficulty which reduces the importance of polyploidy as a possible mechanism for evolution is the fact that it is limited almost exclusively to flowering plants. Multiple sets of chromosomes have been reported in some of the other plant forms but this is rare. And furthermore, polyploidy rarely occurs in animals.

Wallace⁹ points out that, for an animal polyploid species to develop successfully, a complicated combination of rare events—hybridization and doubling of the chromosome number—would have to occur simultaneously in each of two individuals, one male and one female, living in the same locale. In addition, these two individuals would have to choose each other as mates in preference to normal individuals of the parental species living in the same region, and their off-

spring, too, would have to prefer one another and mate brother and sister for a number of generations. Animal species then could adopt polyploidy, Wallace believes, only as a consequence of the coincidence of four, five, or six extremely rare events.

Mayr¹⁰ says that while polyploidy is the only proved mechanism of instantaneous speciation in sexually reproducing organisms, and while it is common among plants, it is of no significance in animals.

Polyploidy Evaluated as Mechanism

In any case, the critical question is whether the changes polyploidy brings about are the types of changes which are needed in progressive evolution. To this question, the answer seems to be a clear "no." We note gigantism; we note a possible better adaptation to climatic condition, but we do not find the types of changes which would be required for euglena to man evolution.

Stebbins¹¹ believes that the long continued evolution needed to differentiate genera, families, orders, and phyla, appears to have taken place chiefly on the diploid, or at least on the homoploid level, in those forms which have had a polyploid origin. The little evidence that exists for evolution by means of polyploids, he feels, is a bit hazardous at present and not too impressive. He says that even with this evidence it does not appear that progressive evolution is furthered by polyploidy.

Stebbins points out, further, that none of the trends in floral specialization which have been so important in plant evolution are caused or promoted by polyploidy, and he concludes that polyploidy does not originate a major new departure. Indeed, he says, polyploidy is a complicating force rather than one which promotes progressive evolution. He characterizes the species originating by polyploidy as being, for the most part, very similar to the diploid ancestors in external morphology and in ecological preferences, or else they contain recombination of the characteristics found in those ancestors.

Cameron¹² believes that polyploidy is an evolutionary dead end, and that ultimately polyploids will succumb as a result of their inability to go back to the diploid condition, and because genetic variation seems to be hampered by the high number of chromosomes.

Ehrlich and Holm¹³ say that such mechanisms as polyploidy are often considered disadvantageous from a long range point of view. Interestingly enough, however, they argue that since these mechanisms are extremely common in both plants and animals they must have some selective advantage.

Goldschmidt and his pupils cling to the importance of polyploidy and similar mechanisms. They believe that real evolution can take place only by changes involving whole chromosomes. In commenting on Goldschmidt's views, Mayr says¹⁴ that the fact that some geneticists can come to conclusions diametrically opposed to those of other geneticists is striking evidence of our ignorance of the actual facts.

Chromosomal Changes as Mechanism

What about other chromosomal changes as a mechanism for evolution? Some have suggested the addition or subtraction of a single chromosome, *aneuploidy*, as a mechanism for progressive change. Most people who suggest this mechanism are interested in the possibility provided by the addition of a chromosome to the normal chromosomal complement. They suggest that this extra chromosome may provide additional genetic material which can make possible the changes which progressive evolution demands. Most instances of aneuploidy represent a decrease in chromosome number,¹⁵ but let us look at the evolutionary possibilities of the addition of one or more chromosomes.

Evidence which comes from a study of human chromosomal abnormalities is most interesting: (a) We now know that many if not most cases of Down's syndrome (Mongoloid idiocy) are due to an extra chromosome. These individuals have 47 chromosomes instead of the normal 46. The extra chromosome is one of the smallest of the human chromosomes (number 21).

(b) Investigators have also found two sexual disorders in man that are due to abnormal chromosome numbers. Klinefelter's syndrome is due to an extra "X" chromosome, and Turner's syndrome is due to the absence of one of the sex chromosomes. In both cases the individuals are sterile, suffer from hormonal abnormalities which affect their sexual phenotype, and are generally mentally retarded.

(c) Recent studies on males with an extra "Y" chromosome suggest that this condition may be associated with psychopathic criminality and aggressiveness.

(d) Two other conditions in which there is an extra chromosome have recently been described in man. One condition is Trisome 18 in which there is an extra chromosome (number 18) and the other, Trisome D, is probably the result of another extra chromosome (number 15). Both are associated with multiple congenital anomalies and the survival rate is poor.

If such evidence which we have from the results of the addition or subtraction of a single chromosome from the normal human comple-

ment of 46 is any indication, it seems unlikely that this mechanism is of any significance in evolution. Ehrlich and Helm say¹⁶ that there are numerous examples suggestive of progressive increases in chromosome number but unfortunately little experimental evidence.

White¹⁷ believes that the formation of supernumerary chromosomes is the chief method by which chromosome number has increased. A supernumerary chromosome is one which is absent in some individuals of the species altogether without noticeably affecting the appearance of the organism. It is suggested that supernumerary chromosomes may be more or less "blanks" to which genetic material can be added, which will provide for progressive evolution. At the present time, there is no evidence that supernumerary chromosomes are anything else than an abnormal temporary situation in the cell; and, there is no indication that active parts of chromosomes ever become translocated to such a chromosome.

Translocation and Inversions

There remains to discuss the possibility that rearrangements may be mechanisms for evolution. These include translocation and inversions. Translocation are instances in which a piece of one chromosome is attached to a non-homologous chromosome. Inversions are instances in which the order of the genes on the chromosome is reversed.

Such rearrangements do change the organism and often in a striking way. The changes are often more marked than those to be seen in gene mutations. However, they are almost always harmful changes—harmful to a degree even greater than the changes brought about by mutation.

Muller says¹⁸ that only those rearrangements can survive which involve a breakage of one or more chromosomes at least two points, together with a union of the pieces so formed by their broken ends in a new order leaving the originally free ends, or telomeres, still free, and leaving one spindle fiber attachment or centromere on each chromosome. This limits drastically the number of rearrangements that can survive.

Stebbins says¹⁹ that while inversions alter the genetic mechanism they do so in such a way as to produce more constancy and fitness at the expense of flexibility. Thus the organism is not able to meet even relatively minor changes in the environment.

Many cytogeneticists believe that chromosomal rearrangements may result in the development of new species. While we have little laboratory evidence bearing on the problem, comparison of

(Continued on Page 54)

THE EMPIRE MOUNTAINS—A THRUST FAULT?

CLIFFORD L. BURDICK* and HAROLD SLUSHER**

Geology of the Empire Mountains of Arizona is briefly reviewed. Evidence indicating thrust faults at other sites (Santa Rita Mountains and Tortolita Mountains) are presented. The Empire Mountain "thrust fault" has been analyzed for usual marks of tectonic activity. Negative results are reported. Therefore, it is concluded that no such "thrust" has occurred in the Empire Range, and that Permian (Paleozoic) rocks lying above are actually younger than the Cretaceous (Mesozoic) layer beneath! Implications of these inferences for uniformitarian geology and evolution theory are evaluated. It is suggested that presence or absence of thrust faulting be judged hereafter solely upon the physical criteria, aside from any evolutionary preconceptions.

Introduction

The Empire Mountains occupy about 30 square miles in southeastern Pima County, Arizona, and consist of two parallel ridges trending north-northeast. They are connected with the Santa Rita Mountains to the west by low rolling foothills and are separated from the Whetstone Mountains to the east by the broad floor of Cienega Wash Valley.

Dr. F. W. Galbraith¹ gives the following description of the Empire Mountains:

The Empire Mountains are made up of marine limestone, shale, and quartzite, of Cambrian, Devonian, Mississippian, Pennsylvanian, and Permian age, aggregating approximately 5,700 feet in thickness, and a series of Cretaceous (?) continental elastic deposits possibly 18,000 feet in thickness. The sedimentary rocks are intruded by stock-like bodies of quartz-monzonite and granodiorite and by dikes ranging in composition from rhyolite to basalt.

The range has two structural parts—an underlying block of Cretaceous (?) rocks, and an overthrust block of Paleozoic and Cretaceous (?) rocks which is divided into four segments by northwesterly striking tear faults. The thrust fault is exposed along the western edge of the mountains and dips to the east at a low angle. Within the overthrust block there are at least three separate imbricate thrust sheets. Domes, anticline, and overturned folds have been formed in the Paleozoic rocks.

The central part of the Empire Mountains is occupied by the Sycamore quartz-monzonite which extends for about two miles along the trend of the range as a roughly elliptical body less than one mile wide. The quartz-monzonite is light gray and medium to coarse grained.

The Empire Mountains are divided into two structural parts, a basement block of Cretaceous rocks, in part folded into a series of broad anticline and synclines with east-west axes, and in part dipping steeply to the east; and an overthrust block of Paleozoic strata which dip eastward. East-west and north-south faults have added to the structural complexity of the range.

Small bodies of granodiorite, rhyolite-porphry are exposed near the Sycamore stock and small dikes of aplite, syenite, trachyte, rhyolite, diorite, andesite, and basalt occur throughout the Empire Mountains.

The purpose of the present investigation was to verify or reject the Empire overthrust hypothesis as mapped (Figure 1). This particular area was selected because the "thrust-plane" contact is especially visible in the Empire Mountains, and can be subjected to physical analysis contrasting structural interpretation with fossil evidences.

The method used in this study was that of comparing known small overthrusts in terms of amount of brecciation, gouging, slickensides, and other mechanical features proving rock movement, with the Empire "thrust" fault where rock containing fossils from the Permian clearly overlies rock having typically Cretaceous fossils.

Analysis of Known Thrust Faults

(1) Known Thrust Fault in Santa Rita Mountains

On the west side of the Santa Rita Mountains, in the Montosa Canyon area, Santa Cruz County, Arizona, occurs a large granite intrusive, or so-called "pluton." South of this granitic structure the Permian limestone blocks tilt away from the granite at angles between 10 and 25 degrees. These blocks rest on igneous rock.

A graduate student at the University of Arizona wrote a thesis on that area, and has indicated in personal conversation that the limestone blocks had been thrust about half a mile. The blocks themselves probably average half a mile in length.

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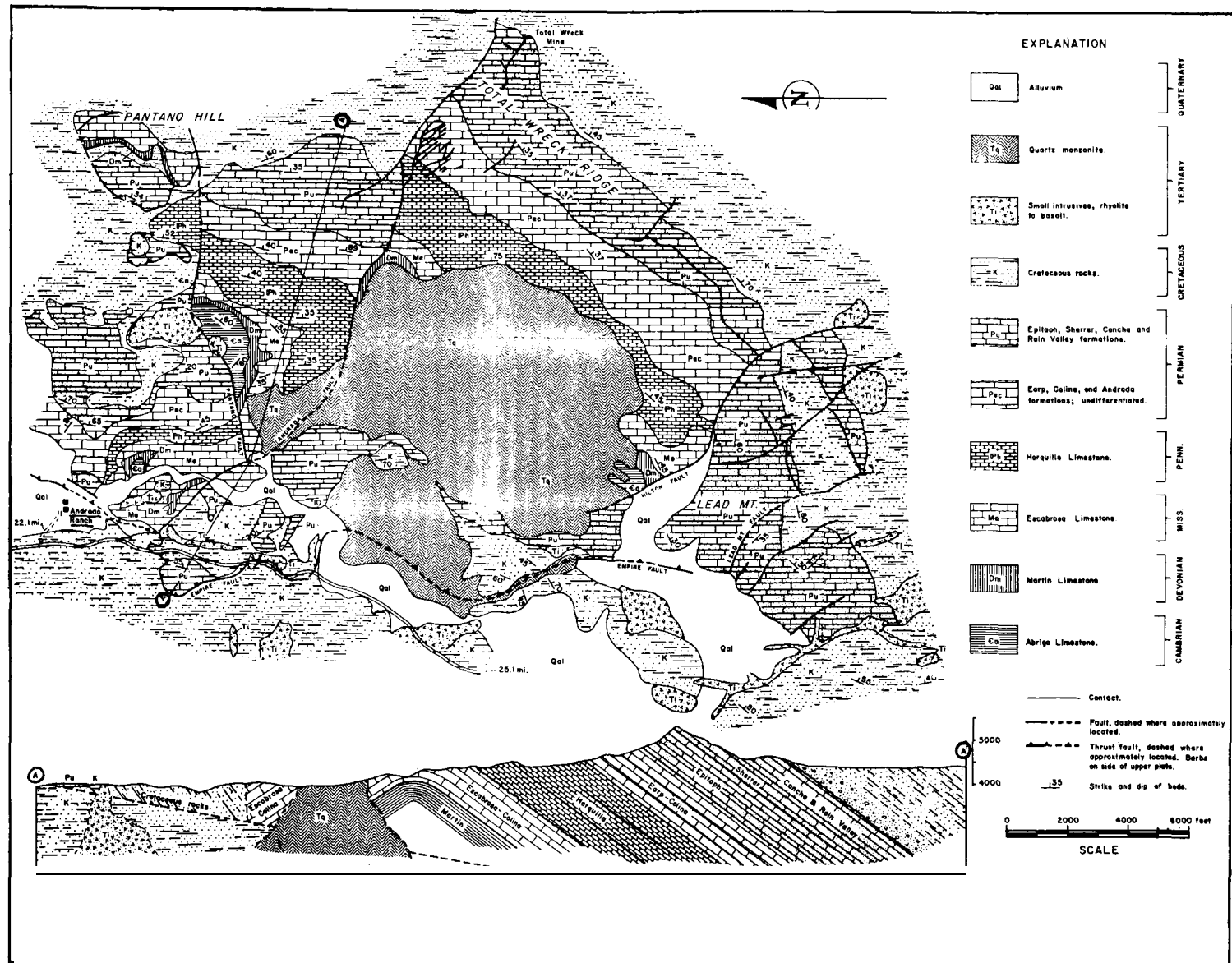


Figure 1. Generalized geologic map and cross section of the Empire Mountains, Arizona. Note location of the Androda Ranch near the left edge of the general geologic map. The "thrust-plane" contact discussed in this paper is located at the left edge of the cross section (A to A'), where Permian (Pu) rock is found overlying Cretaceous (K) rock.

As proof of his contention, the graduate student designated a gouge layer about three feet thick composed of ground up rock powder separating the underlying igneous layer from the overlying thrust block. The authors have studied this evidence and detected indications that there was a drag of one block over the other. We feel that he proved his case for thrust-faulting in that particular instance.

(2) Known Thrust Faults in Tortolita Mountains

The senior author made a study of this range when preparing a thesis for the University of Arizona. The lithological type is granodiorite, diorite, monzonite and granite. Most of the range has been subjected to regional metamorphism, forming a granite gneiss. On the north side of the mountains, where compression formed mica schist, some blocks of rhyolite were thrust southward over the underlying andesite. There is no fossil evidence here for thrusting, but very strong mechanical indication.

Between the andesite and the rhyolitic cap rock occurs a layer (from 15 to 20 feet thick) of tectonic breccia—crushed and ground pieces of rock fragments. One notably large piece of rock, a boulder, shows marked fluting or “slickensides” much like the striae or scratches caused by glaciers (Figure 2).

Problem of Empire “Thrust Fault”

The geologic map (Figure 1) shows the outcrop of the fault plane along the western edge of the Empire Mountains, visible for about four



Figure 2. A thrust block in Tortolita Mountains, Pima and Pinal Counties, Arizona. This detached rock was along the thrust plane. It shows the “slickensides grooves” which point toward previous tectonic activity. This is a close-up, showing a section about 10 by 10 feet.



Figure 3. Overall view of “overthrust” (near “A” in cross section in Figure 1). This picture shows the north end of the Empire Mountains looking eastward. Most of the mountain is Paleozoic (Permian). The center of the picture—light part along the wash—is the locale of the “overthrust” depicted in more detail in Figures 4, 5, and 6.

miles. In only one or two places, however, can the contact between the Permian (Paleozoic) and the Cretaceous (Mesozoic) be seen clearly. Accompanying photographs show the contact along the wash just south of the Andrada Ranch. Here the dark, blue-gray, Permian limestone caps the underlying Cretaceous (Figures 3, 4, 5, and 6).

The lithology of the Cretaceous varies from place to place, but at this point along the wash the Cretaceous has been metamorphosed. On the extreme left side of the geologic map and cross section intrusive igneous rock is shown in direct contact with the Cretaceous. This caused a “contact metamorphosis,” which bleached and marbleized the limestone. Presumably then, the presence of hot intrusive igneous rock converted Cretaceous strata to a light buff colored marbleized limestone. Further south this white marble is being quarried.

Metamorphic rock is usually considered to be older than rock which has not been so altered. Since metamorphism is a more advanced stage of petrogenesis, it should normally be considered older than unaltered rock. Oddly enough, the Permian capping rock (which is supposed to be much older) overlies the Cretaceous metamorphic limestone. Although it is slightly fractured, the Permian cap rock is **not metamorphosed**. From these data one can reasonably infer that the metamorphosed Cretaceous rocks beneath are indeed older than the Permian capping rock!



Figure 4. "Thrust-plane" contact, Empire Mountains. A closer view of the supposed "thrust-plane" is seen above Dr. Hamara and his son. The line of "thrust," which is supposed to have traveled to the left (west) is plainly visible here.

Other Physical Evidence Considered

But are there other lines of physical evidence to the contrary which would support the validity of the thrust idea at this Empire Mountain site? If so, one should find tectonic breccia, ground rock powder, mylonite, gouge layers, slickensides, or striae as noted previously in references to the two known thrust fault areas.

The authors have examined the exposure of the fault contact carefully and no such evidence was located. The buff-colored bed rock had been eroded so that an angular unconformity exists between the two formations. But the capping Permian rock fits into the deep grooves eroded in the Cretaceous like a glove on a hand, or like material poured into a mold (Figures 4, 5, 6, and 7).

If the Permian cap rock had been thrust over the Cretaceous (as uniformitarian geologists assert), all sharp projections would have been planed off because they would have been directly in the line of thrust from the west! The contact appears, rather, to be a purely depositional one and would be difficult to explain otherwise. The Permian above is apparently younger than the underlying Cretaceous material—the fossils and

uniformitarian theory notwithstanding to the contrary!

Rocks Carefully Classified

With the help of Doctor Oma Hamara of the University of Arizona, and his two sons, much time has been spent verifying the classification of the "thrust block" in the Empire Mountains as Permian. We were unable to find any very large fossils, nor any complete or perfect ones, but we did find parts of brachiopods which should definitely belong to the Paleozoic Era. Fragments of coiled gastropod showed up plainly, but we were unable to name any genus.

We did find some beautiful specimens of tiny horn corals, perhaps too small to identify for sure but they did resemble the *Lophophyllidium*, which are typically Pennsylvanian or Permian. Some horn type corals belong to earlier periods of the Paleozoic, such as Devonian and Mississippian, but many types overlap from one Period to another.

We were able to find many pieces of crinoidal stems, belonging to the attached type of Echinoderms, having a water-vascular system. These are all Paleozoic, although they could not be placed in any particular Period. We found



Figure 5. "Thrust-plane" contact, Empire Mountains. This close-up of the supposed "thrust contact" shows the darker Permian limestone above the Cretaceous marble. Figure of young Deter Hamara gives size perspective.

nothing that could have been classified as later than Paleozoic or Permian.

This Permian "thrust block" has a very dark gray color, indicating a large amount of organic material was buried with the fossils. We have no reason to doubt the classification of the various formations of the Empire Mountains. The only point at issue is whether there was a thrust, whether an "older" and lower stratum of rock of the Permian was raised up and thrust over the "younger" Cretaceous.

Are we to trust the evolutionary build-up of the fossils, or say that the Permian limestone was laid down later and on top of the Cretaceous? All the physical evidence would indicate the latter conclusion.

Discussion

In the past, stratigraphers have been inclined to correlate strata and formations primarily on the basis of the fossil evidence—as if that were an all-important criterion. In some instances physical evidence was ignored.

As an illustration of the supreme confidence some scientists have placed in the evolutionary order of fossils, Professor Henry A. Nicholson² flatly declared:

It may be said that in any case where there should appear to be a clear and decisive discordance between the physical and the paleontological (fossil) evidence as in the age of a given series of beds, it is the former that is to be distrusted rather than the latter.

A time has arrived, however, when the physical evidence can no longer be overlooked, even if it cuts across lines of popular theory.

Validity of evolutionary geology rests upon the concept of invariableness in the fossil order. There are many places on earth, however, where fossils do not occur in the order predicted by the



Figure 6. "Thrust-plane" contact, Empire Mountains. Another view of the supposed "thrust contact" shows how the two layers fit nicely against each other without the usual evidences of thrust faulting. Roy Kingman is seen here.

evolution theory. To save the theory in face of such evidence, giant overthrusts (thousands of square miles of sedimentary strata) have been postulated—often without proper regard to the physical improbability of such tectonic activity.

Sir Archibald Geike was a leading British geologist and authority on the Alps. Nappes and overthrusts had been postulated to account for the inverted order of the fossils, but Geike³ candidly commented:

The strata could scarcely be supposed to have been really inverted, save for the evidence as to their true order of succession supplied by their enclosed fossils. . . . Portions of Carboniferous strata appear as if regularly interbedded among Jurassic rocks, and indeed

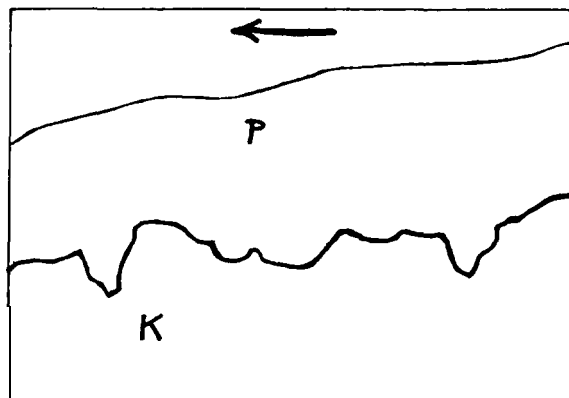


Figure 7. Cross-section of assumed Empire Mountain overthrust. This drawing of the contact shows the jagged fit between the two layers. Arrow indicates the direction that the thrust is supposed to have taken. One may wonder how the overlying Permian limestone could have been thrust over the Cretaceous without planing off the rough edges, and grinding rock powder! (P — Permian blue limestone; K — Cretaceous formation, in part buff colored marble.)

could not be separated, save after a study of their enclosed organic remains.

This quotation illustrates the "reasoning in a circle" that has been prevalent from Geike's day to the present. Biology in many instances did not offer the positive proof required to substantiate the evolutionary hypothesis. Scientists looked to geology—to the order of the fossils in the strata—to furnish the essential evidence. When the strata showed a contrary order, however, they fell back upon the overthrust hypothesis to explain the embarrassing discrepancy; thus employing evolutionary concepts they hoped to demonstrate, to try actually to show the strata in the wrong order.

In this study we have not intended to present a blanket denial of all thrust faults. We have shown, however, that when such faults exist, they are accompanied with physical evidence of differential movement. In the specific case of the Empire Mountain range (where Permian

rock lies atop Cretaceous) we have demonstrated the **lack of any conclusive evidence** for a thrust. The only conclusion we can reach from such data is that no thrust occurred. The area was once mapped as a thrust fault on paleontological evidence **alone** and physical data have evidently been disregarded.

The authors suggest that many such supposed "thrust faults" must be re-analyzed on the basis of physical evidence alone. The lesson seems clear enough that thrust faulting must be judged hereafter solely upon the physical criteria and aside from any evolutionary preconceptions.

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(Continued from Page 48)

the chromosomal patterns of various *Drosophila* species has led many to believe that, in at least some cases, the differences between the species are due to translocation or inversions.

The critical question, however, is whether the changes brought about are the type of changes which progressive evolution requires, and to this question the answer seems to be "no." Also to be considered is the fact that chromosomal changes are usually lethal. It is unlikely that an animal, in which a translocation or inversion has occurred, will meet an individual of the opposite sex which has the same chromosomal change with whom he can then mate.

Huxley concludes²⁰ that chromosomal rearrangements are rarely if ever the sole cause of evolutionary diversion. He says that, for one thing, they have very little prospect of becoming established. Then, too, he says their presence in non-interbreeding groups is normally accompanied by numerous single gene differences which are themselves often responsible for much of the group incompatibility. He believes that they can, therefore, be regarded only as secondary agents in bringing about speciation.

Conclusions

In summary, we shall have to say that the various types of chromosomal changes can hardly be regarded as important evolutionary mechanisms. True, they do bring about striking changes in the organism—changes that are greater than those brought about by mutations. However, along with this goes the fact that most of the changes show even greater lethality than do mutations.

Only polyploidy and chromosomal rearrangement show any promise as a mechanism for evolution, and in the final analysis these contribute nothing that is really new. Moreover both usually result in a substantial reduction in viability and fertility.

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THE CONCEPT OF HOMOLOGY

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*The concept of homology, in the historical sense, was defined in **The Origin of Species** by Darwin as "recognition of fundamental plan in animals and plants is due to descent with modification." Inheritance of successive slight modifications from a common ancestor was very likely a reaction to the extreme view of the immutability of species held in Darwin's times. This paper seeks to show that it is neither hopeless nor unscientific to attribute a common plan or a basic pattern of a Creator to the similarities shown by the forelimbs of vertebrates.*

A review of recent and widely adopted high school textbooks in biology shows that homology in the Darwinian sense is still being offered as "proof" of evolution. Recognition of the rapid inroad of evolutionary teaching into our educational system to the complete suppression of creationist viewpoints calls upon scientist and non-scientist alike to lead in a return of the data of the natural sciences within creation guidelines.

Introduction

This paper will present some of the historical background for the concept of homology as expressed by Darwin and Huxley, as well as some rebuttal to the concept that was made even in their day. Also consideration of some recent textbooks, both on the college level as well as that of the high school, will be presented in order to show the generally accepted premise that this concept affords "evidence" for evolution. I believe that it is time that scientists on the frontiers of research as well as those on the frontiers of teaching should be heard from on this important subject.

Homology is defined by Webster as the correspondence in type of structure between parts or organs of different organisms due to differentiation by the process of evolution from the same or corresponding part or organ of some remote ancestor. Included in support of the definition is mention of the relation in structure between the arm of a man, the foreleg of a horse, and the wing of a bird as typical examples of homology.

Homology, at least historically, was emphasized more in the animal than in the plant kingdom. So far as the former goes, it belongs to morphology, specifically in the field of comparative anatomy, though some have stressed it even in the discipline of embryology.

But I have seen little research recently in comparative anatomy; in fact, many medical schools have now dropped it from their requirement for entrance, and many universities and colleges are no longer teaching the subject. Could it be that it is simply so obvious, so much a commonplace observation, that animals should have certain resemblances—and that therefore, comparative anatomy is merely the pointing out of the commonplace? Furthermore, is it not because existence of similarities is dependent upon the preference of the investigator?

And the reader might ask, hasn't the idea of homology been abandoned generally, at least as favoring the theory of evolutionary origins of living things? As one of the oldest arguments usually offered in favor of evolution, isn't it by now pretty well outmoded and relegated to a former generation of thought?

But with these questions asked, I find, as a teacher interested in good teaching, that in nearly every textbook of biology, the subject matter of the concept of homology is presented with the same overtones that it has always carried, with the same special pleading for the case for evolution. What about recently published books?

The advertisement for William T. Keeton's, *Elements of Biological Science*, states that the author has, "an undogmatic approach throughout that stimulates student interest through emphasis both for and against scientific conclusions." I was, therefore, anxious to find whether or not the subject of homology was presented, and in what fashion. Keeton¹ writes:

Systematists, then, when they are studying similarities between two species, must determine whether the similarities are probably *homologous* (inherited from a common ancestor) or merely *analogous* (similar in function and often in superficial structure but of different evolutionary origins). Thus the wings of robins and those of bluebirds are considered homologous; i.e. the evidence indicates that they were inherited from a common avian ancestor with wings. But the wings of robins and the wings of butterflies are only analogous because, though they are functionally similar structures, they were not inherited from a common ancestor but, evolved independently from different ancestral structures.

And so, patiently and with forbearance, as Dr. Evan Shute² so fittingly writes, "the evidence pro and con must be presented for dispassionate analysis once again," because the textbook author has not done so for his readers.

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(As for the undogmatic approach, I came across this most amazing statement in the Keeton book: "Whales, which are mammals descended from terrestrial ancestors, have evolved flippers from the legs of their ancestors; those flippers superficially resemble the fins of fish, but the resemblances are due to convergence and they do not indicate a close relationship between whales and fish.")

Surely, teachers must evaluate for the student such dogmatic statements as are contained in the above, viz., that "whales . . . are mammals descended from terrestrial ancestors" and that they have "evolved flippers from . . . legs." It is often difficult even for students in college to see the fallacy behind this sort of statement. Thus, the point that I want to get across right here is that homology, and the argument from vestigial organs, are still presented to students of biology as a proof for evolution!

Just how is it that whales are thought to have "evolved" from land mammals? I have rarely seen an explanation by evolutionists for this amazing phenomenon, but I came across the following passage in the writings of the late Douglas Dewar, whom it was my privilege to visit once at his home in England, at Hindley-on-Thames, while I was serving after the war as a missionary in Germany:

A delightful example of this occurs in the late Sir J. Arthur Thomson's *Biology for Everyman*. He tells us that whales are descended from land animals that took to the water. He writes, "We may begin with an animal like the stoat that occasionally jumps into the water and swims well. The next step may be illustrated by the otter, that is thoroughly at home in the river and may swim for miles out to sea, yet remains equally at home on land. On the next level may be placed the almost exterminated sea-otter (*Enhydra*) of the North Pacific, whose hind feet are suited only for swimming. Then we reach the progressive series represented by sea-lion, walrus, and seals—the last being almost as thoroughly aquatic as the, whales, except they bring forth their young on the shore and nurse them there."

And then Dr. Dewar, in his own terse manner, dismisses all this with one thrust as he wrote, "The above passage, while in no way resolving the difficulty of the transformation of a land into an aquatic mammal, contains the fallacious assumption that evidence of the transformation is afforded by the fact that some existing mammals are more aquatic than others."

Historical Background of Homology

But so much for the supposed transformation of land animals into whales. Surely the concept

of homology is very old; certainly it is neither new nor modern. Perhaps no one knows exactly when it was first put forward, but it was used by Darwin in *The Origin of Species* to support and bolster his doctrine of evolution. He speaks of the matter in these memorable words:

What can be more curious than the hand of a man, formed for grasping, that of a mole for digging, the leg of the horse, the paddle of the porpoise, and the wing of the bat, should all be constructed on the same pattern, and should include similar bones, in the same relative positions?⁶

We see in this statement how incredible it seemed to Darwin—the simple fact of the correspondence of parts between the fore-limbs of vertebrates. But we must remember that in the days when Darwin wrote the climate of the times was totally on the side of the absolute immutability of species. R. E. D. Clark, in his chapter, "Before Darwin," makes this quite clear.

In the eighteenth century, Linnaeus (1707-1778), the great systematizer of zoology, became profoundly convinced that species were immutable. His belief, founded upon direct observation, was unshaken by the anatomical resemblances which he so frequently found to exist between different animals. There are, he claimed, "just so many species as in the beginning the Infinite Being created . . . biologists, too, had come to believe in the absolute fixity of species."

To the complete overthrowing of such narrow concepts of immutability came the *Vestiges* by Chambers, in 1844, some years before Darwin went on the Beagle or published his notes. The tone of this revolutionary book was thoroughly evolutionary, but devoutly "Christian." Darwin, it is thought, was greatly influenced by the book.

Thus the climate of opinion by 1859 was right for the overthrow of one extreme view—the absolute immutability of life forms—to the acceptance of another extreme view—that *all* organic forms have changed, and changed considerably! We have seen, in the last hundred years, the pendulum swinging back again to a more sober approach upon the part of creationist science, at least.

Many of Chambers' arguments (such as the absurd acceptance of the supposed close relationships between sea weeds and men and frogs, and the strange idea of recapitulation, later so overworked by Ernst Haeckel) were avidly adopted by those who were looking for a means with which to meet theologians who accepted species immutability! The difficulty, then, was that men of science, who believed in God's revelation, often contended for Him on too narrow a basis! Some still continue to do so.

Homology Per Darwin Examined

To get at the real issues behind the concept of homology, at least as it was first conceived, it is worthwhile to go back to the source-book of evolution (*The Origin*) and find out just what Charles Darwin said about it. And we shall be concerned, not only with what he said about the nature of the similarities between organic beings—their morphology or comparative anatomy, but also the “why” of such homologies. He speaks of homology in these words:

Nothing can be more hopeless than to attempt to explain this similarity of pattern in members of the same class, by utility or by the doctrine of final causes. The hopelessness of the attempt has been expressly admitted by Owen in his most interesting work on the *Nature of Limbs*. On the ordinary view of the independent creation of each being, we can only say that so it is;—that it has pleased the Creator to construct all the animals and plants in each great class on a uniform plan, *but this is not a scientific explanation.*⁸ (Emphasis added)

We see from this quotation, then, that Darwin could never quite dispense with the idea of a Creator-God; in fact it troubled him until the hour of his death. It is true, of course, that the celebrated anatomist of that time, Richard Owen, did maintain, as many creationist scientists do today,⁹ that such similarities as we see in animals and plants about us are due to a common Plan or a common Design of a Creator.

However, Darwin, and indeed most modern evolutionists, will have nothing of this for an explanation. It is, they say, not scientific! How often do I hear high school students, and even some in the lower grades, expressing these same doubts, which very likely they have learned from their teachers, who have graduated from universities, where they have been indoctrinated into the “religion” of biology, i.e., evolution!

Instead of “the independent creation of each being,” the concept of absolute fixity of species which was forced upon Darwin, we have this “scientific” explanation offered by Darwin:

The explanation is to a large extent simple on the theory of the selection of successive slight modifications, —each modification being profitable in some way to the modified form, but often affecting by correlation other parts of the organization.¹⁰

So we are led to believe, then, that because creation, according to a common plan or pattern, is “hopeless,” we must then accept other theories and other hypotheses without end to make the theory of common descent work!

As a teacher on the college level I find that

some students have preconceived ideas that creation is “hopelessly at variance with modern science.” As a lecturer on matters of science, the Bible, and evolution, I often have the privilege of speaking before high school convocations or in small classes in biology, and I find that high school students express the same doubts that Darwin suggested in his book! With but few exceptions, the only argument they have heard is evolution. Might it be because this is the only world viewpoint their young teachers know?

At every opportunity I draw from what I believe to be the best rebuttal to the whole idea of evolution as a “scientific” theory. I refer to the Introduction to the centennial edition of the *Origin*, by Dr. W. R. Thompson, F. R. S.! And I stress the meaning of F. R. S.—Fellow of the Royal Society! Actually, Dr. Thompson was formerly Director of the Commonwealth Institute of Biology at Ottawa, Canada. High school libraries, as a rule, do **not** have this edition of *The Origin* and most librarians have never even heard of it!

The force of the arguments put forward by Thompson is the greater because of their position in the Introduction to the very “Bible” of evolutionists; and of course, as he admits, it is not a “hymn to Darwin and Darwinism that introduces so many textbooks on biology.” He has this to say in regard to the matter of “slight modifications” to explain homology:

What such cases of . . . general homology actually demonstrate is that there are large numbers of organisms, differing considerably in the details of structure but constructed on the same fundamental plan. However, this is no proof of descent from one original ancestor of this anatomical type. *This itself requires proof.*¹¹ (Emphasis added)

Furthermore, Thompson rejects the oft-repeated quibble of evolutionists, that such similarity is more difficult to account for on the independent origin of complex types; and, he suggests that until the mechanism is accurately known by which “the selection of successive slight modifications” could account for this similarity, we must admit that our information on this matter is inadequate. Also it must be asserted that evolutionists, for the most part, have made the mistake of considering only similarities, while ignoring almost completely, the differences between organisms.¹²

Darwin's Reasoning Noted

I should like to call attention to the manner in which Darwin attempts to account for *successive slight modifications*, and call attention to a most amazing piece of writing which serves as the best rebuttal to such changes as I have seen in

print. Darwinian reasoning on this line goes like this:

In changes of this nature, there will be little or no tendency to alter the original pattern, or to transpose the parts. The bones of a limb might be shortened and flattened to any extent, becoming at the same time enveloped in a thick membrane, so as to serve as a fin; or a webbed hand might have all its bones, or certain bones, lengthened to any extent, with the membrane connecting them increased, so as to serve as a wing; yet all these modifications would not tend to alter the framework of the bones or the relative connexion of the parts.¹³

And with the best catch phrase of them all, "if we suppose," so often resorted to by evolutionary propagandists, we are introduced to this superb explanation for the "why" of homology:

If we suppose that an early progenitor—the archetype as it may be called—of all mammals, birds, and reptiles, had its limbs constructed on the existing general pattern, for whatever purpose they served, we can at once perceive the plain signification of the homologous construction of the limbs throughout the class.¹⁴

It is absurdly easy to exaggerate the similarities while at the same time overlooking the differences, and it is a mistake most difficult to avoid. There is a delightful commentary on the matter of the supposed homology of the vertebrate limb; it was written shortly after the appearance of the *Vestiges*. It is given by Clark, and is often called "homologizing the table!"

The reviewer imagines an ingenious young man, Martinus Scriblerus, who is determined at all costs to discern connexions between things quite irrespective of whether those connexions are real or imaginary. . . . What should have prevented him from casting a philosophic glance upon the furniture in his room? With less ingenuity than certain physiologists, he would easily detect a marvelous unity of plan. . . . He would probably have taken the table with its four legs and the disk they support, as his great type of joinery, and would have traced a modification of this type in all the articles around him. The chair is manifestly nothing else than the table with a development of the hinder legs called the back. From the chair to the sofa the transition would be ridiculously easy; indeed, the sofa can only be considered as a variety of the chair, produced by a high state of cultivation. In the footstool or ottoman, the disk of the table has become thick and pulpy while its legs have dwindled into small globular supports. . . . What is the four-posted bedstead, but a reduplication of the original type, a table placed on a table, the

upper one being laid open? . . . the coal skuttle, might, perhaps, present some difficulties. . . .¹⁵ The ludicrous nature of such reasoning can be easily detected. Such speculation, and such similar reasoning by evolutionists has brought forth many fantastic homologies, none of which can be substantiated by experimental proof of any kind. The simple truth is, of course, that one joiner or cabinet maker could have made each piece of furniture and all of them if he chose, just as the notion struck him, utilizing for each piece such purposefulness as he deemed necessary to make the piece work.

It has often been objected that creation scientists cannot argue, that because man makes things in certain ways, that therefore, God, as Creator, has made things like we do. Also, as one widely publicized high school text asserts, in referring to advances in locomotion of animals, "One should not suppose any of these advantages . . . were purposefully acquired."¹⁶ I submit that although God's methods of creation are largely inscrutable to us now, that there surely is design in the organic world. That there is certainly purpose would seem to be the obvious explanation, that indeed, eyes were made for seeing, and ears were made for hearing!¹⁷

In this connection, on the matter of making things, I came across this statement purporting to come from a biologist of a former generation, George Mivart. He is quoted as saying:

Mivart asks us to contemplate what we would do, as it were, if we were God and were going to create man. He says we would be guided by these considerations: (I) to live on this earth man must resemble animals in that he must eat, breathe, etc.; (II) as being an intelligent creature he must have a large nervous system; (III) as such, no invertebrate nor reptile nor fish nor bird is so built as to be able to support such a huge nervous system; (IV) whales, porpoises and seals are ruled out . . . and for the same reason we must rule out (V) the hoofed mammals; (VI) this restricts us to the carnivores, and among them those who have a body most closely suited to what a man should possess are the simians.¹⁸

Thus man has many traits in common with other animals, seeing that he is to breathe the same air, eat certain of the same foods, etc., and this should come as no surprise. But the Bible says, in its own way, much the same thing, and yet condemns the scientific humanist in his attempt to hold man up as being "just" an animal! In Ecclesiastes we find these words:

I said in mine heart concerning the estate of the sons of men, that God might manifest them, and that they might see that they themselves are beasts.

For that which befalleth the sons of men befalleth beasts; even one thing befalleth them: as the one dieth, so dieth the other; yea, they have all one breath; so that a man hath no preeminence above a beast; for all is vanity.

All go unto one place; all are of the dust, and all turn to dust again.

Who knoweth the spirit of man that goeth upward, and the spirit of the beast that goeth downward to the earth?¹⁹

Attention Given Serial Homologies

The matter of serial homologies is mentioned often, and some examples are given by Darwin. But we shall let one of his contemporaries, Thomas Henry Huxley, grandfather of the celebrated modern evolutionist, Sir Julian Huxley, expound upon this matter. It was Huxley who popularized Darwin's ideas; he was certainly an arch-enemy of Christianity. He wrote:

I have before me a lobster. When I examine it, what appears to be the most striking character it presents? Why I observe that this part which we call the tail of the lobster is made up of six distinct hard rings and a seventh terminal piece. If I separate one of the middle rings, say the third, I find it carries upon its under surface a pair of limbs or appendages, each of which consists of a stalk and two terminal pieces. . . .

If I now take the fourth ring I find it has the same structure, and so have the fifth and the second; so that, in each of these divisions of the tail, I find parts which correspond with one another, a ring and two appendages; and in each appendage, a stalk and two end pieces. These corresponding parts are called, in the technical language of anatomy "homologous parts." The ring of the third division is the "homologue" of the ring of the fifth, the appendage of the former is the homologue of the appendage of the latter. . . .

. . . but whither does all this tend? To the very remarkable conclusion that a unity of plan, of the same kind as that discoverable in the tail or abdomen, pervades the whole organism of its skeleton. . . .

I can point out to you exactly, what modification the general plan has undergone in that particular segment; what part has remained movable, and what has become fixed to another, what has been excessively developed and metamorphosed and what has been suppressed.

. . . But I imagine I hear the question, how is all this to be tested? . . . Does Nature acknowledge, in any deeper way, this unity of plan we seem to trace?²⁰

This is the general concept of serial homology, one which is still widely expressed in the literature today. Note that Huxley says he can point out "exactly just how all this modification has come about." He calls upon embryological development to finally solicit more "evidence" for his views, which itself requires proof.

I am reminded of my work as a doctoral candidate at the University of Minnesota. As a graduate student I had to learn a great amount of data on homology, and as an assistant in the department I had to teach it. I refer to the teaching as given in a certain standard laboratory manual. Under the title "Appendages" I find:

The appendages of the lobster (or crayfish) comprise excellent material for the study of the PRINCIPAL OF SERIAL HOMOLOGY—the modification in structure of a series of originally similar organs serving different purposes. Beginning with the second antennae these are all variations of a common biramous type (illustrated by the third abdominal appendage) consisting of a basal segment, the *protopodite*, and two branches, an outer *exopodite*, and an inner *endopodite*.²¹

Here we see, then, the principle of serial homology expressed much in the same manner as Darwin and later Huxley spoke of it. The laboratory manual is widely used and accepted in many college courses in zoology and biology. While I have no quarrel with zoologists who propose to name the parts of the biramous appendage of the lobster, I object to the certain and dogmatic attitude authors express about the manner such modifications may have come about. Like Huxley, they point out "exactly" just which modifications have been made, and in what manner. This is, of course, pure supposition, and it should be recognized as such. While the laboratory manual does not specifically state that serial homology is due to evolution, students readily make such an implication.

Space will not permit an extended review of works since Darwin and Huxley which served as a rebuttal to the rising acceptance of evolution as the only explanation for homology, but it can perhaps be safely said that they appealed to the argument from design.^{22,23,24} Suffice it to say, some of the dangers they foresaw concerning the acceptance of evolution by high school students are essentially similar to those we speak of today, in fact, this is the chief reason for the writing of this paper.

The difficulty lies in the fact that there is very little reading done on the creationist viewpoint, and high school students are generally poorly prepared even in the evidences for evolution. This brings me, then, to consideration of some

popular and widely accepted high school texts, and what is said in them about homology.

Consideration of High School Texts

A text now widely in use in high schools throughout the land is *Modern Biology*. Since my return from the mission fields of Switzerland and Germany in 1953, I have watched with interest various changes that have taken place in succeeding editions of this popular text. I am certain that few parents, and perhaps fewer teachers are aware of specific changes effected since the deaths of the senior author, Paul B. Mann, and one co-author, Truman J. Moon. James H. Otto is the only member of the original team of writers still remaining.

The 1956 edition, the last in which Mann was writing, carried a statement concerning the fact that there was "nothing in all of science that in any way opposes a belief in God and religion."²⁵ This has been **omitted completely** from the two succeeding editions., viz, 1963 and 1965. I cannot say for certain, of course, but I imagine that Dr. Mann was a religious person and that, at his passing, it was easy to dispense with the statement about God and religion for this is offensive to many educators; any mention of such is generally omitted from modern texts in biology.

Another reason may very well be that, as science is now taught, there is much that does oppose belief in God and religion! If this is not true, then why do so many young people in high school and junior high school raise so many objections to the Bible and against God when I speak to them about the creationist point of view? I believe that the God-opposed doctrine—evolution—is in our schools and the Bible is out, and I am not the only scientist of this opinion!

Modern Biology, 1956 edition, contained one chapter on the "Changing World of Life," in which some seven "evidences" were offered as proof for evolution; all this was included toward the close of the book, so that the teacher could omit the section if he chose. The "evidences" listed were: 1) fossils, 2) homologous structures, 3) vestigial structures, 4) embryology, 5) geographical distribution, 6) results of breeding, and 7) experimental genetics. Fossil man was not mentioned nor shown in this edition!

In the 1963 edition a chapter was added on "Structure of the Human Body," and in this chapter "fossil men" were included, with fanciful reconstructions!²⁶ The 1965 edition was further increased in size, as was the presentation of evolution. The chapter title, "Changing World of Life," became "Organic Variation" and there is an **entire** chapter on the "History of Man." Let it not be said that editions of *Modern Biology* do not teach evolution!

In all fairness, it must be admitted that the authors still include some qualified statements for Darwin's theory of evolution, stating: "In its broader features it is accepted generally, although it fails to account for all the known facts."

Treatment of Homology

Homology is discussed in about the same way in all three editions, and the same identical figure accompanies all three, though the caption has been changed. (Figure 1). The following is given on homology:

In both plants and animals we find parts that are evidently of similar origin and structure, although they may be adapted for different functions in different species. These parts are called homologous structures . . . the bones of the bird's wing, the front leg of a horse, and the paddle of the whale are so similar in structure, that with slight exceptions, they are given the same names.²⁷

Again let me repeat that similarities in plants and animals do not necessarily indicate descent from a common ancestor; it could just as easily be due to a common plan or a common design. What is called adaptation by evolutionists is maintained by creationists as evidence of design with as much science on one side as the other. The **facts** of the similarities are the same for each proponent; it is the **interpretation** which is *different*, and this, of course, must remain subjective.

Giving an answer to the similarity in names of the bones, it must be admitted that this is what would be expected if one mind designed the various animals. Also let us admit that no anatomist would mistake for a moment the radius or ulna of a bird, when compared with that of a dog or of another animal. There are considerable differences, but the same plan.

Modern Biology editions are highly respected throughout the country and avidly used by many biology teachers. This text, among those widely used, is perhaps the least objectionable in regard to "propaganda" for the doctrine of evolution. Yet, no teacher or student should believe for a moment that the text does not teach evolution. Actually, the doctrine of evolution is all there in the text for the young person to read and to study; and, with the addition of the data on anthropologic "evidence" of man's ancestry, it is perhaps as complete as any.

In the hands of a skillful teacher, who is himself persuaded to accept the evolution story as given, it can be a very convincing demonstration. In the hands of a teacher willing to present both sides of the controversy—evolution vs. creation—it can serve to show why the authors generally are cautious in not claiming too much for any of the "evidences."

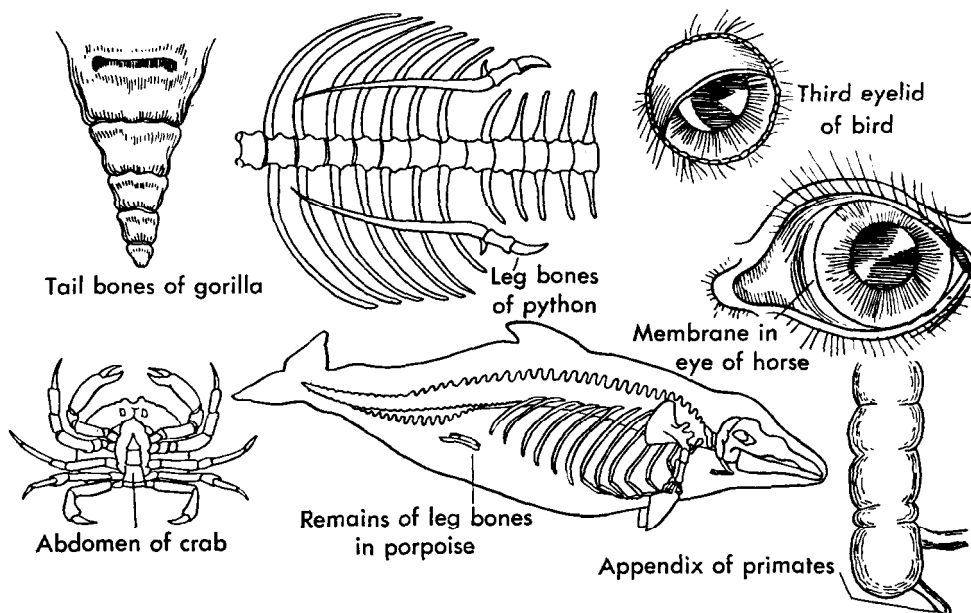


Figure 1. "Nonfunctional vestigial organs are common among animals, and provide one source of evidence that life has changed through the ages," from *Modern Biology*. Moon, Otto and Towle. 1963. Holt, Rinehart and Winston, New York. p. 14. Used by permission of publisher.

Perhaps we need, then, to begin with our grade school and high school teachers, because what they believe and accept as background in science is very likely what they in turn will teach others. I teach elementary education majors, as well as general biology students who may go into teaching later, and it has been my experience that young college people, who plan to become teachers, are generally poorly prepared to meet this issue.

Many are not even aware that there will be a conflict in their classrooms, between what the State requires them to use as a text and, if they are of creationist persuasion, what they privately believe. If they are already evolutionist in persuasion and outlook, it is because they have heard just enough to convince them of some of its broad generalizations, but not enough detail to show the deceptive nature of its arguments, as in homology. The facts are there for all to see, but the meaning of those facts is a matter of one's own subjective appraisal.

As I have written elsewhere,²⁸ biology teachers at David Lipscomb College evaluate the claims of evolution before every class of students under our supervision. I emphasize that before one can meet false doctrine he must first know it!

I come now to consideration of other widely adopted high school biology textbooks; namely, the three BSCS (Biological Sciences Curriculum Study) biology textbooks, initiated in the interest of better teaching in biology by the American Institute of Biological Sciences, and produced

under the immediate supervision of the Director, Arnold B. Grobman, of the University of Colorado at Boulder, Colorado.

I refer, of course, to the Green, Yellow and Blue versions of the BSCS series, each of which is published by a different publishing house. I will quote from each with regard to the manner of presentation of the general theme of evolution, and of homology in particular.

(While lecturing this past summer in the Denver area, I was privileged to speak to two of the writers of the Green version, both of them high school teachers. One writer volunteered that he was very disappointed and much displeased with some of the bold assumptions made in the book; the other admitted that "perhaps some statements were a little far-fetched.")

Green Version of BSCS Series

The Green version is perhaps the least objectionable of the three in advocating evolution as a fact, since an ecological approach is utilized. But as I pointed out to one of the writers on that version, it is hardly consistent with complete objectivity in science to "sneak in" evolution doctrine early in the very first chapter (actually on page 19, where webs of life are considered and where dinosaurs are utilized to show various types of consumers! I especially object to the mixture of poorly qualified and completely authoritarian statements, such as:

Figure 1-12 gives an impression of what might have been going on about 180 million

years ago, when dinosaurs were the biggest things around. Most of the actors in this scene have disappeared; others have evolved and taken over their parts. But the *processes* have been continuous.²⁹

It is true that the caption to the figure (1-12) laments the fact that "the relationships shown in this figure are not as certain" as those of a preceding figure utilizing present-day organisms. But I decry the method here used of assuming evolution as already proven, and calling upon youngsters to accept statements like "others have evolved" without the slightest shred of evidence having been offered for the theory beforehand.

In fact, the only evidence stressed in the book is that of the fossil remains, discussed at great length in the chapter on "Patterns of Life in the Past." Oparin's theory on the origin of life is sandwiched into this chapter under the heading "The Earliest Life—The Pre-Cambrian." The idea of "consumers" as the first living things is adopted though this is considered "odd," since producers are thought to be the primary basis of all living processes! The authors write that Oparin's theory simplifies things; it is easier to imagine how life began than it is to imagine how photosynthesis began! How true this really is; yet, the heterotroph hypothesis is here avidly endorsed!

I can find no direct reference to homology as "evidence" for evolution in this text, but in the chapter on the "Human Animal" a reference is made to the fact that man can stand, walk and run upright on his hind legs. This condition, the authors say, leaves his hands free to manipulate and carry things—and this involves many anatomical modifications, but what these modifications are, or how they are brought about, is not given.

Some distinctive differences are given between the human animal and his closest contemporaries, the apes. One difference is that the head is fixed to the spinal column in such a way that man can look straight ahead when standing upright. The so-called fossil evidence of man is pictured and discussed in the same chapter under the heading "Becoming Human."

I challenge anyone to believe that a youngster, of the age when this is generally presented, would not quickly see that here there is a direct conflict between what the preacher says on Sunday from the pulpit, and what the teacher teaches through the week in his biology class. Thus doubt becomes his overwhelming and miserable companion.

Little wonder, then, that the Bible account of man's origin is discredited and the gospel is nullified because this is supposed to be "science"!

If any pupil dares to raise any question concerning this conflict, he is offered the alternative of "theistic evolution," as so many young biology teachers say when questioned. This is the way "God did it," they offer.

Plea for More Parental Attention

How many parents actually know that such things as this are found in their son's or daughter's high school text in biology, and how many could give any kind of answer to their doubting student's questions? Indeed, how many preachers could? I know of some who are well prepared to "give answer to everyone that asketh a reason for the hope," even if it is in science.

And yet, the whole matter could be solved, if the student had a copy of *In the Beginning*, that very fine little book by Rita Rhodes Ward.³⁰ Everywhere I go I urge parents and church leaders to "put one of these into the hands of every young person," but to some it seems that the saving of a young person's faith at the time of his doubt is not worth a mere \$1.25! And this is the tragedy of the whole matter, it is not just science at stake; it is faith!

A copy of Thompson's Introduction to *The Origin*, cited before, might also help to hold a boy or girl on a firm footing! I have yet to find either one of these on the shelves of a high school library, or of any church library! Yet there are literally scores of books on the evolution world-view, including the Life Nature Library series, all in beautiful color. Could we do more to see that books on the Creation viewpoint are placed in reach of high school young people?

A young school teacher in Danville, Illinois (graduate of the University of Illinois with an M.A. degree and of some years teaching experience in science) makes the same plea to parents and educators alike:

This book was not written to discuss the history of the theory of evolution or the number of men who have promoted it down through the years. . . . Lengthy books have been written by scholars on the subject. Unfortunately, most of them are in favor of it! Nearly every biology or general science book contains some thoughts on the subject, so the average pupil of today is exposed to this theory from the time he or she *enters the sixth grade in elementary school*. (Emphasis added. Evolution is even now being pushed rapidly downward into even lower grades, and in some places into the second grade—Author.)

My main criticism of this is that pupils do not get an opportunity to read materials presenting the Bible story of Creation. The pupil who would protest the textbook presentation of evolution is without any information with

which to combat the views presented by his text or teacher. Many are overwhelmed by the so-called "evidence" supporting evolution. *The result is often tragic.* The child's faith in the Bible is shaken and he is left floundering without knowing where to get help. (Emphasis added)

The encyclopedias fall down at this point, as do most other reference books. (Author's Note: The reason for this is that the authors themselves are evolutionist-persuaded and are not usually objective enough to point out any other view. However, the *World Book Encyclopedia*—1967 printing, Vol. 6, pp 330-334, widely used by pupils, does have a very fine treatment of the matter, written by an evolutionist, Carrel Lane Fenton.) I do not know any reference work, normally used in the classroom, which even mentions the Bible story of Creation. Sadly enough, many ministers are unable to answer the challenges of the texts and cannot counsel the needy one.³¹

While I believe that this is certainly the situation, surely the young people themselves are to blame in part. I find few who really know much about the "evidence," most of my lecture time is often taken up in telling what they should already know.

Yellow Version of BSCS Series

The Yellow Version of the BSCS series presents quite a different approach—from the standpoint of ten basic themes in biology, the first of which is "Change of living things through time: evolution." These basic themes have been thoroughly and adequately reviewed in a previous article in the *Creation Research Society Quarterly* by Mrs. Rita Ward,³² but an examination of the first will bear repeating.

Evolution in this text is introduced in this fashion: A heading states, "Like Produces Like," but the fossil evidence is then invoked to show that over the course of time, descendants of the first organisms "have changed to become the animals and plants of today. This is evolution, once hotly debated but now a well established theory."³³

The authority of the experts is given in the statement: "The tremendous variety of kinds of animals and plants living on earth today is a consequence of evolution—each kind becoming modified for living in its own way."³⁴ I believe that it is just as "scientific" to claim that each organism is designed to live in its own way, and the adjustments and accommodations for life are so well illustrated by such creatures as the Duck-billed Platypus and many others.

I was attracted to a statement on page 9 of the Yellow Version in which the authors state that

one of the human goals in biology, among others, is "to understand the origins of life and to rid oneself of superstitions and fears." Yet, after a thorough treatment of the controversy over spontaneous generation is given in Chapter 2, then these amazing statements are offered, may I point out, to bolster the **superstition** of spontaneous generation:

All competent biologists are biogenesisists. They accept the view that on the earth today life comes only from life. . . . We know that the world was once without life—that life appeared later. How? *We think it was by spontaneous generation!* (Page 42.) (Emphasis added)

The entire Chapter 36 is devoted to an exposition of the heterotroph hypothesis and of Oparin's theory. A "sub-glob" of protoplasm is invoked as being one of the steps in this type of "speculative thinking" and there are several references to a "hot, thin soup." Yet all of these arguments have been adequately answered elsewhere, and often in previous publications of this Society.

As for homology, the Yellow version offers this as a "proof" of evolution, in these words:

During the course of evolution, the structures of the various descendants of the common ancestor became increasingly different. In many cases, however, some evidence of similarity still remains. Thus the wing of a bat, the arm of a man, and the flipper of the whale all have the same basis of structure in spite of their superficial dissimilarity. . . . This type of relationship is called homology. . . .³⁵

As "proof" of this assumption that similarity can only be the result of evolution, the idea of "vestigial organs" is invoked. The list of organs includes the appendix of man, which the authors dogmatically state "has no important function," and further that it has been "removed from thousands of persons without ill effects." (p. 607)

I ask, because one of the lungs can be removed without ill effects from a person with lung cancer, does this indeed make the organ therefore "useless"? Vestigial organs are listed for other animals, such as the "vestiges of hind limbs in whales, the ancestral hind legs of the python, and the vestigial wings of the flightless kiwi." I think Thompson has given the answer, quoted previously in this paper to all these arguments. Also, Dewar insisted upon the fact that the lack of "nascent" organs, on the way toward becoming useful, represents a formidable obstacle to this type of reasoning!

Authors of this version close the section on homology with this question on p. 607, "Whence comes this wonderful unity and similarity that is evident . . . ?" They admit, "It need not, of

course, come about because all of them have descended from a common ancestor. . . . But since "in our experiments all organisms *do* inherit their characteristics from their ancestors, evolution is one way of explaining unity or basic plan combined with diversity in detail." The appeal to modern genetics, to bolster what the assumptions in homology seem to show, must fail, for it is still true that like begets like. No other views are mentioned!

Blue Version of BSCS Series

The latest edition of the Blue Version, of the BSCS series, *Molecules to Man*, leaves no doubt as to an all-pervading use of evolution through these glowing words:

Of all the theories you may study in biology, the theory of evolution occupies a unique place. It is the most inclusive of the great unifying principles of biology. It is so much a part of the foundation of biology that the science can hardly be understood without it. . . . Throughout this book it will be evident that the theory of evolution by natural selection is the major framework of modern biology.³⁶

In the "Teacher's Edition Notes," there is this statement, which seems to be somewhat more qualified than the previous edition (1963) in regard to acceptance of evolution as fact. I think we need to have this before us so that we may see for ourselves just what they do say. Here it is:

Although the idea of evolution is a relatively new idea for many high school students, some will come to the subject with preconceptions, many of which will act as a barrier to the proper understanding of evolution. The authors feel that evolution should be defined simply as "descent with modification," since the basic assumption in evolutionary theory is that organisms living today are modified forms of their ancestors. Once the student grasps this fundamental assumption, many of his preconceived reservations about evolution will disappear. *He will understand that evolution is not a fact, but a scientific theory proposed to account for certain observations.*³⁷

And yet the true approach of the authors to evolution as a unifying principle is again mentioned in the teacher's notes. The authors regret that no encyclopedic listing of the "evidences" for evolution is given. The fossil record, they say, is only one of "types of supporting evidence," among which homology is described.

In my estimation the absurd claims of the first edition of the blue version have been somewhat "toned down," in this latest edition, yet the concept of homology is given in very definite fashion. It has changed little since the time of Darwin's

exposition of the same, and this was the reason why I began with Darwin, though it is now only of historical importance.

In the chapter on the skeletal and muscular systems we find a rather extensive statement concerning homology. This entire matter of similarity was not found in the previous edition. One illustration in the new edition shows essential similarities and differences between the walking, swimming, digging and handling fore-limb of typical vertebrate types. The authors write:

The bones of the forelimbs of various vertebrates are compared in Figure 24-5. At first glance, you might think that the left forelimbs of the salamander, crocodile, bird, bat, whale, mole, and man are very different . . . these limbs are used for different activities: walking, flying, swimming, digging, and handling. Yet if you look closely, you will see that the bones of these limbs are remarkably similar. . . . *It is thought that* such similarities exist because these vertebrates share a common ancestry. (Emphasis added)

. . . *It is assumed that those organisms* with more similar structures are more closely related than those with less similar structures.³⁸ (Emphasis added)

In the "notes to the student," artfully and quite cleverly added to the pages of the book (I really commend this method!), there is a reference to the fact that these are examples of homology, but the words homologous and analagous which give so much trouble to evolutionists, are not used at all in this section. I have not been able to find the subject of vestigial organs mentioned anywhere in this text; it is not mentioned at least in the index.

A Final Comparison

Before I close this paper I want to show similarity in teaching on the matter of homology in another language. I quote just a little from a textbook as widely adopted in the German-speaking countries of Europe as are some of our texts in, this country. I refer to Lindner's *Biologie*, a book used in the Gymnasium (pronounced Gim-nawz-ee-um) or "Hochschule," slightly more advanced than our junior college level and leading to the university, I found the book in use at the University of Zurich in Switzerland, and I call attention to this short passage:

Organe, die bei verschiedenen Abteilungen einer Tier oder Pflanzengruppe denselben Bauplan aufweisen und dieselbe Stellung im Verhältnis zum Ganzen haben, heissen *homologe Organe* . . . ihr gemeinsamer Grundplan kann nur so erklärt werden, dass sie sich

(Continued on Page 66)

JACK-IN-THE-PULPIT PREACHES A SERMON

WILLIAM J. TINKLE*

Lovers of the out-of-doors are familiar with a little plant which does not have showy flowers but is remarkably regular in its form. It is called "Jack-in-the-Pulpit" or "Indian Turnip," and the scientific name is *Arisaema triphyllum*. To see its peculiar flower arrangement, look in woods anywhere east of Kansas from April to July, according to the latitude.

There are two leaves, each with three leaflets, standing about a foot tall. The stem grows up from a turnip-shaped structure which botanists call a *corm*. It is said that Indians dried and cooked these corms for food. They were wise enough not to taste one raw, for upon acting so rashly it seems that a thousand needles are pricking the tongue. The "weapons" are crystals of calcium oxalate.

At the summit of the erect stem is a large bract called a *spathe* which arches over the tiny greenish-yellow flowers clustered around the stem (hidden in Figure 1). The spathe often is striped with brown or purple.

The first year that the plant bears flowers they are likely to be all staminate (male). In later years, there usually are both staminate and distillate flowers, the latter lower on the stem. Late in the season, the leaves and spathe have dried up and the flowers have grown to a showy cluster of red berries.

How could our evolutionist friends explain the phylogeny of such a "personality"? Its form is not such as to make it win in a struggle for existence. If it were unknown, would a learned botanist predict that such a plant would be discovered? He would be laughed out of court!

The life history of the dragonfly is another bizarre exception to rules. It is not reasonable, according to evolution, that the dragonfly should develop its unique structures, and make such unusual metamorphic changes: (a) As an immature nymph this creature lives in water and "breathes" by means of gills inside the abdomen, drawing in water and forcing it out. (b) When grown to full size it climbs out of the water for the first time and waits until the skin splits down the back, allowing the insect to emerge as a "different" creature. (c) The insect becomes long and slender, beautifully colored, and wings unfold which beat with marvelous speed. (d) The dragonfly is unexcelled as a flier; using muscles which it never used while it was growing up.

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Figure 1. Jack-in-the-Pulpit, *Arisaema triphyllum*. A. Plant with flowers, B. Cluster of berries.

It breathes by air tubes ramifying to all parts of the body.

The doctrine of small, accidental changes in every direction, followed by natural selection of the most useful ones, does not account for either "Jack-in-the-Pulpit" or the dragonfly. In the presence of the diversity of nature, the evolutionist stands silent—he has no real explanation. All he can say is, "That is just the way these forms developed."

The evolution theory thrives on glittering generalities but cannot explain the development of concrete types. Evolution is based upon the assumption of selfish advantage in structure.

A structure which gives the plant or animal an advantage in its living and struggling to get along is supposed to become better developed through natural selection. Traits which do not confer selfish advantage are not accounted for.

The beauty of form and color in plants does not give wild plants a selfish advantage, and thus form and color are not explained by the theory of evolution.

The theory is based also upon the assumption of *gradual* change; but the intermediate forms, of which there would have to be many in the dragonfly, would not be functional and so would be an obstruction in natural selection. This difficulty has been pointed out many times with respect to various creatures.

Creation and evolution present contrasting views of nature and of God, its Author. Jesus said that God is personal; enough like a man that those who had seen Him had a conception of God. (John 14:8 and 9) If this be true, we can believe that God purposely created a world of variety and beauty. On the other hand there is a group of persons who prefer to represent God by a group of laws—cold, grinding laws.

Take your choice of these two world views. But don't look for solid ground half-way between them. There is none.

(Continued from Page 64)

durch Abstammung von einer einheitlichen Grundform herleiten.³⁹

(Translation: "Organs which demonstrate the same basic pattern and the same position in regard to the whole in different animal or plant groups are called homologous organs . . . their common basic plan can only be explained in that they point back to descent from a common ancestor.")

The typical plea for support for evolution from basic plan is made here again, the phrase "can only be explained . . . by descent from a common ancestor" somehow reminds one of Dobzhansky's petulant remark: "They do not make sense, otherwise!"

To be sure, our forthcoming *Creation Research Society* text, *Biology, A Search for Order in Complexity*, has done biology a great service, in exposing these false claims for homology as "proof" of evolution, and showing that similarities could be due as easily to one great Mind. Determination, as to whether organisms are closely related or not so closely related, upon the basis of homologous organs are found to be based upon *subjective* considerations, and not upon *experimental* means alone.

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COMMENTS ON SCIENTIFIC NEWS AND VIEWS

HAROLD ARMSTRONG*

Comets present a difficulty to those who want to believe in a very old Solar System. For now and then a comet breaks-up into a swarm of meteorites and gradually disappears. This we know, for some have disappeared thus in historical times. If the Solar System were untold ages old, it is hard to see how there could be any comets left at all. Yet we know that there are some.

It has been suggested, as a way out of the difficulty, that there might be a huge swarm of comets in orbits somewhere outside the orbit of Pluto. These would not suffer much damage there; and occasionally, for reasons not made very clear, one comet might shift its orbit and come in closer to the sun. Thus the supply of visible comets would be continually replenished.

On the face of it, this thesis seems rather far-fetched, and there is no observational evidence to support it. Now some evidence has been found against such a thesis.

A recent article¹ describes some investigations to see whether the motion of observed comets, whose orbits go out a long way from the sun, might be influenced by something which might be interpreted as such a belt of comets (just as Neptune was discovered by the effect it had on the motion of Uranus).

But this time the hypothesis is denied. Present observations do not reveal any belt of comets such as some hoped to find. It is concluded, "... the available evidence does not support the hypothesis of a comet belt of significant mass."

Tidal Friction and Tides

A recent article on tidal friction² might be of interest for several reasons. First of all, it gives many facts which must be considered to qualify the statement that the earth is being slowed down in its rotation by tidal friction. As a matter of fact, there is some evidence that it has speeded up a little in recent centuries, perhaps, it is suggested, because of changes in the moment of inertia brought about by changes in the amount of polar ice.

The suggestion that maybe, at some time in the past, the moon came close to the earth, say within 15,000 to 20,000 miles, is considered, and as well the kind of tides that would happen under such circumstances. This has been suggested before, but the calculation of some of the consequences is likely new.

Of course, such a thing would be most destructive.

The author refers to "... tides ... (which) could form bores that surge across continents ..."; and the heat from all the friction would evaporate huge quantities of water. There is a hint that such a happening might be the cause of the unconformity (if there really is one) between the Pre-Cambrian and Cambrian.

One thing that will interest us is that here is talk of a flood in a journal which is certainly not Creationist. I have heard some Christians who suggested that the Flood might have been caused by huge waves surging over the land. On the whole, that theory seems to have more difficulties than that of the canopy, but it may be well to have considered it. In any event, this article may be of some interest because of discussion of various problems, and for the references.

Sound Studies and Speech Origin

Many Christians have pointed, in the past, to the ability to speak as one great distinction between man and beast. Now this distinction has received support in an unexpected way.

A recent article³ reports some studies of sounds made by primates: monkeys, chimpanzees, and gorillas. Sounds were recorded, and then subjected to very complicated analyses. The conclusion is that the vocal mechanism of these animals seems incapable of producing human speech.

It is suggested, on the basis of some reconstructions of skulls, that the Neanderthal and such men may not have had our full ability to speak. We may not find this view very convincing, for on the one hand we are a little skeptical about the reconstructions; and, on the other hand, we shall recall that some birds, whose vocal organs are surely not much like ours, can imitate human speech quite well. Again, in any study of animals we shall keep in mind the difficulty of distinguishing between what they can do and what they will do.

The author was unable to avoid some lip service to evolution, but actually pointed to a serious difficulty for the theory. For, if the ability to speak—the very ability to make the sounds of speech—evolved, then the ability to take meaning from those sounds—the consciousness of language—must have evolved at the same time.

But it is surely beyond belief that two things, each so complicated, could have come about by chance at the same time. The article, in fact, seems to hint at some teleological principle, without much commitment.

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It is suggested, also, that language as we know it may go back not so very many thousand years. We can grant that, but not because language evolved then. In fact, the oldest languages that we know of are just as fully developed as any other. All the facts would show that speech did not evolve, but was bestowed as a full and complete ability.

Creation Science Fair Proposed

A recent article⁴ has something to say about cruelty to animals, committed in the name of science, in high schools. Or, rather, while the people involved were students at high schools. The worst aspects were not so much in the regular course of studies as in connection with science fairs and other exhibitions.

One might wonder why the *New Scientist*, a British journal, had to go so far afield for something to criticize. But still, "He that rebuketh a man afterwards shall find more favour than he that flattereth with the tongue." (Proverbs 28:23) So, in so far as there are things going on which ought not to be, we should know about them.

Scripture warns us against cruelty; for instance: "A righteous man regardeth the life of his beast: but the tender mercies of the wicked are cruel." (Proverbs 12:10). What, then, can we do about this matter?

Well, we can use our example, and any influence that we may have, against the kind of experiment which causes such things. We can point out that rarely indeed do such things, as they would be carried out at high schools, either lead to any useful information, or teach those involved any technique which really has to do with medicine. We can also point out that where the laws of the land speak on these matters, the schools are not above them.

Might we, moreover, propose something better in the place of these cruel and senseless experiments? Could we, some time, try a Creation Science Fair? What a lot of things there are which a student might investigate in the summer, say, and for which he might find more time than an older person.

He might investigate some of the alleged "overthrusts," or the human tracks petrified along with trilobites, which were recently reported in this publication and elsewhere. Such a search could be combined with a healthful camping trip, and the student might find that: "Great men are not always wise" (Job 32:9), but that God's Word is the source of truth.

Might Notion Elicit Responses?

May I propose a notion in the hope that readers may offer some thoughts on it?

If we consider animals, we see some living, some extinct. If we consider most of the wider classes, they are represented reasonably well by those that are still living. There are whales, for instance, as large as any mammal that ever lived. Birds, fish, and insects likewise are living in a considerable variety.

But when we come to reptiles, they would seem to be only a "wreck" of their former selves. There is nothing living now to compare with the dinosaurs. There are no flying reptiles. And marine reptiles are limited to a few very unimpressive snakes. It is, indeed, the reptile kind which has really suffered.

Can we possibly see a reason for this? What I am suggesting is this: is it possible that the serpent in the Garden of Eden was really a reptile, not necessarily a snake? There seems to be, in Biblical Hebrew, no separate word for "reptile," aside from "serpent" or "creeping thing." And the very good reason for this was that, when the Bible was being written, no other was needed. (It does not really affect this point if "leviathan" means "crocodile").

Is it possible, then, that the curse in Eden applied more generally to the reptile? We need not necessarily go so far as to suppose that it was a dinosaur which was involved in the temptation of Eve. But in terms of reptiles, has the curse not come true?

All those reptiles that remain go about upon their belly, either on no legs at all or very short legs. But there are no legless mammals at all. Why not, since legless reptiles have been successful? But the legless condition, coming from the curse, is quite understandable.

If this suggestion is true, the reptiles may have been reduced to their present condition soon after the fall, or not until the Flood. In any event, the fact that the reptile kind seems to have suffered more than others seems plain, and these considerations may help us to see the reason.

"Genetic Engineering" Haltered

During a symposium at Queen's University, November 7, 1968, Dr. Rene Jules Dubos, of Rockefeller University, New York, threw some much-needed cold water on the currently popular concept of "genetic engineering."⁵ He said, in part:

I doubt that our powers to alter mankind are going to become much greater than they were in the past. The most important characteristics of the human body and mind have remained essentially unchanged since the late stone age. Cro-Magnon man would probably be quite capable of becoming a business execu-

tive if reared in today's environment. . . . Even if methods of genetic alteration are developed, and there is no evidence that they will be in the foreseeable future, there will be drastic . . . limitations to their use. . . . Any significant alteration of . . . genetic make-up is likely to cause profound disturbances . . . even if . . . desirable genetic characteristics were created. . . . It would be the environment that would determine the development of the child. . . . Political and social forces are much more effective in changing man's nature than are the activities of physicians and geneticists.

We may, perhaps, draw something else from these remarks. If it is granted that mankind has not changed appreciably in many thousands of years, as an evolutionist would have to interpret the statement about Cro-Magnon man, then, if it be true that "the present is the key to the past," it must follow that neither did it change in the previous few thousand years, and "so on to infinity."⁶

If, on the other hand, the present is not the key to the past, well, then the evolutionary case collapses. For then, the only way of learning about the past is by records; and surely anyone, creationist or not, must agree that, of the various writings which purport to be records of the beginning, on the face of it, only those in Scripture are worth considering. Which is what we are maintaining.

Comments on *Pontius Pilate*

It might be of interest briefly to mention here the book, *Pontius Pilate*, by Paul L. Maier, recently published by Doubleday. It is in the form of a historical, or biographical, novel, but adheres strictly to the facts, so far as they are known. Where it is necessary to fill in with conjecture, care is taken to see that the conjecture not conflict with the known facts.

The period covered mainly is when Pilate was governor of Judea, and thus the time of the Crucifixion. There are many historical notes, which give useful information, not only about facts but also about sources in which further information may be found.

The author takes the view that the Crucifixion was in 33 A. D., not four to seven years earlier, as is so commonly asserted. This, of course, is what St. Luke 3:1 would say, if taken to mean just what it says and in conjunction with other Scripture.

We are accustomed to considering chronologies over thousands of years, and not being very concerned over four years or so. Yet, the question is one of some interest, for we know that every relevant archeological discovery shows how accurate a historian St. Luke was, and we should not be surprised to find that here, too, his words in their ordinary literal sense are true.

Incidentally, this book has the merit of being one of the few recent historical novels which we should not be ashamed to read to anyone. As well as being of interest for one's own reading, it might, when the occasion arises, be a very suitable gift.

A Reading Suggestion

Readers, who have not already seen the publication, might be interested in looking at the magazine *Outdoor World*, published bi-monthly by Preston Publications, Inc., 1645 Tullie Circle, N. E., Atlanta, Georgia 30329. Unlike some magazines on nature, it does not strive by "hook or crook to preach evolution, but notices the case for creationism.

In Vol. 1, No. 4, November and December 1968, e.g., on page 15, this remark appears: ". . . (alligators and related reptiles) have survived for a long time (120 million years, some scientists claim; certainly since early Bible times, according to creationist scientists)."

The writing and art are very good, and there is something for everyone: usually a children's story, something on some outdoor skill, and often plans and instructions for making something.

The subscription rate is \$5.75 per year in the United States and Canada.

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RADIOCARBON AND POTASSIUM-ARGON DATING IN THE LIGHT OF NEW DISCOVERIES IN COSMIC RAYS

ROBERT L. WHITELAW*

*Potassium-argon dating method is totally dependent upon the assumption that the A-36/A-40 ratio in the atmosphere has been invariant throughout geological time. Having shown this earlier, the author now offers evidence that argon-36 may well have been building up from zero since Creation. The strongest such evidence now comes from startling new data on cosmic rays surveyed in **Science and Technology**, November, 1968. Also, these same data serve to confirm the author's earlier analysis showing that the radiocarbon clock points to Biblical Creation.*

Introduction

Of the various "clocks" proposed for dating events in geological history, the two in principal favor today are radiocarbon, for events in the biosphere, and potassium-argon, for events in the lithosphere.

The C-14 or radiocarbon clock presumes to date the death of any biological specimen, animal or vegetable, with reasonable accuracy up to six or eight half-lives of carbon-14 (about 45,000 years). It has been in extensive use since 1950 by leading universities of the world, as witness the exhaustive listings of almost 10,000 dates in the annual journal, *Radiocarbon*.

(It should be noted here, in passing, that these dates, available for any layman to read, have profoundly disturbing implication for the famous geological time scale and for the eons of time demanded by the evolutionist. Almost every uncovered biological specimen is found to be datable; every fossil, bone, cultural deposit, buried log, vegetation, gyttja, peat, and even much coal and petroleum; all appear to lie within the measurable 45,000 year figure!)

The potassium-argon clock presumes to date entrapment of any tiny sample of potassium-bearing rock, based upon assumptions and methods described earlier,¹ and generally yields dates between 1 and 10 billion.²

Both Clocks Based on Assumption

Both clocks are *absolutely* dependent upon accurate knowledge of a tiny constituent of the earth's atmosphere at the time of the event being dated. The radiocarbon clock (as proposed by Libby³ and faithfully adhered to by the scientific community since) *assumes* that the C-14 concentration throughout the living world was the same at the death of the specimen as it is today.

This assumption is based on two prior assumptions: (a) that the production rate of C-14 in the outer atmosphere had long before approached equilibrium with its decay rate, i.e., that

"creation," if it occurred at all, was long before living matter; and (b) that no cosmic events occurred in the last 45,000 years that could possibly change the C-14 production rate or decay rate.

A relatively recent creation date was, of course, too preposterous for any "respectable" scientist to contemplate, although other events far more preposterous, so long as they do not demand the hand of a Creator, are "scientifically" quite believable, as Wald⁴ and others openly testify.

Assumptions of Potassium-Argon Clock

Turning to the potassium-argon clock, we find it hanging upon a thread of assumption even more tenuous than that of the radiocarbon clock.

The fraction of total argon in the atmosphere today is about $9/10$ of one percent, and about 0.337% of this (1 part in 300) is *now* known to be the isotope Argon-36, the balance being Argon-40. Furthermore, the very existence of A-36 in the atmosphere has only been known and measurable within the last 25 years, so that we cannot even say for sure what its concentration was a mere 100 years ago!

Nonetheless, in order to read the potassium-argon clock, its advocates blandly *assume* that when the tiny rock specimen was trapped in the molten state, no matter how many billion years ago, the fraction of A-36 in the total argon trapped with it *was the same as it is today!* And they further *assume* that whatever atmosphere infused next to the sample throughout geological time always had this same fraction of A-36.

In looking at these two sets of assumptions—those for the radiocarbon vs. those for the potassium-argon clock—we find an interesting disparity. From the very first, Libby made his case for the radiocarbon clock on the fact that the earth is *not* an isolated system; that its outer atmosphere is in fact constantly bombarded by high-energy cosmic rays (of energy and even substance unknown!); and that these rays produce free neutrons which in turn react with nitrogen nuclei to produce carbon-14.

Potassium-argon clock-readers, on the other hand, build their case essentially upon an opposite assumption. They demand an earth whose atmosphere maintains its ratio of A-36/A-40

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unaltered over time spans that dwarf the imagination. Billions of years of solar radiation, magnetic flares, interstellar dust—not to speak of notable eruptions and cataclysms upon the earth's surface—are swept aside as of no consequence.

Show us, we are told in effect, what could possibly change the atmospheric inventory of Argon-36; and until you do we will take our scientific stand upon the ratio A-40/A-36 being 295.6 yesterday, today and forever!

Which View of Atmosphere Correct?

Which of these two views of the earth's atmosphere is correct? To answer we need only let the scientific facts speak for themselves, and the later the facts the better the case, as we shall see.

With respect to radiocarbon being constantly produced in the outer reaches of the atmosphere by cosmic rays, clearly Libby was correct even though the actual nature of cosmic rays was not fully known. He was even correct in discovering that the production rate is apparently still some 20% greater than the decay rate, a fact which points directly toward a recent creation as detailed in a previous paper (See Whitelaw, 1968). His only significant error was in dismissing this 20% difference as "experimental error" on the grounds that a recent creation was unthinkable.

Next, let us look at the idea that the A-40/A-36 ratio has been fixed at 295.6 throughout geological time. This is certainly no fundamental, inviolate physical relationship like the gravitational constant, or $E = mc^2$. Rather, this ratio involves a temporary state of only one region of the geosphere, irradiated and bombarded from without, infused with dust and vapor from within, constantly being stripped of nitrogen, carbon dioxide and oxygen in one place and replenished elsewhere—and all these elementary processes only well-known since yesterday, so to speak!

Yet we are being asked to believe that two of the constituents of this atmosphere, the most active and unstable region of earth, have maintained the same ratio for billions of years. Surely by every canon of scientific method, the burden of proof is upon those who put forward such a theory.

Case Against Constant Argon Ratio

But the case against a constant argon ratio in the atmosphere—the main "prop" of the potassium-argon method—rests upon still better evidence.

First, it is not difficult to postulate a number of reasonably probable A-36 production processes: (a) If cosmic rays are rich in high-energy

photons, as in the Van Allen belt, one sequence of gamma-n reactions leads from argon-40 to argon-36. (Argon-40 bombarded by an energetic photon loses a neutron and becomes argon-39, and so on down to argon-36). (b) Another sequence may well employ the high-energy neutrons both in and from cosmic rays. An n-alpha reaction converts argon-40 to sulphur-37 which promptly decays to chlorine-37 with a half-life of 5.04 minutes. A further n-2n or gamma-n reaction produces chlorine-36 which slowly decays to argon-36 (half-life 3×10^8 years). (c) Still another source of argon-36, by similar processes, can be the chlorine in sea-spray carried to high altitudes by great storms, or potassium-bearing volcanic dust from the many eruptions that have shaken the earth.

The **second** and even more potent argument in favor of argon-36 build-up in the atmosphere is the astounding new knowledge of the nature and energy of cosmic rays themselves; information so new and unexpected that it is rocking the foundations of *any* notion of atmospheric equilibrium.

New Knowledge of Cosmic Rays

An excellent survey of this new knowledge of cosmic rays, still growing in its total implications, is given by Stephen Rosen in *Science and Technology*, November, 1968, pp. 22-30. The entire article is pertinent, but it suffices to quote a few passages for one to begin to realize how much "science" must now be unlearned, and how much has yet to be learned:

Since the advent of instrumented satellites and space probes, many new questions have arisen, and consequently there are now additional problems to solve. For instance, we are still not certain where cosmic rays come from, nor precisely how they travel here. We do not know how or why they are able to reach the energies they do—energies that far exceed those we can produce in our biggest accelerations. . . . (p. 22, second paragraph).

For instance, we have not always known that cosmic rays are energetic, extraterrestrial protons and nuclei of heavier elements. Until the 1930's they were thought to be electrons. . . . (p. 22, third paragraph).

The curve in Fig. 1. . . suggests that something is happening on a galactic scale—the sources of the cosmic rays maybe changing, or perhaps they are coming from different "storage regions." . . . (p. 24, first paragraph).

The highest energy of a cosmic ray observed— 10^{20} eV—is *more than a billion times* the energy obtainable at present in the most powerful accelerators on earth. . . . (p. 24, fourth paragraph).

It seems likely, but is by no means a certainty, that all of these *high-energy* particles are protons. There is no doubt, however, that the great majority of *all* cosmic-ray particles are protons, exceeding nuclei heavier than helium by about 13 times. Particles representing helium nuclei amount to perhaps 8% of the total, and the remaining heavier nuclei less than 1%. . . . (p. 24, fifth paragraph).

Additional confirmation of these startling findings is given in a brief survey of work by P. H. Fowler which is reported in *Scientific Research*, October 28, 1968, page 25.

Conclusions

Further references and quotations would only enhance implications of these new discoveries, the key words being "energy," "changing," and "do not know"! Suffice it to say, in closing, that

the nucleus of argon-36 is only *nine* times heavier than helium, so that even if no mechanism whatsoever were found for conversion of other isotopes into argon-36, *a certain fraction of cosmic rays themselves* are now known to be the nuclei of argon. And since we are talking about a buildup of argon-36 to only 1/30,000th part of the atmosphere, the number of years of cosmic rays necessary may be well within the 7,000 years since Biblical creation!

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BOOK REVIEW

E. NORBERT SMITH*

Animal Dispersion in Relation to Social Behavior by V. C. Wynne-Edwards. Hafner Publishing Co., New York. 1962. 653 pp. \$10.25.

Written by an Oxford-trained biologist, the theory introduced in this book is valuable to creationists for two reasons: first, Morris and Whitcomb, and others have interpreted Genesis 1:29-30 as teaching that prior to the Fall all animals were vegetarian. Evolutionists have argued that without predators the smaller animals would have no population checks and would have quickly over populated the world, thus negating any semblance of a perfect Creation.

Wynne-Edwards has shown in this book that, more often than not, animals can and do limit their own population by many diverse mechanisms, thereby adding scientific respectability to the interpretation of a perfect Creation without predation.

Second, and of considerably more importance, the possibility that animals automatically can and do control their own numbers greatly weakens the second of the three "legs" that support Neo-Darwinian evolution, e.g., excessive fecundity, tooth and fang competition for survival, and survival of the fittest. It is exactly for this reason, according to Dr. Wynne-Edwards during personal conversation with him, that his theory has met with some difficulty in England and the United States.

In Germany and Russia, where he said less narrow stereotyped evolutionary preconceptions exist, the theory has received wider acceptance. Although published only seven years ago, approximately ten thousand copies of the book have been sold.

The theory was reviewed in the August, 1964, issue of *Scientific American*, and was selected to appear in the recent, but popular reprint of *Scientific American* articles, *39 Steps to Biology* (W. H. Freeman and Co., San Francisco.)

Dr. Wynne-Edwards spoke at the recent American Association for the Advancement of Science meeting on Dec. 31, 1968, at Dallas, Texas. It is from the paper he presented there that the following summary of the theory was taken:

Seven years ago I put forward the hypothesis that social behavior plays an essential part in the natural regulation of animal numbers. (That was in the book to which Dr. Esser referred.) And some of you I know are familiar with the main contrite of this hypothesis. It has two main foundations: the first is the demonstration over a long period of years, that many of the higher animals especially in the vertebrates and arthropods are able to regulate their own numbers. This they do either by controlling the recruitment into the population, which comes from reproduction and emigration, or by controlling the losses due to mortality and immigration,—and still more often by a combination of both these processes. The

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conclusion reached by Darwin in *The Origin of Species* is animals are always striving to increase in numbers but are held in check by outside forces, such as predation, disease, starvation, and climatic matters has turned out not to be the whole story. It is true that during the history of most animal populations there come periods wherein one or the other of Darwin's checks take a heavy toll. When that happens the survivors normally compensate by starting their breeding at a high rate. In that way they can often quickly restore their numbers to the previous level. If we design an experiment to exclude all external sources of mortality, that is to say, all Darwin's checks, we find that a completely isolated laboratory population almost always goes out to a ceiling density and then stays at that ceiling as long as we keep the environment constant. In wild populations the same can occur as long as the uncontrollable mortality is not abnormally high.

The second foundation of the hypothesis is that animals dependent on natural resources, whether these resources are animal or vegetable, can get a bigger yield, a better crop of food, if the resource is sufficiently managed. In many situations, over-exploitation leads to a progressive depletion of food resources. If herbivores over-graze their pasture or predators consume too many of their prey, the resource may not be able to produce as big a crop the following year. We have gained insight into the management of the current

natural resources in the last thirty years. For example, with fish and game, we know that it is essential to limit the size of the annual crop if the stock is to survive. We issue licenses and make regulations in order to prevent over exploitation.

In nature there are many devices that have evolved for the very same purpose. Best known of all as you all are aware, is to parcel out the ground where the food is found into a mosaic of territories owned by the consumers. Then provided the average territory size is large enough, population density can be held down to a level at which no harm could possibly be done to the food resources. On the contrary, a theoretically perfect territorial system shares out the maximum sustainable yield of food among the largest possible number of consumers.

Creationists should view this theory with great interest. Although far from being accepted by leading United States biologists (like many other things we believe to be true), the thesis is seemingly demonstrable by a wide range of observable scientific evidence in many living animals from plankton to primates.

This theory apparently would support the possibility of a perfect Creation without predation; and, if the intensity of competition for survival is reduced greatly this will deliver a painful if not fatal blow to the entire natural selection principle without which Neo-Darwinian evolution has no mechanism.

Our Society of research scientists representing various fields of successful scientific accomplishment is committed to full belief in the Biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution), both of the universe and the earth with its complexity of living forms.

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2. All basic types of living things, including man, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.
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