Course Syllabus for

EVOLUTION AND SPECIAL CREATION

Robert J. Dunzweiler, Professor

I. BASIC DEFINITIONS

A. Definitions of Evolution

"When I first came to the notion,...of a succession of extinction of species, and creation of new ones, going on perpetually now, and through an Indefinite period of the past, and to continue for ages to come, all in accommodation to the changes which must continue in the inanimate and habitable earth, the idea struck me as the grandest which I had ever conceived, so far as regards the attributes of the Presiding Mind."

-- from a letter of Sir Charles Lyell to Sir John Herschel, London, June 1, 1836. Quoted In *Life, Letters and Journals of Sir Charles Lyell*, ed. by Katherine H. Lyell (London: 1881), Volume 1, pp. 467-468.

"It is interesting to contemplate a tangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent upon each other In so complex a manner, have all been produced by laws acting around us. These laws, taken in the largest sense, being Growth with Reproduction; Inheritance which is almost implied by reproduction; Variability from the indirect and direct action of the condition of life, and from use and disuse; a Ratio of Increase so high as to lead to a struggle for Life, and as a consequence to Natural Selection, entailing Divergence of Character and the Extinction of Less-improved forms. Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There Is a grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, while this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being evolved."

-- Charles Darwin, *Origin of Species* concluding paragraph.

"Evolution is the gradual development from the simple unorganized condition of primal matter to the complex structure of the physical universe; and In like manner, from the beginning of organic life on the habitable planet, a gradual unfolding and branching out into all the varied forms of beings which constitute the animal and plant kingdoms. The first is called inorganic, the last Organic Evolution."

-- Richard Swann Lull, *Organic Evolution* (New York: Macmillan Co., 1917), p. 6.

"1. The evolution doctrine Is not a creed to be accepted on faith, as are religious faiths or creeds. It appeals entirely to the logical faculties, not the spiritual, and is not to be accepted until proved.

"2. it does not teach that man is a direct descendant of the apes and monkeys, but that both man and the modern apes and monkeys have been derived from some as yet unknown generalized primate ancestor possessing the common attributes of all three groups and lacking their specializations.

"3. it is not synonymous with Darwinism, for the latter is merely one man's attempt to explain how evolution has occurred.

"4. Contrary to a very widespread idea, evolution Is by no means incompatible with religion. Witness the fact that...the majority of thoughtful theologians of all creeds are today in accord with the evolution idea, many of them even applying the principle to their studies of religion; for religious ideas and ideals, like other human characters, have evolved from crude beginnings and are still undergoing processes of refinement.

"5. The evolution idea is not degrading. Quite the contrary; It is ennobling.

"6. The evolution doctrine does not teach that man Is the goal of all evolutionary process....The goal of evolution in general is perfection of adaptation to the conditions of life as they happen to be at any particular time.

"7. Evolution Is therefore not entirely a thing of the past."

-- Horatio Hackett Newman, *Evolution Genetics and Eugenics,* Third Edition (Chicago: The University of Chicago Press, 1932), pp. 8-9.

"There are, however, seven basic assumptions that are often not mentioned during discussions of Evolution. Many evolutionists ignore the first six assumptions and only consider the seventh. These are as follows:

1. The first assumption Is that nonliving things gave rise to living material, i.e., spontaneous generation occurred.

2. The second assumption Is that spontaneous generation occurred only once. The other assumptions all follow from the second one.

3. The third assumption is that viruses, bacteria, plants, and animals are all interrelated.

4. The fourth assumption is that the Protozoa gave rise to the Metazoa.

5. The fifth assumption is that the various invertebrate phyla are inter-related.

6. The sixth assumption is that the invertebrates gave rise to the vertebrates.

7. The seventh assumption is that within the vertebrates the fish gave rise to the amphibia, the amphibia to the reptiles, and the reptiles to the birds and mammals. Sometimes this is expressed In other words, i.e., that the modern amphibia and reptiles had a common ancestral stock, and so on."

-- G. A. Kerkut, *Implications of Evolution* (Oxford: Pergamon Press, 1960), p. 6.

"Darwin was then able to formulate a complete theory providing a rational explanation of the causes as well as of the fact of evolution In plants and animals. It Is formally based on four propositions which he already knew to

be true, and three deductions which are now also known to be true. They may be enumerated as follows:

1. Organisms produce a far greater number of reproductive calls than ever gave rise to mature individuals.
2. The numbers of Individuals in species remain more or less constant.
3. Therefore there must be a high rate of mortality.
4. The individuals in a species are not all Identical, but show variation in all characters.
5. Therefore some variants will succeed better and others less well in the competition for survival, and the parents of the next generation will be naturally selected from among those members of the species that show variation In the direction of more effective adaptation to the conditions of their environment.
6. Hereditary resemblance between parent and offspring is a fact.
7. Therefore subsequent generations will maintain and improve on the degree of adaptation realized by their parents by gradual change."

-- Sir Gavin de Beer, *A Handbook on Evolution* (London: Trustees of the British Museum (Natural History), 1964), pp. 10-11.

B. Definitions of Evolutionism

"Evolution" is a biological concept referring to the origin and development of living things. "Evolutionism" is a philosophical concept referring to the extension and application of the process of evolution to all of reality.

Evolution is a biological process whereas Evolutionism is a philosophical world-view.

Evolutionism should not be confused with some form of "Theistic Evolution," In which the entire physical universe (or some part of it) is evolving under the guidance of God. Evolutionism is naturalistic or materialistic in its view of the nature of ultimate reality, and excludes any notion of God or the supernatural from its world-view.

The following six statements summarize Evolutionism:

1. Either matter is eternal, or it has simply, of itself, come into being.
2. The complex structure of the physical universe has evolved from the simple unorganized condition of primal matter.
3. Living material has evolved from nonliving matter.
4. All living things -- whether monerans, protistans, plants, or animals -- have evolved from the simplest living things.
5. Man has evolved from animals.
6. Each of the above processes took place by means of the random operation of previously existing natural forces.

"All phenomena have a historical aspect. From the condensation of nebulae to the development of the infant in the womb, from the formation of the earth as a planet to the making of a political decision, they are all processes in time; and they are all interrelated as partial processes within the single universal process of reality. All reality, in fact, is evolution, in the perfectly

proper sense that it is a one-way process in time; unitary; continuous. irreversible; self-transforming; and generating variety and novelty during its transformations....

"The over-all process of evolution in this comprehensive sense comprises three main phases; although there is continuity between them, they are very distant in their main features, and represent three sectors of reality, in which the general process of evolution operates in three quite different ways. We may call these three phases the inorganic or, if you like, cosmological; the organic or biological; and the human or psycho-social. The three sectors of the universal process differ radically in their extent, both in space and time, in the methods and mechanisms by which their self-transformations operate, in their rates of change, in the results which they produce, and in the levels of organization which they attain. They also differ in their time relations. The second phase is only possible on the basis of the first, the third on the basis of the second; so that, although all three are in operation today, their origins succeeded each other in time. There was a critical point to be surmounted before the second could arise out of the first, or the third out of the second.

"....Nowhere in all its vast extent is there any trace of purpose, or even of prospective significance. It is impelled from behind by blind physical forces, a gigantic and chaotic jazz dance of particles and radiations, in which the only over-all tendency we have so far been able to detect is that summarized in the Second Law of Thermodynamics -- the tendency to run down."

-- Julian S. Huxley, *Evolution in Action* (New York: The New American Library, 1953), pp. 9-12.

Evolutionism, then, is that view of reality which holds that natural processes, operating exclusively by means of natural forces, are responsible for the whole range of physical, chemical, biological, psychological, and sociological phenomena which make up the history of the universe.

C. Definition of Special Creation

"In order to set forth the scriptural understanding of this word, and in order to avoid the semantic ambiguity which so often accompanies its use in discussions of this nature, I should like to suggest three meanings for the term.

First of all, 'creation' means the bringing into being of that which did not (either in its substance or its form) previously exist. An example of this meaning would be the creation of the original matte-energy complex of the physical universe. This usage we shall call EX NIHILO CREATION (i.e., 'creation from nothing').

Secondly, 'creation' means the bringing into being of that which did not (in its form) previously exist, employing previously-existing substance An example of this meaning would be the creation of Adam's body from the dust of the ground. This usage we shall call IMMEDIATE CREATION (i.e., creation by direct action of God, using previously-existing substance).

Thirdly, 'creation' means the bringing into being of that which did not (in its form) previously exist, employing both previously-existing substance and secondary causes. An example of this meaning is the creation by God, through human parents, of each child born into the world. This usage we shall call MEDIATE CREATION.

In each of these three usages -- Ex Nihilo Creation, Immediate Creation, and Mediate Creation -- it is important to remember and to recognize that in the context of this discussion it is God who is the Creator. But it is also important to remember that when we speak of God's activity in Creation, we must from time to time clarify the statement, 'God created such-and-such' by specifying whether God created ex nihilo or immediately, or mediately.

-- "A proposed Creationist Alternative to Evolutionism," a series of four lectures delivered as the Fall Lecture Series at the Philadelphia College of Bible on November 1-4 1971 by the author of this syllabus, Lecture One, pp. 8-9.

The term "Special Creation" as used in this syllabus denotes the concept that each of the created "kinds" of Genesis 1-2 is a special creation by God, rather than a product of development from some other living (or nonliving) thing. In some cases, special creation may mean ex nihilo creation; in other cases it may mean immediate creation.

D. Definition of Creationism

Creationism is that view of reality which holds that the triune God, employing supernatural and natural forces as well as second causes, has, for the purpose of glorifying Himself, created or brought into objective being the universe and all things in it, whether material or non-material, and sustains or holds in being all things according to His good pleasure.

However, there appear to be at least four basic types of Creationism, all of which claim to be the Christian view:

"(1) Non-Scientific Creationist View -- This category includes those views which regard the Creation account in Genesis as mythical or symbolic, those which regard the Genesis account as a pictorial-revelatory account of Moses' visions during six consecutive days, and those which understand the events of the six days to have been arranged by means of some non-chronological framework, whether topical, logical, or literary. Although these views differ from each other at many points, yet they are agreed upon two crucial emphases. The first emphasis of each form of the Non-Scientific Creationist View is that science and theology occupy two distinct spheres, and any conflict between these spheres is settled the moment both are content to remain within their proper boundaries. The second emphasis of each form of this view is that in Genesis I the author offers us a story of creation. It was not his intent to present an exact report of what happened, but to impress the reader with the fact that all that exists has been created by God.

(2) Theistic Evolutionist View -- This category includes those views which hold that God, having brought into existence the primal matter of the universe, and having created living material, proceeded to create all forms of life mediately, that is, by employing the process of evolution

as His mode of operation. Some who espouse the Theistic Evolutionist View hold that the creation of man was part of this process, whereas other advocates of the view hold that, because of his spiritual nature, man must be viewed as a special creation. Most proponents of this view hold that, at the least, man's soul must have been a special creation of God.

(3) Scientific Creationist View -- All varieties of this view, whether they are named 'Progressive Creationism,' 'Threshold Evolution,' or simply 'Scientific Creationism,' hold that God created primal matter, living material, all of the basic 'kinds' of living things, and man, as special creations. The main points at which they differ arise out of differing approaches to and methods in the interpretation and correlation of the relevant scriptural data or scientific data or both.

(4) Anti-Scientific Creationist View -- This last category includes all of those views which reject the conclusions, the methodology, or the data of science as capable of making a significant contribution to the interpretation of those scriptural data which are relevant to the doctrine of Creation. Thus those views which advocate a recent date for the age of the universe, of earth, of life, and man; which affirm the doctrine of the 'fixity of species,' i.e., the dogma of the inherent impossibility of one species giving rise to the development of another, or which assert the Noachian Flood as a proper and adequate explanation for both the existence and the sequence of the sedimentary strata of rocks in the geologic column, fall within this category. However, as we have already mentioned, its most prominent characteristic is its rejection of the data and observations of science as an aid to the better understanding of the relevant scriptural data."

-- ibid., pp. 5-6.

Which of these types of Creationism (if any) should we adopt? Which does justice to both the biblical and the scientific data in their integrity? The remainder of this course must devote itself, not only to the attaining of a grasp of Evolutionism and the evidences adduced for it, but also to the answering of these (and other) questions.

II. THE PRESUPPOSITIONS OF EVOLUTIONISM

The following first principles or basic assumptions or presuppositions are common to all forms of Evolutionism. Other basic assumptions may be made by particular individuals or schools of thought, but they would be additional to those listed below.

A. A Naturalistic World-View

All of reality is conceived of in terms of physical entities and their qualities and relationships. Mind is the psychological function of a highly complex physical organism, the brain.

The universe as a whole is ateleological (without purpose or meaning). The term "God" may properly be employed to denote Nature as a whole, but it cannot refer to an infinite, personal, supernatural Being who is Creator, Sustainer, and Ruler of the universe.

B. The Nonexistence of Absolute Truth (or at least its unattainability)

Since sensory experiences and our impressions of them are our only source of knowledge (thus reason, intuition, and revelation are ruled out as sources of knowledge); and since what we call thinking is really only the brain's manipulation of our sensory impressions; and since our ideas can be tested and verified only experimentally; therefore empiricism as a theory of the source of knowledge and pragmatism as a theory of the test for truth are the only useful epistemological tools.

In addition, since all reasoning is ultimately inductive (since all deductive premises relating to objective reality must arise from induction); and since induction can never lead to anything more than probability (no matter how high the degree); therefore absolute truth must forever remain unattainable. If absolute truth exists, we cannot know it with absolute certainty (i.e., we cannot know absolutely that it exists, and cannot know absolutely what it is if it exists).

It therefore becomes necessary to regard even our most certain knowledge as hypothetical, tentative, uncertain in any absolute sense, and continually subject to modification and open to correction.

C. The Exclusive Reliability of the Scientific Method

The scientific method is the only reliable tool available by which to discover truth (the scientific method is Pragmatism's test for truth). The major assumption in this presupposition is that the ultimate test for truth is detailed empirical verification.

(the following is quoted from an old exhibit in the American Museum of Natural History, in New York City)

"The Scientific Method

1. Facts are gathered.

2. Problems are stated. What do the facts mean? How are their peculiarities to be explained?

3. Possible solutions are listed. These are hypotheses not theories. This is the method of multiple hypotheses.

4. It is determined which of the possibilities:
   (a) agree with all the facts
   (b) are most nearly sufficient to explain the facts
   (c) give the simplest consistent explanation (involving the fewest nonfactual assumptions)
   The hypotheses that survive these tests may be advanced as theories.

5. Additional observations are made in the light of the theories in an effort to find facts:
   (a) inconsistent with the favored theory
   (b) consistent only with it and inconsistent with others
   If one alternative proves to be entirely consistent with the facts and sufficient to explain them, it may be accepted as a proved theory."

Another model of the scientific method may be outlined as follows:

A PROCESS OF INQUIRING

1. Defining the problem. This involves:
   a. becoming aware of a problem
   b. making it meaningful
   c. making it manageable

2. Developing tentative answers (hypothesizing). This involves:
   a. examining and classifying available data
   b. seeking relationships and drawing logical inferences
   c. stating hypotheses

3. Selecting from among tentative answers (reflective thinking).

4. Testing the tentative answer. This involves:
   a. assembling evidence
      (I) identifying the needed evidence
      (2) collecting the needed evidence
      (3) evaluating the needed evidence
   b. arranging evidence
      (1) translating evidence
      (2) interpreting evidence
      (3) classifying evidence
   c. analyzing evidence
      (1) seeking relationships
      (2) noting similarities and differences
      (3) identifying trends, sequences, and regularities

5. Developing a conclusion. This involves:
   a. making meaningful patterns
   b. stating the conclusion

6. Applying the conclusion. This involves:
   a. testing against new evidence
   b. generalizing about results

(this model was proposed by a professor of philosophy at Lehigh University)

D. The Uniform and Dependable Operation of Natural Processes

This principle is the foundation of modern experimental science, without which modern science as we know it would be impossible. The universal laws in nature which men seek to establish are expected to be such as will permit dependable prediction and effective control of future events by their aid.

E. The Reliability of the Principle of Homology

"The only postulate the evolutionist needs is no more than a logical extension of what the layman considers a truism or a self-evident fact, namely, that fundamental structural resemblance signifies genetic relationship that, generally speaking, the degree of closeness of structural resemblance runs essentially parallel with closeness of kinship. . . If we cannot rely upon this postulate, which may be called the principle of homology, we can make no sure progress in any attempt to establish the validity of the principle of evolution.

"We account for the common possession of certain structural peculiarities by all members of a given kind of species of animal or plant by saying that such characters have been derived from a common ancestor. It is only a short step in logic to conclude that two similar kinds of species of animal have been derived one from the other or both from a common ancestral species. Once having taken this step, we are on the road that leads inevitably to an evolutionary interpretation of natural groups . . . . 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.

"The principle of homology and its necessary implications constitute the only postulate that is necessary for the evolutionist to make in order to go ahead on a sound basis with a presentation of the evidences of evolution. Give him this one point, and he asks no further concessions."

-- Horatio Hackett Newman, Evolution Genetics and Eugenics (Chicago: The University of Chicago Press, 1956), pp. 53,55.

F. The Proved State of the Theory of Evolution

"This book is an attempt by one historian of life to convey an understanding of the forces acting on and through life and to interpret the history in terms significant to us all as humans. The whole emphasis is on these things: the principles of evolution and the human meaning of evolution. No space is devoted to proofs that evolution has, in fact,

occurred. Such proofs are not only ample but also overwhelming. They are completely convincing to all who have studied them with reasonably open minds. Of course no amount of proof can convince those who simply do not want to know or to accept the truth. Such wishful thinkers cannot be persuaded by repetition, and those who do really want to know the truth already know the evidence or can readily find it in earlier works. Here the factual truth of evolution is taken as established and the enquiry goes on from there."

-- George Gaylord Simpson, *The Meaning of Evolution* (New York: The New American Library, 1951), p. 11.

"These facts are so well-known and make up such an army of evidence that they form the chief foundation of the statement that evolution has long since passed out of the domain of hypothesis and theory, to which Mr. Bryan refers, into the domain of natural law.

"Evolution takes its place with the gravitation law of Newton. It should be taught in our schools simply as Nature speaks to us about it, and entirely separated from the opinions, materialistic or theistic, which have clustered about it."

-- Henry Fairfield Osborn, *Evolution and Religion* (New York: Charles Scribner's Sons, 1923), pp. 16-17.

"As we shall see, these records (the 'living record' and the 'fossil record') are interconsistent, and they leave hardly any doubt that 'descent with change' -- evolution -- has indeed taken place."

-- Paul B. Weisz, *Biology* (New York: McGraw-Hill Book Company, 1954), p. 599.

"From this brief account it will be clear that experimental studies are still in their infancy; no doubt great advances will be made in the next few decades. Meanwhile, with the universal acceptance of the fact of evolution, the focus of thought has switched from a concentration on the past to a consideration of the present and future. The result must surely be a more realistic and dynamic appreciation of evolutionary change."

-- W. H. Dowdeswell, *The Mechanism of Evolution* (New York: Harper and Brothers, 1960), concluding paragraph.

"No serious biologist today doubts the fact of evolution, the development of all living organisms from previously existing types under the control of evolutionary processes. However, there have been and will continue to be differences of opinion on how evolution takes place, just as there are different ideas on the exact processes involved in, for example, the formation of mountain ranges. Thus while the fact of evolution is amply clear, there are different theories regarding the significant processes that have brought about evolutionary change.

"In this book we are not concerned with enumerating so-called proofs of evolution. The fact of evolution is demonstrated on every side in all fields of biology and indeed forms the basic unifying principle in the study of living systems. We do not need a listing of evidences to demonstrate the fact of evolution any more than we need to demonstrate the existence of mountain ranges."

-- Jay H. Savage, *Evolution* (New York: Holt, Rinehart and Winston, 1963), Preface.

G. The Unworthiness of the Special Creation View to be Considered a Respectable Alternative

"If Darwin's hypothesis be rejected, there is it must be frankly admitted, no satisfactory alternative to take its place."

-- W. B. Scott, *The Theory of Evolution* (New York: Macmillan, 1917)

"Evolution itself is accepted by zoologists. . . because no alternative explanation is credible."

-- D. M. S. Watson, in *Nature* (famous British periodical), August 10, 1929.

"The only alternative (to evolution) is the doctrine of special creation which may be true but is irrational."

-- L. T. More, *The Dogma of Evolution* (Princeton; Princeton University Press, 1925).

"There are only three possible alternatives as regards the origin of living substance on this earth. Either it was supernaturally created; or it was brought to the earth from some other place in the universe, in the interior of a meteorite; or it was produced naturally out of less complicated substances.

"The first suggestion runs counter to the whole of our scientific knowledge. Both the inorganic and the organic world are built out of the same matter, and work by means of the same energy. To postulate a divine interference with exchanges of matter and energy at a particular moment in the earth's history is both unnecessary and illogical."

-- Julian Huxley, *Evolution in Action* (New York: The New American Library, 1957), p. 20.

"The nature of the proof of organic evolution, then, is this: that, using the concept of organic evolution as a working hypothesis it has been possible to rationalize and render intelligible a vast array of observed phenomena, the real facts upon which evolution rests. Thus classification (taxonomy), comparative anatomy, embryology, palaeontology, zoogeography and phytogeography, serology, genetics, become consistent and orderly sciences when based upon evolutionary foundations, and when viewed in any other way they are thrown into the utmost confusion. There is no other generalization known to man

which is of the least value in giving these bodies of fact any sort of scientific coherence and unity. In other words, the working hypothesis works and is therefore acceptable as truth until overthrown by a more workable hypothesis. Not only does the hypothesis work, but, with the steady accumulation of further facts, the weight of evidence is now so great that it overcomes all intelligent opposition by its sheer mass. There are no rival hypotheses except the outworn and completely refuted idea of special creation, now retained only by the ignorant, the dogmatic, and the prejudiced."

-- Horatio Hackett Newman, *Evolution Genetics and Eugenics* (Chicago: The University of Chicago Press, 1956), p. 51.

III. EVIDENCES ADDUCED FOR EVOLUTION

"There are evidences of evolution in the grouping of animals into phyla, classes, orders, families, genera, species, varieties, and races; in the homologies that exist in general structure and in particular organs between different groups of animals and plants; in the orderly process of ontogeny or embryonic development of the individual; in actual blood relationship, based upon chemical reactions; on the succession of extinct animals and plants found as fossils imbedded in the geologic strata; in the present geographical distribution of the various groups of animals and plants, in the light of data derived from a study of geological changes, and finally, in experimental evolution, which involves the observation under experimental control of changes in organisms and the origin of new varieties or elementary species."

-- Horatio Hackett Newman, *Evolution Genetics and Eugenics* (Chicago: The University of Chicago Press, 1956), p. 51.

A. The Evidence from Classification (Taxonomy)

1. Origin of the Taxonomic Nomenclature

Karl von Linne (Linnaeus) (1707-1778) -- a Swedish naturalist, called "the father of taxonomy" -- constructed a system of classifying animals and plants, as a convenience for cataloging and ready reference, and assigned descriptive Latin names to the various kinds of organisms. He also introduced the system of binomial nomenclature, the practice of describing a plant or animal by both its generic and its specific name.

Example: *Apis mellifica* Linnaeus 1758

The present system of zoological nomenclature dates from Linnaeus' *Systema Naturae* Tenth Edition (1758). The International Commission on Zoological Nomenclature establishes rules as an authoritative code in naming taxonomic divisions. The present system of botanical nomenclature dates from Linnaeus' *Species Plantarum* Edition 1 (1753). The International Botanical Congresses establish authoritative rules as a guide in forming taxonomic titles.

2. Categories 0r the Taxonomic Nomenclature

a. The Hierarchy of Classification

Kingdom
Phylum (plural phyla)
Class
Order
Family
Genus (plural genera)
Species (plural species)

The Hierarchy of Classification Intercalated by Intermediate Categories

Kingdom
Phylum
Subphylum
Superclass
Class
Subclass
Superorder
Order
Suborder
Infraorder
Superfamily
Family
Subfamily
Genus
Species
Subspecies
Race (or, variety)

AN EXAMPLE OF THE WAY IN WHICH THE CLASSIFICATION SYSTEM WORKS

Modern classification (taxonomy) Is based upon the work of Karl von Linne (Linnaeus), a Swedish botanist, who in 1753 published a classification of plants and in 1758 a classification of animals. He viewed his system as a convenience for cataloging and ready reference. His hierarchy of classification (with subsequent additions) consists of the following categories (reading from the largest group at the top to the smallest group at the bottom):

Kingdom
Phylum (plural phyla)
Class
Order
Family
Genus (plural genera)
Species
(subspecies, varieties, etc.)

By way of illustration as to how an animal or plant might be classified under this system, let us take the Cougar (also celled Mountain Lion, Puma, and Panther). The Cougar is call *cougar* on the species level, and is found throughout North America.

The Cougar species is classified, together with the Jaguar species, the Ocelot species, and the Domestic Cat species, under the larger category of the genus Felis (the truly 'catlike" cats).

In turn, the genus Felis and the genus Lynx (also called Bobcat and Wildcat) are classified together under the larger category of the Cat family (Felidae).

The Cat family, together with a number of other families (e.g., the Dog family (Canidae) the Hyena family (Hyaenidae) the Weasel family (Mustelidae) the Raccoon family (Procyonidae) and the Bear family (Ursidae) are classified under the order Carnivora (flesh-eaters).

The order Carnivora is grouped with the orders of Insectivora (insect-eaters), Rodentia (rodents), Proboscidea (elephants), Cetacea (whales), etc., under the class Mammalia (mammals), which includes all backboned animals which reproduce on land, possess hair, and nurse their young.

The class Mammalia, four classes of fishes, the class Amphibia (salamanders, frogs, toads, etc.), the class Reptilia (turtles, lizards, snakes, crocodiles, etc.), and the class Aves (birds) are classified under the phylum Chordata (Chordates), which includes all animals possessing a well-developed nervous system and a body supported by a bony chord or spinal column.

The phylum Chordata is one of the 15 phyla which together make up all living animals in the kingdom Animalia (animals).

Thus a Cougar may be classified on any one of these levels, depending upon the closeness or remoteness of similarity which he bears to other members of the animal kingdom. The scientific name (which always includes both genus and species) of the Cougar is thus Felis couguar.

Synopsis of the Classification of the Cougar

Kingdom: Animalia (animals)
Phylum: Chordata (chordates)
Class: Mammalia (mammals)
Order: Carnivora (flesh-eaters)
Family: Felidae (cats)
Genus: Felis ("true cats")
Species: couguar (Cougar)

b. Meaning of the Classifying Terms

Species -- a natural population of organisms capable, under natural conditions, of breeding with one another, but not usually with organisms of other populations (a genetically orientated definition); or, a group of organisms similar to one another in most superficial (physiological) and all fundamental (morphological) characteristics (a descriptive, anatomically related definition).

Genus -- a group of species similar to one another in many superficial characteristics and in all or almost all fundamental characteristics; yet dissimilar to other groups of species.

HOW THE CLASSIFICATION SYSTEM WORKS

Modern classification (taxonomy) is based upon the work of Karl von Linne (Linnaeus), a Swedish botanist, who in 1753 published a classification of plants and in 1758 a classification of animals. He viewed his system as a convenience for cataloguing and ready reference. His hierarchy of classification (with subsequent additions) consists of the following categories (reading from the largest group at the top to the smallest group at the bottom):

Kingdom
Phylum (plural phyla)
Class
Order
Family
Genus (plural genera)
Species
(subspecies, varieties, etc.)

By way of illustration as to how an animal or plant might be classified under this system, let us take the Cougar (also called Mountain Lion, Puma, and Panther). The Cougar is called couguar on the species level, and is found throughout North America.

The Cougar species is classified, together with the Jaguar species, the Ocelot species, and the Domestic Cat species, under the larger category of the genus Felis (the truly "catlike" cats).

In turn, the genus Felis and the genus Lynx (also called Bobcat and Wildcat) are classified together under the larger category of the Cat family (Felidae)

The Cat family, together with a number of other families (e.g., the Dog family (Canidae) the Hyena family (Hyaenidae) the Weasel family (Mustelidae) the Raccoon family (Procyonidae) and the Bear family (Ursidae)) are classified under the order Carnivora (flesh-eaters).

The order Carnivora is grouped with the orders of Insectivora (insect-eaters), Rodentia (rodents), Proboscidea (elephants), Cetacea (whales), etc., under the class Mammalia (mammals), which includes all backboned animals which reproduce on land, possess hair, and nurse their young.

The class Mammalia, four classes of fishes, the class Amphibia (salamanders, frogs, toads, etc.), the class Reptilia (turtles, lizards, snakes, crocodiles, etc.), and the class Aves (birds) are classified under the phylum Chordata (Chordates), which includes all animals possessing a well-developed nervous system and a body supported by a bony chord or spinal column.

The phylum Chordata is one of the 15 phyla which together make up all living animals in the kingdom Animalia (animals).

Thus a Cougar may be classified on any one of these levels, depending upon the closeness or remoteness of similarity which he bears to other members of the animal kingdom. The scientific name (which always includes both genus and species) of the Cougar is thus Felis couguar.

Synopsis of the Classification of the Cougar

Kingdom: Animalia (animals)
Phylum: Chordata (chordates)
Class: Mammalia (mammals)
Order: Carnivora (flesh-eaters)
Family: Felidae (cats)
Genus: Felis ("true cats")
Species: couguar (Cougar)

Family -- a group of genera sharing some or a few superficial characteristics and many fundamental characteristics not shared by other groups of genera.

Order -- a group of families sharing a complex of fundamental characteristics not possessed by other groups of families.

Class -- a group of orders sharing certain fundamental characteristics not shared by other groups of orders.

Phylum -- a group of classes sharing a basic characteristic (or characteristics) not shared by other groups of classes.

Kingdom -- a group of phyla characterized by one of the following descriptions:

(1) very elementary organisms lacking nuclear-cytoplasmic differentiation (Monerans)

(2) primitive monocellular or multicellular organisms (Protistans)

(3) well-organized multicellular types, capable of photosynthesis (Plants)

(4) those well-organized multicellular types remaining (Animals)

c. The Four-Kingdom Classification In Outline (as given by Jay M. Savage In *Evolution* (New York: Holt, Rinehart and Winston, 1963), p. 11)

PRIMITIVE FORMS

(each subgroup within the major divisions equals a phylum in formal classification)

I. Monerans
- viruses
- bacteria
- blue-green algae

II. Protistans
- red algae
- cryptomonads and dinoflagellates
- yellow-green algae, golden-brown algae, and diatoms
- brown algae
- fungi
- zooflagellates
- rhizopods
- sponges
- cilates
- sporozoans
- slime molds
- euglenoids
- green algae

ADVANCED FORMS

III. Animals (well-organized multicellular types grouped into 20 to 25 phyla)

IV. Plants (well-organized multicellular types, usually capable of photosynthesis, placed in two phyla)

3. Synopsis of the Classification of Organisms (under the two-kingdom system)

The following is taken from Paul B. Weisz's work, *Biology* (New York: McGraw-Hill Publishing Co., 1954) Appendix A

THE PLANT KINGDOM

PHYLUM THALLOPHYTA (100,000 species)
- Subphylum Schizophyta
  - Class Bacteria
  - Class Cyanophyceae -- blue-green algae
- Subphylum Algae
  - Class Chiorophyceae -- green algae
    - Order Volvocales -- *Volvox*
    - Order Conjugales -- *Spirogyra*
    - Order Ulotrichales -- *Ulothrlx*
  - Class Rhodophyceae -- red algae
  - Class Phaeophyceae -- brown algae
  - Class Bacillariaceae -- diatoms
  - Class Flagellata -- euglenoids
- Subphylum Fungi
  - Class Myxomycetes -- slime molds
  - Class Phycomycetes -- bread mold
  - Class Ascomycetes -- yeasts, *Penicillum*
  - Class Basidiomycetes -- mushrooms, rusts, smuts

PHYLUM BRYOPHYTA (25,000 species)
- Class Hepaticae -- liverworts
- Class Musci -- mosses

PHYLUM PTERIDOPHYTA (15,000 species)
- Class Lycopodineae -- clubmosses, ground pines
- Class Equisetineae -- horse tails, scouring rushes
- Class Filicineae -- ferns

PHYLUM SPERMATOPHYTA (200,000 species)
- Subphylum Gymnospermae
  - Order Cycadales -- cycads
  - Order Coniferales --pine, fir, spruce
- Subphylum Angiospermae
  - Class Dicotyledoneae -- dicots
    - Subclass Archichiamydeae
      - Order Amentiferae -- oak, birch, walnut, chestnut
      - Order Rosales -- rose, apple, strawberry, pear, peach, cherry, bean, pea, peanut
      - Order Papaverales -- mustard, cabbage, poppy, turnip
      - Order Malvales -- cotton, cocoa, fig, hemp, elm
      - Order Ranales -- avocado, camphor, laurel, magnolia, buttercup, columbine

Order Umbellales -- celery, parsnip, carrot, parsley
Order Caryophyllales -- rhubarb, spinach, buckwheat
Order Cactales -- cacti
Order Geraniales -- geranium, citrus, rubber
Subclass Sympetalae
Order Gentianales -- lilac, olive, ash, gentian
Order Ericales -- blueberry, cranberry, rhododendron
Order Rubiflorales -- potato, tomato, tobacco, mint, thyme, lavender, pepper
Order Rubiales -- coffee, quinine, gardenia
Order Cucurbitales -- melons, cucumber, pumpkin, squash
Order Asterales -- dandelion, goldenrod, sunflower, lettuce, aster, daisy, artichoke
Class Monocotyledoneae -- monocots
Order Glumales -- wheat, corn, rye, rice, oats, barley, bamboo, sugar cane, and all other grasses
Order Palmales -- palms
Order Liliales -- lilies, iris, pineapple, banana
Order Orchidales -- orchids; "the last word in plant evolution so far."

THE ANIMAL KINGDOM

PHYLUM PROTOZOA (50,000 species)
Class Flagellata -- flagellate protozoa
Class Rhizopoda -- ameba, radiolaria
Class Sporozoa -- malaria parasite
Class Ciliata -- paramecium
PHYLUM PORIFERA (15,000 species)
Class Calcarea -- sponges with calcified skeletons
Class Hexactinellida -- sponges with siliceous skeletons
Class Demispongiae -- including sponges with horny skeletons
PHYLUM COELENTERATA (10,000 species)
Class Hydrozoa -- hydra, physalia
Class Scyphozoa -- jellyfishes
Class Anthozoa -- sea anemones, corals
PHYLUM CTENOPHORA (100 species) -- comb jellies (sea gooseberries)
PHYLUM PLATYHELMINTHES (10,000 species)
Class Turbellara -- planaria, and other free-living types
Class Trematoda -- flukes; Chinese liver fluke
Class Cestoda -- tapeworms
PHYLUM NEMERTINEA (600 species) -- proboscis worms
PHYLUM NEMATOMORPHA (a few dozen species) -- hair worms
PHYLUM CHAETOGNATHA (a few dozen species) -- arrow worms
PHYLUM ACANTHOCEPHALA (300 species) -- spiny-headed worms
PHYLUM PHORONIDEA (20 species) -- wormlike, tube-dwelling animals
PHYLUM GASTROTRICNA (1,500 species) -- a group of minute, ciliated animals
PHYLUM BRACHIOPODA (200 species) -- lampshells, e.g., *Lingula*
PHYLUM ROTIFERA (2,000 species) -- rotifers
PHYLUM BRYOZOA (3,000 species) -- moss animals, e.g., *Plumatella*
PHYLUM NEMATODA (10,000 species) -- roundworms. trichina worm, hookworm

PHYLUM ANNELIDA (10,000 species)
- Class Oligochaetes -- earthworm
- Class Polychaetes -- *Nereis*
- Class Hirudinea -- leeches

PHYLUM MOLLUSCA (100,000 species)
- Class Amphineura -- chitons
- Class Gastropoda -- snails, slugs
- Class Pelecypoda -- mussels, oysters, clams, shipworms
- Class Cephatopoda -- squids, octopods, nautilolds

PHYLUM ARTHROPODA (750,000 species)
- Class Crustacea
  - Subclass Branchiopoda -- water fleas
  - Subclass Cirripedia -- barnacles
  - Subclass Malacostraca
    - Order Decapoda -- lobsters, crayfish, shrimp
- Class Chilopoda -- centipedes
- Class Diplopoda -- millipedes
- Class Arachnoidea -- spiders, scorpions, mites, ticks, horseshoe crab
- Class Insecta (some 20 orders)
  - Order Thysanura -- silverfish
  - Order Orthoptera -- grasshoppers, cockroaches
  - Order Isoptera -- termites
  - Order Anoplura -- lice
  - Order Odonata -- dragonflies
  - Order Hemiptera -- bedbugs, stinkbugs
  - Order Siphonaptera -- fleas
  - Order Coleoptera -- beetles (nearly 250,000 species)
  - Order Hymenoptera -- ants, bees, wasps
  - Order Lepidoptera -- moths, butterflies
  - Order Diptera -- flies, mosquitoes

PHYLUM ECHINODERMATA (6,000 species)
- Class Asteroidea -- starfishes
- Class Echinoidea -- sea urchins, sand dollars
- Class Ophiuroidea -- brittle stars
- Class Holothuroidea -- sea cucumbers
- Class Crinoidea -- sea lilies

PHYLUM CHORDATA (50,000 species)
- Subphylum Hemichorda -- acorn worms
- Subphylum Urochorda -- sea squirts
- Subphylum Cephalochorda -- lancet fish
- Subphylum Vertebrata

[the following is taken from Alfred S. Romer's work, *Man and the Vertebrates* (Chicago: The University Press, 1957), Appendix 1]

A SYNOPTIC CLASSIFICATION OF VERTEBRATES

- Class Agnatha (jawless vertebrates)
  - Order Osteostraci
  - Order Anaspida
  - Order Heterostraci
  - Order Cyclostomata -- lamprey, brook lamprey

- Class Placodermi (archaic jawed fishes)
  - Order Arthrodira
  - Order Acanthodil
- Class Chondrichthyes (sharklike fishes)
  - Order Cladoselachil (primitive sharks)
  - Order Elasmobranchii -- sharks, skates, and rays
  - Order Holocephali -- chimaeras
- Class Osteichthyes (higher bony fishes)
  - Subclass Actinoptarygii (ray-finned fishes)
    - Order Chondrostei -- sturgeon, paddlefish, bichir
    - Order Holostei -- gar pike, bowfin
    - Order Teleostei -- herring, mackerel, eel, sea robin, trunkfish, sunfish, globe fish, seahorse, flounder, carp, catfish, salmon, trout, archer fish, four-eyed fish, shark sucker, pilot fish, electric eel, mudspringer, deep-sea fishes
  - Subclass Choanichthyes (fishes with internal nostrils)
    - Superorder Crossopterygii -- lobe-finned fishes
    - Superorder Dipnoi -- lungfishes
- Class Amphibia
  - Order Labyrinthodontia (primitive amphibians)
  - Order Urodeia -- salamanders, newts
  - Order Anura -- frogs, toads
  - Order Apoda (wormlike forms)
- Class Reptilia
  - Subclass Anapsida
    - Order Cotylosauria (stem reptiles)
    - Order Chelonia -- turtles, tortoises
  - Subclass Ichthyopterygia
    - Order ichthyosauria
  - Subclass Synaptosauria
    - Order Sauropterygia -- *Plesiosaurus*, *Thaumatosaurus*, *Elasmosaurus*
  - Subclass Lepidosauria
    - Order Eosuchia (ancient two-arched reptiles)
    - Order Rhynchocephalia
    - Order Squamata
      - Suborder Lacertilia -- monitor lizard, Gila monster, glass "snake", horned toad, small-legged lizard, blind worm, flying dragon, chameleon
      - Suborder Ophidia -- cobra, marine snake, rattler, copperhead, water moccasin, coral snake, king cobra, anaconda
  - Subclass Archosauria (ruling reptiles)
    - Order Thecodontia (ancestral forms)
    - Order Crocodilia -- crocodile, alligator, Indian gavial
    - Order Pterosauria (flying reptiles) -- *Rhamphorhynchus*, *Pterodactylus*
    - Order Saurischia ("reptile-like" dinosaurs)
      - Suborder Theropoda (bipeds) -- *Allosaurus*, *Tyrannosaurus*
      - Suborder Sauropoda (quadrupeds) -- *Brontosaurus*, *Diplodocus*, *Brachiosaurus*
    - Order Ornithischia ("birdlike" dinosaurs)
      - Suborder Ornithopoda (bipeds) -- *Camptosaurus*, *Trachodon*, *Corythosaurus*
      - Suborder Stegosauria -- *Stegosaurus*
      - Suborder Ankylosauria (armored dinosaurs) -- *Ankylosaurus*, *Palaeoscincus*
      - Suborder Ceratopsia (horned dinosaurs) -- *Triceratops*, *Protoceratops*

- Subclass Synapsida (forms leading toward mammals)
  - Order Pelycosauria -- *Dimetrodon, Edaphosaurus*, *Ophiacodon*
  - Order Therapsida (mammal-like reptiles) -- *Cynognathus*, *Kannemeycria*
- Class Aves (birds)
  - Subclass Archaeornithes (archaic birds) -- *Archaeopteryx*, *Archaeornis*
  - Subclass Neornithes (more advanced birds) -- *Ichthyornis*, *Hesperornis* (toothed birds of the Cretaceous), *Diatryma* (Eocene), *Phororhacos* (Miocene), *Dinornis* (moa, Pleistocene), *Aepyornis* (Pleistocene "elephant bird" of Madagascar), ostrich, rhea, cassowary, emu, kiwi, penguins, golden plover, *Gallus* (fowls), heath hen, dodo
- Class Mammalia (mammals)
  - Subclass Prototheria (egg-laying)
    - Order Monotremata -- *Ornithorhynchus* (duckbill), *Echidna* (spiny anteater)
    - Order Multituberculata (an archaic extinct group)
  - Subclass Metatheria (young born alive, placenta usually undeveloped or poor)
    - Order Pantotheria
    - Order Triconodonta
    - Order Symmetrodonta
    - Order Marsupialia (pouched mammals) -- opossum, Australian "cats," Tasmanian "devil," Tasmanian 'wolf," bandicoot, Australian "squirrels," flying phalanger, koala or Australian "bear," wombat, kangaroo, wallaby
  - Subclass Eutheria (placental mammals)
    - Order Insectivora (insect-eaters) -- hedgehog, mole, shrews, tree shrew
    - Order Carnivora (flesh-eaters)
      - Suborder Creodonta (archaic flesh-eaters)
      - Suborder Fissipedia (land carnivores)
        - Family Viverridae -- mongoose, civet, genet
        - Family Hyaendae -- hyenas
        - Family Felidae -- *Dlnictis* (Oligocene cat), *Smilodon* (Pleistocene saber-tooth), *Actinonyx* (cheetah), *Felis* (most living felids)
        - Family Mustelidae -- weasel, marten, skunks, badgers, wolverine, otter, sea otter
        - Family Canidae -- *Cynodictis* (Oligocene), *Canis* (dog, wolf, jackal), *Vulpes* (fox)
        - Family Procyonidae -- raccoon, coati, panda, giant panda
        - Family Ursidae -- *Ursus* (most bears), *Thalarctos* (polar bears)
      - Suborder Pinnipedia (marine carnivores)
        - Family Otariidae -- sea lion, fur seal, elephant seal
        - Family Odobaenidae -- walrus
        - Family Phocidae -- Atlantic seal
    - Order Condylarthra (primitive ungulates)
    - Order Dinocerata -- *Uintatherium* (Eocene)
    - Order Perissodactyla (odd-toed ungulates)
      - Family Equidae (horses) -- *Eohippus*, *Orohippus* (Eocene), *Mesohippus*, *Miohippus* (Oligocene), *Parahippus*, *Merychippus* (Miocene), *Hipparion* (Miocene-Pliocene), *Equus* (Pleistocene-Recent)
      - Family Tapiridae -- tapirs
      - Family Rhinocenotidae -- *Hyracodon*, *Baluchitherium* (Oligocene), *Teleoceras* (Miocene), *Rhinoceros* (living forms)

Family Titanotheriidae -- titanotheres (Eocene-Oligocene)
Family Chalicotheriidae -- *Moropus* (Miocene)
Order Artlodactyla (even-toed ungulates)
Suborder Suina (piglike forms)
Family Suidae -- pigs, wart hog, peccary
Family Hippopotamidae -- hippopotamus, pygmy hippo
Family Entelodontidae (giant hogs) -- *Archaeotherium* (Oligocene), *Dinohyus* (Miocene)
Suborder Protoselenodontia (Primitive ruminants)
Suborder Tylopoda -- *Oxydactylus* (giraffe-camel, Miocene), *Camelus* (camels), *Auchenia* (llama)
Suborder Pecora (ruminants)
Family Tragulidae -- *Tragulus*, *Synthetoceras* (Pliocene), water deer
Family Cervidae -- Megaceros (Pleistocene "Irish elk"), red deer, American "elk," Virginia deer, roe deer, moose, reindeer, caribou
Family Giraffidae -- giraffe, akapi
Family Antilocapridae -- prongbuck
Family Bovidae -- cattle, bison, sheep, goats, musk ox, and many other genera of antelopes
Order Hyracoidea -- conies
Order Proboscidea (elephant group)
Family Moeritheriidae (archaic proboscidians) -- *Moeritherium* (Eocene-Oligocene)
Family Mastodontidae -- *Phiomia* (primitive mastodon, Oligocene) *Trilophodon* (Miocene), *Mastodon* (Pleistocene)
Family Eiephantidae (mammoths and elephants) -- *Mammonteus* (woolly mammoth), *Elephas* (Asiatic elephant), *Loxodonta* (African elephant)
Order Sirenia (sea cow) -- dugong, manatee
Order Notoungulata (major group of extinct South American ungulates) -- *Protypotherium*, *Astrapotherium*, *Nesodon* (Miocene), *Toxodon* (Pleistocene)
Order Litopterna (extinct South American ungulates)
Order Pyrotheria (extinct South American parallels to elephants)
Order Rodentia (rodents, gnawing animals)
Suborder Simplicidentata (with one pair of upper "chisels")
Infraorder Sciuromorpha -- mountain beaver, squirrels, chipmunk., ground squirrels, prairie dog, woodchuck, beaver, giant beaver, pocket gopher, kangaroo rats
infraorder Myomorpha -- *Mus* (house mouse), Rattus (house rats), etc.
Infraorder Hystricomorpha -- guinea pig, chinchilla, American porcupine, Old World porcupine, Brazilian porcupine, tree porcupine, capybara
Order Lagomorpha Duplicidentata (gnawing animals with an extra pair of upper "chisels") -- hares, common rabbit, cottontail
Order Chiroptera (bats)
Suborder Microchiroptera (ordinary bats) -- common bats, vampire bat
Suborder Megachiroptera (fruit bats or "flying foxes")
Order Cetacea (whales)
Suborder Archaeoceti (extinct archaic whales) -- *Zeuglodon* (Eocene)

- Suborder Odontoceti (toothed whiles) -- sperm whale, porpoise, pigmy sperm whales, blackfish, beaked whale
- Suborder Mystacoceti (whalebone whales) -- *Balaenoptera* (rorquals, including blue whale), *Balaena* (right whales)

Order Edentata (South American edentates)
- Suborder Loricata (armored forms) -- nine-banded armadillo, *Stegotherium* (Miocene armadillo), *Propalaeohoplophorus* (Miocene glyptodon), *Glyptodon* (Pleistocene), *Periodon* (giant armadillo)
- Suborder Pilosa (hairy forms) -- *Hapalops* (Miocene ground sloth), *Megatherium*, *Mylodon*, *Megalonyx* (giant ground sloths, Pleistocene), tree sloths, giant anteater

Order Tubulidentata -- aardvark

Order Pholidata -- pangolin

Order Primates
- Suborder Lemuroidea -- ordinary lemurs, "bush baby," potto, slow lemur
- Suborder Tarsioidea -- tarsiers
- Suborder Anthropoidea (monkeys, apes, and men)
  - Infraorder Platyrrhini (South American Monkeys)
  - Infraorder Ctarrhini (Old World forms)
    - Family Cercopithecidae (Old World monkeys)
    - Family Simiidae (great apes) -- gibbon, orang, gorilla, chimpanzee
    - Family Hominidae -- *Australopithecus*, *Homo*

4. Taxonomy and Structural Similarity

"**Vertebrate Characters** -- If certain groups be omitted from consideration, the vertebrates are characterized by an internal bony skeleton, a hollow nervous system located all on one side of the digestive tract (usually to be described as the upper or dorsal side), and gill slits opening from the throat to the outside or touching the outside well in at least the developmental stages. These characters are found in no other phylum. In the fishes, the gill slits persist throughout life and between them the gills are developed as respiratory organs; the limbs are in the form of fins; the skin usually contains scales; and the heart consists of only two chambers. In the amphibia (frogs, toads, salamanders), gills are present and functional in the larval or tadpole stage and in some kinds they persist throughout life. The amphibian skin is devoid of any hard structures, and the heart has three chambers (two auricles and one ventricle). The reptiles never have gills in any stage, and the gill slits are open only in the embryo; in this respect they are like birds and mammals. The heart is generally three-chambered, though the ventricle is partially divided, and in crocodiles it is completely divided so that the heart is four-chambered. The body of a reptile is covered with scales or hard plates. Birds possess feathers, wings (functionless in some), a four-chambered heart, and air cavities in some of the bones, and are devoid of teeth. Mammals have hair, a diaphragm separating the chest from the abdomen, and a four-chambered heart. Embryonic development of mammals takes place as a rule within the body of the female, and the young are nourished with milk. The fishes, amphibia and reptiles are cold-blooded, while birds and mammals are warm-blooded.

"The vertebrate characters which remain to be described are not advantageously referred to as taxonomic distinctions. Instead of pointing out the differences among various animals with respect to them, more is to be gained by emphasizing their similarities. The brain is an example. While some brains are long and narrow, others short and wide, some flat and others high, they all possess the same principal features. Cerebrum, cerebellum, optic lobes, pituitary body, and the crossed optic nerves are readily discernible notwithstanding their variable forms.

"The nerves that emerge from the central nervous system within the skull show likewise great similarity. They arise from the same part of the brain, and most of them pass to the same organs and serve the same function. The first of these nerves, counting from the front, is the nerve of smell, the second is the optic nerve, and the eighth is the nerve of hearing in all vertebrate animals. The third, fourth and sixth are distributed to the muscles which move the eye. The remaining cranial nerves -- there are 10 of them in the lower vertebrates, 12 in the higher -- go to various regions of the face, throat and organs of the chest, and among them there are some differences in both distribution and function in the several vertebrate classes.

"The highly developed sense organs show equally great similarities. In the eye there is in all, the same general arrangement. The eyeball may be of somewhat different shapes, but the transparent cornea in front, the iris and pupil, the lens, the retina and the choroid and sclerotic coats are present and in the same general relations to one another in all of them.

The inner division of the ear, to which the nerve of hearing is connected, consists of an irregularly shaped body and three semicircular canals, two of them placed vertically but in different planes, the third set horizontally. Each canal of this membranous labyrinth has an enlargement near one end in the classes of vertebrates described above. From the frogs to the mammals, there is, adjoining the membranous labyrinth, a cavity known as the tympanum, which is connected with the throat by a tube, and in which in all these classes are small bones which serve to convey the vibrations producing sound.

"Any other system of organs could be used from similar comparisons, and would yield the same conclusions. Digestive systems in the bulk of the vertebrates consist of corresponding organs in the same order, with the appropriate glands pouring secretions into them at the same places. Excretory systems consist largely of the same mechanisms; muscles are arranged in much the same ways, are attached to corresponding bones, and serve mostly the same functions; blood vessels follow the same general courses, give off branches usually at the same points, and serve the same portions of the body. It might be argued that these systems, in order to perform their functions, must be arranged in these ways, and the fact that they are so much alike in the various vertebrates means only that they have certain things to do in relation to each other and are situated in the only places where these things can be done. This argument could not be applied, however, to the location of the endocrine glands. These organs produce secretions which, instead of being poured out through ducts, diffuse directly into the blood. In this liquid the secretions are carried everywhere, and there would be no necessity of having the glands located at any specific points. Yet the thyroid gland occurs always in the region of the throat near the front gill slits, from which place its secretion flows out to influence physiological processes in the remotest parts of the body. The pituitary, located always at the base of the brain, might be anywhere else and influence growth and the reproductive system equally well. The thymus develops always in the region of the gill slits, but in the adult extends, in the several classes of vertebrates, to various places in the neck region or upper part of the chest -- far from the seat of its principal known and supposed effects. The reproductive organs produce endocrine secretions which influence secondary sexual characters from head to foot (combs, wattles, tall feathers and spurs of fowls, for example). The conclusion that these organs might be elsewhere and still serve the same purpose is not mere conjecture. It has been proved by grafting them into strange situations, or by introducing their secretions artificially at other points.

"**Internal Similarity with External Difference** -- If experiments with the endocrine secretions show that a given function could be performed regardless of any particular anatomical arrangement, there are situations in which the tables are turned and many different functions are performed by essentially the same anatomical structure. A classical example of this relation, often described because it extends over a large number of well-known animals, is found in the fore and hind limbs of vertebrate animals. These limbs possess very similar skeletal foundations, but are externally modified in so many ways that they may be used for many different purposes. The human arm is rather simple and unspecialized, and its skeleton may be used as a starting point for comparisons. It is attached to the trunk through a shoulder girdle composed, on each side, of a collar bone and a

shoulder blade. The upper arm consists of one bone, the lower arm of two bones, and the wrist of a group of irregular small bones. Beyond these there are five chains of bones set end to end to form the body of the hand and the digits. Among the least specialized of the arms of other vertebrates is that of the frog. Its shoulder girdle contains a third bone on each side which forms the chief brace of the arm against the breast bone. The arm itself differs from the human arm chiefly in that the two bones of the lower arm are fused side by side, the small bones in the wrist are less numerous, and there are practically only four rows of bones in the hand with somewhat different numbers of bones in them. In the sea turtles the fore limb is externally a long flat paddle, not divided in the flesh into separate fingers at the end. Yet, with the exception of the inflexibility of some of the Joints, the bony structure within, even to the number of segments in the digits, is essentially the same as in many land vertebrates. The arms of whales are likewise flat and without separation of the digits in the flesh but their skeletons differ from typical vertebrate arms almost only in the absence of a collar bone, the immovability of the elbow joint, and an increase in the number of bones in the digits. In bats, the principal modification is the great elongation of the bones of the body of the hands and the fingers (except the thumbs) to form the framework of the wings. One of the bones of the lower arm is rudimentary; otherwise the arm skeleton is typical. In birds the wing is formed, not by an extension of the digits, but notwithstanding a great reduction of them. There are only three fingers, and each of these has one or two fewer bones than the corresponding fingers of man. The expanse of wing thus lost is more than compensated by very stiff feathers. The only other striking difference between the bird wing and a typical vertebrate forearm is the reduction of the separate wrist bones to two. In the forefeet of horses there is only one well-developed chain of bones instead of the usual four or five, while two others are represented by the single splint bones on either side. The single toe in these animals is generally held to be in the interest of speed. In snakes the forelimbs are completely wanting, though the other skeletal characters show many resemblances to other vertebrates.

"The hind limbs show somewhat fewer and less striking departures from the ordinary. In sea turtles and horses their modifications are of about the same kind and degree as those of the forelimbs. In most whales they are entirely missing, though in a few there are small bones embedded in the flesh in the pelvic region without any connection with the spinal column, which are usually homologized with the hip girdle. In most snakes, likewise, hind legs are wholly wanting. In a few (including the python and the boa), hind legs are externally visible only as clawlike structures scarcely protruding beyond the general level of the scales on the surface. Connected with these claws internally are rudimentary bones representing the girdle and probably one or more of the leg bones."

-- A. Franklin Shull, *Evolution* (New York: McGraw-Hill Book Company, 1936), pp. 18-23.

"As comparative anatomy is the field from which inferences of relationship among animals are most commonly drawn, it is an especially important source of evidence for evolution. If any particular organ system is studied in diverse representatives of a single phylum, one gets the impression that the system is based upon a prototype which is simply varied from class to class (with finer variations within each class).

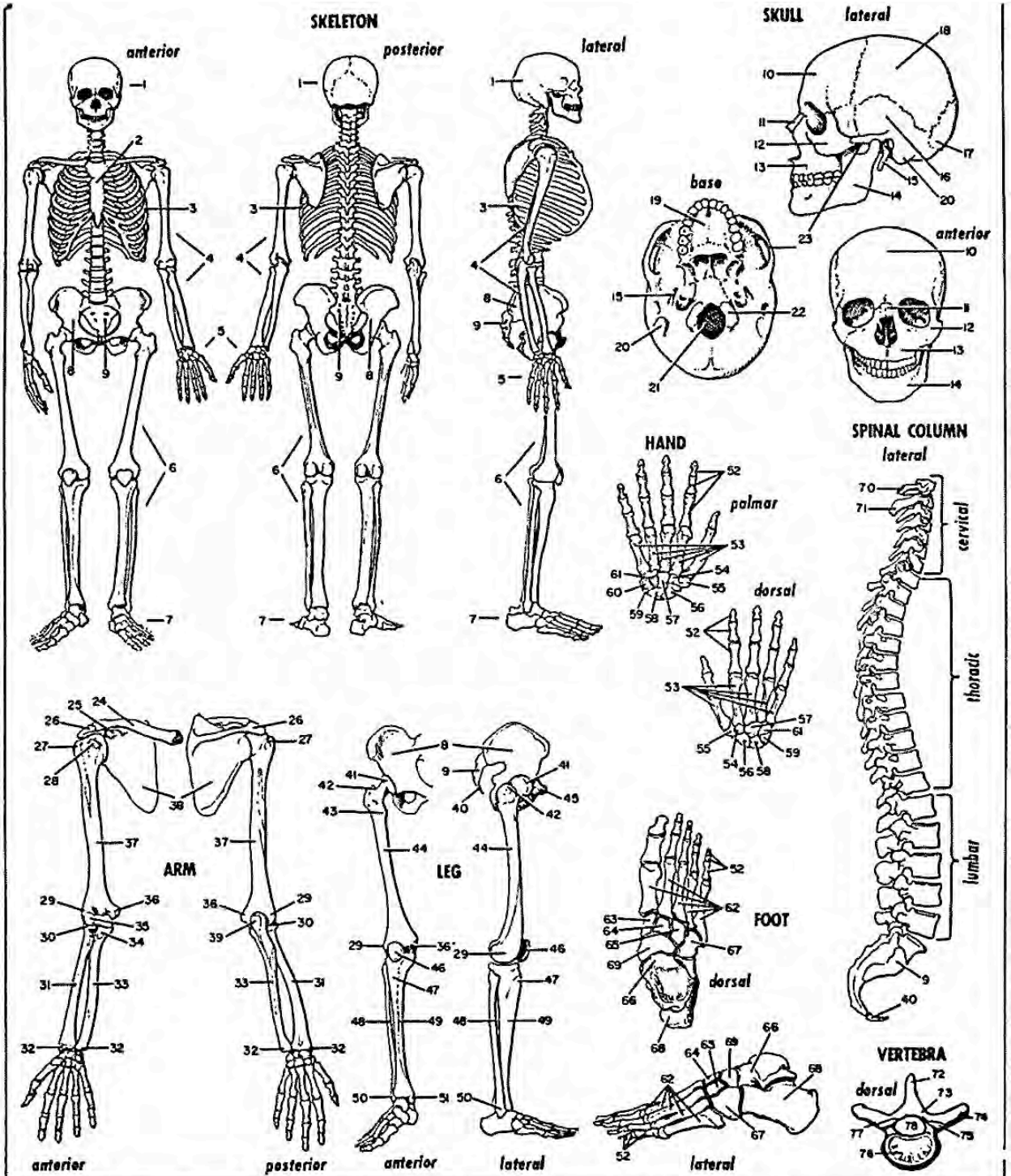
"The same principle holds true within each class. The forelimb of the mammals may be taken as an example. In any, there is a single long bone, the humerus, in the upper arm. In the forearm there are two parallel bones, the ulna and the radius. In the wrist there are typically eight carpal bones arranged as two rows of four. Five parallel metacarpals form the skeleton of the palm of the hand, while rows of three phalanges each form the skeleton of the digits, excepting the first digit, which has only two phalanges.

"The shrews (order Insectivora, family Soricidae) show a very primitive arm structure. Their close relatives, the moles (family Talpidae) are, however, highly modified for digging. All of the bones of the limbs are short and broad, giving the limb a shovel-like appearance. Thus adaptation is attained by mutual fitting of structure (the shovel-like limb), function (digging), and environment (the subterranean habitat). in the order Chiroptera (bats), the humerus, radius and ulna, and four of the digits are greatly elongated to support the wing membrane. In the ungulates, the humerus is short and heavy. The remaining bones of the forelimb are generally elongated, and the digits are reduced in number. Fusion of bones is quite common in adults, but in the embryos the primitive centers of ossification can be identified. The details naturally differ considerably among the various orders of ungulates.

"Examples could be multiplied indefinitely but the principle remains the same throughout. Within any taxonomic category, all of the members appear to be built upon common plan, with variation among the various members resulting in the adaptation of each to its mode of life. The higher the category examined, the greater the scope of variation. But the common plan is always discernible."

-- Edward 0. Dodson, *Evolution: Process and Product* (New York: Reinhold Publishing Company, 1960), pp. 31, 39.

√Evolution and Special Creation, page 26a figure



5. Taxonomy as an Evidence for Evolution

a. The argument stated

"Taxonomic summaries lend themselves to diagrammatic representation by a tree....

"Now everyone understands that the various parts of a real tree are related to one another in a branching fashion because the whole organism is the product of growth from a single seed, growth accompanied by branching and differentiation. if anyone were to suggest that the various branches, twigs, and leaves had been independently created and secondarily Joined together, his sanity would be doubted . . . . The analogy cannot be avoided: the fact that no other type of diagram can symbolize the data of taxonomy so readily as can a tree strongly suggests that, like a real tree, the tree of life owes its branching character to organic growth and differentiation -- in other words, to evolution.

"The various taxonomic categories simply represent varying degrees of blood relationship. Thus, all members of the phylum Chordata have common ancestors, but they are exceedingly remote, and hence only the most fundamental chordate characters are held in common by extreme members of the phylum. Within any class, however, the degree of relationship is much closer, and hence more numerous and fundamental characters are held in common by diverse members of a class. All birds, for example, share many characters in common. As one goes down the taxonomic scale this trend becomes stronger until finally members of a single species differ only in minor characters, and this because of their common inheritance. It is difficult to study any group of organisms in detail without feeling that this argument is a cogent one."

-- Edward O. Dodson, *A Textbook of Evolution* (Philadelphia: W. B. Saunders Company, 1952), pp. 36-37.

"Naturalists, as we have seen, try to arrange the species, genera, and families in each class, on what is called the Natural System. But what is meant by this system? Some authors look at it merely as a scheme for arranging together those living objects which are most alike, and for separating those which are most unlike; or as an artificial method of enunciating, as briefly as possible, general propositions -- that is, but one sentence to give the characters common, for instance, to all mammals, but another those common to all carnivora, but another those common to the dog-genus, and then, by adding a single sentence, a full description is given of each kind of dog. The ingenuity and utility of this system are indisputable. But many naturalists think that something more is meant by the Natural System; they believe that it reveals the plan of the Creator; but unless it be specified whether order in time or space, or both, or what else is meant by the plan of the Creator, it seems to me that nothing is added to our knowledge. Expressions such as that famous one by Linnaeus, which we often meet with in a more or less concealed form, namely, that characters co not make the genus, but that the genus gives the characters, seem to imply that some deeper bond is included in our classifications than mere resemblance. I believe that this is the case,

and that community of descent -- the one known cause of close similarity in organic beings -- is the bond which, though observed by various degrees of modification is partially revealed to us by our classifications."

-- Charles Darwin in *The Origin of Species*

"**Evidence from Taxonomy, or Classification**. The Linnaean system of classification of plants and animals is based upon structural resemblances between living forms and upon fossil evidence from extinct forms, indeed, the fundamental units of classification (phyla, classes, orders, etc.) are based on varying degrees of similarity of structure within each group of organisms. This grouping of plants and animals according to fundamental similarities places them in an ascending series of Increasing complexity. Taxonomy (the science of biological classification), then, assumes that the closest similarities are to be found among closely related organisms and that the greatest variation will be found among those forms that are either totally unrelated or distantly related. The structural relationships on which this system of classification is based indicate a line of common descent which can best be attributed to, and explained by, the processes of organic evolution."

-- William H. Matthews III, *Fossils An Introduction to Prehistoric Life* (New York: Barnes and Noble, 1962), pp. 158-159.

"As will have become apparent, the significant assumption underlying classification is that the closest fundamental similarities between animals (or plants) are found in the forms most closely related and that the greatest differences are found in those forms which are unrelated or at best very distantly related. The assumption implies the idea of descent with modification, which is no more nor less than evolution. Using this evolutionary basis, we can arrive at an extremely satisfactory classification both of living and of extinct forms; and there is no other basis of classification that works."

-- Horatio Hackett Newman, *Evolution Genetics and Eugenics* (Chicago: The University of Chicago Press, 1956), p. 98.

"The fact that plants and animals can be classified in groups from the simple to the complex is said to be proof that they developed in the same way."

-- Cora Reno, *Evolution Fact or Theory?* (Chicago: Moody Press, 1953), p. 53.

b. The argument analyzed

This argument really proceeds as follows:

If it is possible to construct a classification, based on structural similarity, then structural similarity certainly exists.

If structural similarity exists, then certainly a genetic relationship exists as an explanation of that similarity.

It is possible to construct a classification, based upon structural similarity, of living things.

Therefore a genetic relationship between all living things must exist.

Formal Analysis of the Argument

The Formal Argument	The Formal Structure
If Cl, then SS	If A, then B
If SS then GR	If B then C
Cl	A
Therefore GR	Therefore C

In analyzing any given deductive argument, there are really only two questions to be asked:

(a) Is the formal structure valid?
(b) Are both of the premises true?

if the answer to both these questions is yes, then the conclusion must follow.

In regard to the formal structure, we must admit that it is perfectly valid.

In regard to the major premise (or "first conditional inference"), we must assert that it is true. If it is possible to construct a Classification based upon Structural Similarity, then Structural Similarity certainly exists l

However, when we come to the minor premise (the "second conditional inference"), we discover a most interesting fact. Upon examination, the inference "If Structural Similarity exists, then Genetic Relationship exists" reduces to a restatement of the principle of homology ("fundamental structural resemblance signifies genetic relationship"). But this is the one assumption, the only postulate, the basic presupposition (see page 9, middle) which the evolutionist asks us to grant him. Give him this one point, and he asks no further concessions! This is tantamount to saying, "Grant me the assumption that evolution is a fact, and I will prove to you that evolution has, in fact, occurred."

Such an argument commits the logical fallacy of "begging the question" (i.e., assuming in a premise what one is trying to prove in the conclusion). Thus the minor premise must be challenged! The conclusion does not follow!

However, if this argument is rejected, then what alternative explanation can be given for the existence of structural similarity? One could, of course, deny structural similarity. But that would be flying in the face of universally verifiable facts? But if we admit the facts, what explanation can we as Christians give for them?

6. Taxonomy and Special Creation

a. Linnaeus and special creation

Linnaeus, the father of taxonomy, was an ardent advocate of the special creation view. He is famous for the statement, "There are just so many species as in the beginning the infinite Being created." He held that all of the true species were created as they are known today, except that new combinations may have arisen through hybridization or through degeneration. Later in life, he felt that the "kinds" which God had created were not species, but genera.

Linnaeus explained structural similarity (on the basis of which he constructed his classification) by the theory of archetypes. This theory assumes that the Creator created according to a series of mental plans or blueprints. Thus the hierarchy of taxonomic levels corresponds to a hierarchy of archetypes.

This consideration should point up the fact that evolution is not a necessary adjunct of the classification. Linnaeus developed the basis of the classification, and he was a special creationist!

b. Structural similarity and special creation

(1) Statement of the Problem

If the evolutionary concept of genetic relationship be rejected as the explanation of structural similarity, then what other explanation can be offered by the Christian to explain this fact?

The special creationist must attempt to determine:

(a) whether structural similarity exists purely by virtue of God's *ex nihilo* Creation (with structural similarity) of all extinct and extant species; or
(b) whether structural similarity exists purely by virtue of God's immediate creation (with structural similarity) of all extinct and extant species; or
(c) whether structural similarity exists partly by virtue of God's immediate creation (with structural similarity) of some species and partly by virtue of God's mediate creation (with variation) of other species; or
(d) whether structural similarity exists partly by virtue of God's immediate creation (with structural similarity) of a number of basic kinds and partly by virtue of God's mediate creation (with a considerable amount of variation) of the descendants of the basic kinds (all the extinct and extant species which have descended from the original basic kinds).

(2) Consideration of relevant Scriptural data

(a) The meaning of the Hebrew word "kind" (*min* = מִין)

[The following material is taken from lecture four of "A Proposed Creationist Alternative to Evolutionism," IBRI Research Report 12]

The Hebrew word translated "kind" is used ten times in the first chapter of Genesis. It is used a total of 31 times in the Hebrew Old Testament. This Hebrew word (מִין) is transliterated min. But now we must ask the question: What does *min* mean?

"One of the first principles of lexicography is that the meaning of a word is discovered by an examination of its usage in context. In this connection we are fortunate to have as many instances of min in Scripture as we do have, and we are doubly fortunate in the fact that 30 of its 31 occurrences are found in the writings of one author, namely Moses. We thus have a fairly solid base upon which to build our understanding of the meaning of this Hebrew word.

"As we approach the question of the usage of the word *min*, something that could affect its meaning strikes us almost immediately. In every one of its 31 uses, *min* is preceded by a preposition, and it is the same proposition in every case. This preposition (לְ) has the meanings "to, according to, for." It would appear that the meaning "according to" best fits its usage in these cases. Unfortunately, this preposition has sometimes been translated by the English preposition "after," and this has caused readers to think that there is some temporal idea, some time component in the Scriptural phrase. There is no idea in the Hebrew preposition לְ of something "coming after" something else, or of one thing "following" another. This time idea must be expunged from our understanding, if we wish to correctly interpret these usages. The meaning of this preposition, in all of its usages with min, is simply "according to."

"Let us proceed, then, to an examination of those scriptural passages in which min is used. However, lest we enter upon this examination of a portion of the Word of God in a careless manner, let us pause and ask ourselves, "What method of examination will best facilitate our study?"

"In inductive studies in which a considerable number of items are involved, it is sometimes quite sufficient to study them in simple enumerative order. At other times, especially when the items to be studied differ in degree of difficulty, it is often more efficient to begin with the less difficult problems and proceed to the more difficult ones. In this study, we shall adopt the latter approach.

"Let us begin at Genesis 6:19-20. Here we read God's words to Noah:

> And from every living thing, from all flesh, two of each shall you cause to come into the ark, to preserve alive with you; they shall be male and female. From the bird, according to

> its kinds, and from the cattle, according to its kind, and from every creeping animal of the ground according to its kinds; two of each shall enter unto you to preserve alive.

"It is important to note that there is no time element, no before-and-after sequence in this passage. Verse 20 says nothing about birds, cattle, and creeping things which come after other birds, cattle and creeping things. Verse 20 also says nothing about animals being similar to their parents. I mention these things at this point because these two ideas of coming after and being similar to are the ideas most frequently associated with the translation "after its kind."

"In this connection, I believe that the King James Version's translation of *min* with the preposition is misleading to English-speaking people today. What can the phrase "after its kind" as it is ordinarily understood mean in this context? What can it mean for Noah to take "fowls after their kind" into the ark with him? What can it mean for Noah to take "cattle after their kind" into the ark? What was Noah to understand by such a command? Did God wish Noah to make certain that he took into the ark only those birds and those cattle which had been begotten in their parents' likeness? Such an interpretation reduces a simple command to meaninglessness!

"At this point I must speak frankly. There are many exegetes and theologians who appear to firmly believe that, unless *min* with its preposition is translated in every case by the phrase "after its kind," a potential loophole is opened which could be interpreted as providing aid or support to evolutionists. And such a loophole must not be opened, even at the expense of interpreting Scripture in a faulty, incorrect or meaningless way!

"This allegation receives support from the fact that, by translating *min* with its preposition exclusively (with one exception) by the phrase "after its kind," twenty out of thirty uses become meaningless for present-day English, and the remaining ten uses are all in Genesis 1, where we are dealing with Creation! But what does it matter that twenty uses become meaningless; Creationism has been preserved, and Evolutionism has been deprived of a potential weapon! Is not the good accomplished thereby greater than the evil?

"To this we must answer with all the earnestness and vigor at our command: Christianity does not need the well-intentioned but exegetically questionable, hermeneutically unsound, theologically indefensible, and ethically reprehensible attempts on the part of some Christians to save other Christians (especially Christian young people) from the faith-destroying theory of Evolutionism. What Christianity needs in this desperate hour is a straightforward translation of the Word of God in its integrity! Let those who wholeheartedly believe in the truthfulness of the Scriptures set them forth truthfully!

"But how, then, shall we translate this passage in Genesis 6 in a meaningful way, while simultaneously preserving its integrity? (Actually, in the proper understanding of the inspired Word of God,

these two purposes never conflict. Scripture can only be meaningful if its integrity is preserved; and if its integrity is preserved, it will be meaningful.

"In this passage God told Noah that "from the bird, according to its kinds, he was to take two of each into the ark. "The bird according to its kinds" simply means "various kinds of birds" which Noah was to take into the ark. The correctness of this translation is reinforced by the clause, "two of each shall enter unto you." The phrase "two of each" certainly does not mean that only two birds, two cattle, and two creeping animals of the ground were to enter the ark with Noah, but rather that two of each kind of bird, two of each kind of cattle, and two of each kind of creeping animal of the ground were to be brought into the ark.

"This translation receives further support from the record of fulfillment of God's command, as found in Genesis 7:13-14. This passage states:

> In the very same day Noah and Shem and Ham and Japheth the sons of Noah entered, and the wife of Noah and the three wives of his sons with them, into the ark. They, and every living animal, according to its kind, and every cattle, according to its kind, and every creeping animal which creeps upon the earth, according to its kinds, and every bird, according to its kinds, every winged bird.

"Here we do not read that Noah brought into the ark those animals which came after and were similar to their parents (the idea associated with the expression "after its kind"). We read simply that Noah brought into the ark two specimens of each kind of living animal, each kind of cattle, each kind of creeping animal, and each kind of bird. Thus the phrase "according to its kind" as the translation of *min* with the preposition is not only the proper translation, it also makes good sense!

"Proceeding now to Leviticus 11, we discover that *min* is used five times in connection with animals that are not to be eaten. Verse 14 states that the kite, according to its kind, is not to be eaten. (Incidentally, this is not addressed to that famous species of kite-eating tree which plagues Charlie Brown; it is a prohibition to the children of Israel against the eating of the various kinds of long-tailed, long pointed-winged birds called kites!) Notice what this verse does not say. It does not say that the kite which has come after and is similar to its parents is not to be eaten. It simply says that the various kinds of birds known as kites are not to be eaten!

"The same is true in Leviticus 11:15, 16, 19 and 29. The children of Israel are forbidden to eat various kinds of raven, various kinds of hawk, various kinds of heron, and various kinds of tortoise.

"In Leviticus 11:22 we find that *min* is used four times in connection with animals which may be eaten. The children of Israel are permitted to eat various kinds of locust, various kinds of bald locust, various kinds of beetle and various kinds of grasshopper. In all of these cases, instead of translating *min* with its preposition by the phrase "after its kind," we should translate it by the phrase "according to its kind."

In the second giving of the Law, as recorded in Deuteronomy 14, there are four instances of *min*. They are found in verses 13, 14, 15 and 18, and they all concern animals which are not to be eaten by the children of Israel. In verse 13 they are forbidden to eat the vulture according to its kind. In verse 14 they are prohibited from eating the raven according to its kind. In verse 15 they are commanded not to eat the hawk according to its kinds. And in verse 18 they are told not to eat the heron according to its kind. All of these uses are quite transparent. They are simply not to eat any kind of vulture, raven, hawk, or heron. There is not the slightest hint, in the expression of *min* preceded by לְ of the idea of animals being "after their kind," i.e., of animals which have come after and are similar to their parents. The entire thrust of the expression is the inclusion, within a given category of animals not to be eaten, of all the various kinds of that category. Thus we translate the expression in the Hebrew, "according to its kind," or "according to its kinds."

"In Ezekiel 47:10 we have the only usage of *min* outside of the Pentateuch. This is also the only instance out of 31 uses in which the proposition לְ is translated "according to" in the Authorized Version. The passage, speaking of the great river which flows from beneath the Millennial Temple, states:

> And it shall come to pass, that fishermen shall stand upon it, from Engedi even to Eneglaim; they shall be a place to spread out nets; their fish shall be according to its kind, as the fish of the great sea, exceedingly many.

"This passage would appear to be speaking of the many varied kinds of fish which shall inhabit the great river of the Millennial Temple, and the Authorized Version translates it in exactly this fashion.

"This brings us to the disputed uses in Genesis 1. The word *min* with the preposition לְ occurs ten times in the first chapter of Genesis. Three of these instances are associated with the Immediate Creation of plants, one instance is connected with the Immediate Creation of aquatic animals, one instance is concerned with the Immediate Creation of birds, and the remaining five instances relate to the Immediate Creation of terrestrial animals.

"One point, which may at first appear to be a truism but must nevertheless be made, is that these plants and animals which God created did not exist before God created them. There are many who are quick to give assent to this proposition, but who reject its clear implication. The clear implication of this proposition is that, in the Genesis account of Creation, we are not dealing with reproduction, but with the original creation of all living things. Genesis 1 is not speaking of plants reproducing other plants; it is speaking of God creating plants. Again, Genesis 1 is not speaking of animals reproducing animals; it is speaking of God creating animals. With this clarification firmly in mind, let us proceed to an examination of *min* in the first chapter of Genesis.

"In the following translations I have translated *min* with the preposition in the same fashion as in all the instances already noted. I have done this for at least three reasons:

(1) An examination of the 21 instances of *min* outside of Genesis 1 has revealed the fact that *min* with the preposition לְ uniformly means "according to its kind(s)."

(2) Twenty of those 21 instances fall within the writings of Moses (7 in Genesis, 9 in Leviticus, and 4 in Deuteronomy); Moses also wrote Genesis 1.

(3) In Genesis 1 we are dealing with the Immediate Creation of all living things; i.e., their initial coming into existence by God's creative commands.

In Genesis 1:11-12 we read:

> And God said, Let the earth cause vegetation to sprout forth; the herb yielding seed, the fruit tree producing fruit whose seed is in it, according to its kind, upon the earth. And it was so. And the earth produced vegetation, the herb yielding seed according to its kinds, and the tree producing fruit whose seed is in it, according to its kinds, and God saw that it was good.

In the English it is difficult to phrase the words of these verses in such a way as to show the connection of *min* with its antecedent. Verse 11 connects *min* with "fruit tree." This may be expressed by reading, "Let the earth cause to sprout forth various kinds of fruit tree which produce fruit whose seed is in it." Likewise verse 12 connects min with "herb" and with "tree." This may be expressed by reading, "And the earth produced various kinds of herbs yielding seed, and various kinds of trees producing fruit whose seed is in it." Although this mode of reading may seem a bit awkward, it is the only way in which to show the proper relationship of the words concerned.

In Genesis 1:21 we read:

> And God created great aquatic animals, and every living being that moves, which the waters multiplied according to their kinds, and every winged bird, according to its kinds; and God saw that it was good.

Here we understand the statements of fact to mean simply that God created various kinds of aquatic animals and various kinds of birds. There is no thought of reproduction here, since aquatic animals and birds did not exist before this creation; this passage speaks only of their original creation in various kinds.

In Genesis 1:24 we read:

> And God said, Let the earth bring forth the living being according to its kind, cattle and creeping animal and living animal of the earth, according to its kind. And it was so. And God created the living animal of the earth, according to its kind, and the cattle, according to its kind, and every creeping animal of the ground according to its kind; and God saw that it was good.

Here there is absolutely no thought whatever of terrestrial animals "reproducing after their kind"; the thought is simply that of God's calling forth from the earth all the varied kinds of living being: cattle, creeping animal, and living animal of the earth. Verse 25 should be understood to mean that God immediately created different kinds of the specified categories of land animals. And there is nothing more in the combination of *min* with the preposition than this!

"But now, having ascertained the Biblical usage of *min*, we must ask the question: "To what level in the scientific classification of plants and animals does *min* correspond? Is it the equivalent to a biological species? Can it sometimes refer to a genus, or a family, or an order, or a class, or a phylum?"

"An analysis of the level of the classification of the Biblical "kinds" uncovers a rather remarkable fact. The word *min* is associated with categories of plants and animals which range from the level of sub-species to the level of phylum, and which include all levels between! From this information we may learn a very important truth: the word *min* does not denote one specific level in scientific classification (such as species, for example). Another truth which we may learn from this study is that, in Genesis 1, where we read of God's original Creation, the categories of plants and animals range from family up to phylum, and therefore we may not say that the Bible says that God created all plants and animals on the level of our present species. In the case of some living things, God may have created on the level of our present orders, in some cases on the level of our present families, in some case on the level of our present genera, and in some cases on the level of our present species. Perhaps the paleontologic record could be of help in learning on what present classification level or levels God created the various "kinds" of plants and animals.

"Another truth which we learn from this study is that the Bible does not say that the development of new species is an impossibility. As a matter of fact, if God originally created some living things on the present level of family (for example), then all of the members of the family have since developed, which means that new genera as well as new species have developed. The Bible simply does not teach the dogma of "the fixity of species." As a matter of fact, this dogma grew out of a mistranslation of *min* with the preposition coupled with a mistaken identification of the Biblical word *min* with the scientific concept "species."

"But further, the Bible does not even say that God created all of the original "kinds" of plants and animals in such a way that no new "kinds" could develop from the original "kinds." I realize that in saying this I am desecrating the "sacred cow" of many who believe that the limits of variability established by the phrase "after their kind" is the last bulwark of Creationism against the flood-tides of Evolutionism. However, not finding this translation "after their kind" is Biblically correct, I do not find it theologically correct! And therefore I do not find it a crucial support for Creationism, nor a great bulwark against Evolutionism."

TRANSLATION OF BIBLICAL PASSAGES IN WHICH THE BIBLICAL "KIND APPEARS (ALL CASES)

Gen. 1:11 -- "And God said, Let the earth cause vegetation to sprout forth; the herb yielding seed, the fruit tree producing fruit whose seed is in it, according to its kind upon the earth. And it was so."

Gen. 1:12 -- "And the earth produced vegetation, the herb yielding seed according to its kinds and the tree producing fruit whose seed is in it, according to its kinds and God saw that it was good."

Gen. 1:21 -- "And God created great aquatic animals, and every living being that moves, which the waters multiplied according to their kinds and every winged bird, according to its kinds and God saw that it was good."

Gen. l:24 -- "And God said, Let the earth bring forth the living being according to its kind cattle and creeping animal and living animal of the earth, according to its kind. And it was so."

Gen. 1:25 -- "And God created the living animal of the earth, according to its kind and the cattle, according to its kind and every creeping animal of the ground, according to its kind and God saw that it was good."

Gen. 6:20 -- "From the bird, according to its kinds and from the cattle, according to its kind from every creeping animal of the ground according to its kinds two of each shall enter unto you to preserve alive."

Gen. 7:14 -- "And every living animal, according to its kind and every cattle, according to its kind and every creeping animal which creeps upon the earth, according to its kinds and every bird, according to its kinds every winged bird."

Lev. 11:14 -- "And the vulture, and the kite, according to its kind."
11:15 -- "Every raven, according to its kind."
11:16 -- "And the owl, and the nighthawk, and the cuckoo, and the hawk, according to its kinds."
11:19 -- "And the stork, the heron, according to its kind and the lapwing, and the bat."
11:22 -- "These from among them ye shall eat: the locust, according to its kind and the bald locust, according to its kinds and the beetle, according to its kinds and the grasshopper, according to its kinds."
11:29 -- "And these are unclean to you among the creeping things which creep upon the earth: the weasel (mote?), and the mouse, and the tortoise, according to its kind."

Deut. 14:13 -- "And the glede, and the kite, and the vulture, according to its kind."
14:14 -- "And every raven, according to its kind."
14:15 -- "And the owl, and the nighthawk, and the cuckoo, and the hawk, according to its kinds."
14:18 -- "And the stork, and the heron, according to its kind and the lapwing, and the bat."

Ezek. 47:10 -- "And it shall come to pass, that fishermen shall stand upon it, from Engedi even to Eneglaim; they shall be a place to spread out nets; their fish shall be according to its kind as the fish of the great sea, exceedingly many."

ANALYSIS OF THE TAXONOMIC LEVEL (TECHNICAL SENSE) OF THE BIBLICAL "KINDS"			
Scripture	Nature of Kind	Taxonomic Level	Scientific Group Name
Gen. 1:11	Fruit trees	Some Orders of a Subclass	Dicoyledoneae (subclass)
Gen. 1:12	Herbs	Some orders of two classes	Dicotyledoneae and Monocotyledoneae (mostly herbs)
Gen. 1:21	Aquatic animals	Several Phyla; a number of classes	
Gen. 1:21	Birds	Class	Aves
Gen. 1:24	Terrestrial animals	Several Phyla; a number of classes	
Gen. 1:24	Cattle	Family	Bovidae
Gen. 1:24	Creeping animals	A number of Classes of different Phyla	
Lev. 11:14	Kite	Family	Elaniae
Lev. 11:15	Raven	Genus	Corvus
Lev. 11:16	Hawk	Family	Accipitrinae (true hawks)
Lev. 11:19	Heron	Family	Ardeidae
Lev. 11:22	Locust	Family	Locustidae
Lev. 11:22	Bald Locust	Species (?)	
Lev. 11:22	Beetle	Order	Coleoptera
Lev. 11:22	Grasshopper	Suborder or Superfamily (includes two families)	Acridiidae and Locustidae (families) (probably former)
Lev. 11:29	Tortoise	Order	Chelonia
Deut. 14:13	Vulture	Family	Cathartidae
Ezek. 47:10	Fish	Superclass	Pisces

(3) A Suggested Solution

What explanation, other than that of Evolution, can be given for the real existence of structural similarity?

The Christian can explain structural similarity between "kinds" on the basis that God, using a relatively small number of fundamental structural patterns, created certain basic "kinds" of plants and animals, each "kind" with a unique combination of a number of features from one or more basic patterns, and each combination of features adapted for life in a particular type of environment.

The Christian can explain structural similarity within "kinds" on the basis that God created each basic "kind" with a potential for an enormous amount of variety; and that this potential for variety has, in the case of a number of the basic "kinds" and in the course of many generations, been partially realized.

Thus, whereas structural similarity between the "kinds" may be explained by the principle of DESIGN WITH MODIFICATION (Immediate Creation), structural similarity within the "kinds" may be explained by the principle of DESCENT WITH MODIFICATION (Mediate Creation).

This explanation could be expressed by the following figure:

Similarity Between "Kinds"	**Similarity Within "Kinds"**
If C1, then SS	If C1, then SS
If SS then DnM	If SS then DtM
C1	C1
Therefore DnM	Therefore DtM

c. Sample quotations of various creationist viewpoints on this aspect

"Unfortunately a great deal of misunderstanding has resulted from use of the term 'evolution' to denote mere improvement of a species or the development of new varieties of the same species. There are many varieties of the same species; for instance, there are different kinds of apples, or the different kinds of pickles. We have within the canine or dog species many varieties: foxes, wolves, and dingoes, from the diminutive Mexican Chihuahua to the massive St. Bernard, or Great Dane, but they are all dogs. So there are many varieties of cats within the feline kind, such as the different breeds of domestic cats: Siamese, Angora, and Maltese, not to mention other members of the family such as lions, leopards, tigers, wild cats, etc. But all are still cats. . . But this is not evolution; this is merely improvement, development, and cultivation.

". . .Not one single proven example of an evolution from one species to another has ever been found . . . .We therefore do not reject an 'evolution' which refers to a development or improvement within the species, but we do reject an evolution which assumes a transgression of the basic, inviolable law of Cod, 'Let it bring forth after its kind.'

"Science today itself defines a species as a group capable of reproducing offspring of any two parents . . . .Since members of different species (kinds in Bible language) do not interbreed, there can be no evolution. Without a change or production of a

new species, there can be no evolution; therefore, the theory of evolution is not only unscriptural but it is utterly unscientific, unproven and contrary to all scientific facts and logic.

-- M. R. De Haan, *Evolution or Creation* (booklet), 1962, pp. 5-7

"The present writer regards a species as a group of members which can freely interbreed and produce fertile offspring.

"Animal species, as God created them, have a tremendous power of variation, or of producing new forms.

"Hence all dogs, wolves, coyotes, Jackals and dingoes (all of which are perfectly interfertile) needed to have only one pair to represent them in the ark. Judging also from cross-breeding relations which are known to exist, it is quite likely that all lions, tigers, pumas, leopards, Jaguars, wildcats, ocelots, and other 'cats' were all represented in the ark by a single pair . . . .A single pair of cattle represented all types of cattle, and so on. Not every variety of species was in the ark, but only a representative pair out of which an enormous variety of forms could come."

-- Byron C. Nelson, *The Deluge Story in Stone* (Minneapolis: Augsburg Publishing House, 1931), pp. 156,157.

"I do not assert that every species, or every genus, or, even, every family has been especially created. I do not know what the units of creation are; it may be that they do not exactly coincide with any of the present systematic categories."

-- Douglas Dewar, "Some Recent Literature Concerning Evolution," (series of articles) Sunday School Times 1916 (88:6, 88:7, 88:8, 88:9)

"The theory of a common mind back of the similarities of the organic world seems far more logical than the theory of descent, especially if we hold, as the present writer does, that in many cases the species or even genera are descended from common original types created by God . . . .All the common similarities between species can be accounted for on the theory that God created certain 'kinds', and that these kinds broke up into the various species as we have them in the world today.

". . . even the most conservative Christians could find the view of a progressive creation of various forms of life over successive geological ages, in harmony with the Bible."

-- F. E. Hamilton, The Basis of Evolutionary Faith (London: James Clarke & Co., 1931), pp. 149, 150, 195.

"As we have said before, similarity often does show relationship, but the question in point concerns how far this relationship can be carried. From evidence found in other fields we are led to believe that plants and animals in the same family, genera, or species may often have developed from some common ancestral type.

This is the reason for many of the similarities of structure and the reason why they may well be put into the same classification group. However, the same cannot be said of the larger groups such as the phyla, classes and orders. The other reason for this similarity, as we mentioned before, is that there may have been a common plan in the mind of God when He designed them."

-- Cora A. Reno, *Evolution Fact or Theory* (Chicago: Colportage Library. 1953), p. 54.

B. The Evidence from Recapitulation

1. The Argument Stated

Ontogeny is the development of the individual organism from its beginning in the egg to the attainment of the adult condition. Phylogeny is the ancestral history of the species. The recapitulation theory holds that the individual development (ontogeny) is an abbreviated repetition of the ancestral history of the species (phylogeny). Thus the argument "ONTOGENY RECAPITULATES PHYLOGENY."

"it is a very remarkable fact that all of the vertebrated animals, fishes, amphibians, reptiles, birds and mammals, however different their habits and modes of life, have a mode of ontogeny which is of even more characteristically and unmistakably the same plan than is the type of their adult structure, which was described in the last chapter. The egg, or the active portion of it, divides in a definite and regular manner into a very large number of cells, which arrange themselves in definite layers, an outer and an inner, and within these layers cell-aggregates form incipient organs, which, step by step take on the adult condition. Not only is the plan and type of development essentially similar throughout the whole phylum of the vertebrates, but, in accordance with the recapitulation theory, many structural features which are permanent in lower forms appear in the embryos of higher and more advanced types. In the latter, however, these features are transitory and, in the course of development, they either disappear, or are so modified as to be very different, sometimes unrecognizable, in the adults.

"It can hardly be contended that these rudimentary structures, which are confined to the embryonic stages of development and of which no trace remains in the adult, are so indispensable to the processes of ontogeny, that they were specially created to serve this temporary purpose. For such a contention there is not a particle of evidence and the theory of evolution, which regards these structures as useless remnants, due to inheritance from ancestors in which the structures are functional, offers much the most satisfactory solution of the problem that has yet been suggested.

"An analogy employed by my lamented friend, Mr. Richard Lydekker, may be advantageously repeated here. Let us suppose that a screw-steamer, with longitudinal shaft leading aft from the engine-room to the stern, where it carries the propeller, should, on close examination, reveal many signs that it has originally been a 'side-wheeler,' or paddle-boat. Recognizable remnants of paddle-boxes, of bearings for a transverse

shaft, and the like, are found; what would be the inevitable conclusion? No one would maintain that a naval architect, in possession of his senses, in constructing a screw-steamer would deliberately introduce features which are useful and appropriate only in a paddle-boat. The only reasonable explanation would be that the vessel had originally been built as a paddle-boat and had subsequently been converted into a screw-steamer and in the conversion it had not been found necessary completely to eradicate all traces of the original construction. Obviously, the same reasoning applies to rudimentary organs. The only satisfactory explanation of such useless remnants is that their possessors are descendants of ancestors in which those organs were fully functional. It seems quite absurd to assume that, in a separately and specially created animal, useless structures, reminiscent of other animals in which the same structures are useful and valuable, should be included, merely to indicate ideal relationships and community of plan."

-- W. B. Scott, quoted by Horatio Hackett Newman, *Evolution Genetics and Eugenics* (Chicago: The University of Chicago Press, 1956), pp. 114-23.

2. The Evidence Adduced to Support the Evolutionist Interpretation

"The embryonic development is from the beginning up to a certain point practically alike, looked at in its larger aspect, for all the many-celled animals. That is, there are certain principal or constant characteristics of the beginning development which are present in the development of all many-celled animals.

"The cells which compose the embryo in the cleavage stage and blastoderm stage, and even in the gastrula stage, are apparently all similar; there is little or no differentiation shown among them. But from the gastrula stage on, development includes three important things; the gradual differentiation of cells into various kinds to form the various kinds of animal tissues; the arrangement and grouping of these cells into organs and body parts; and finally the developing of these organs and body parts into the special condition characteristic of the species of animal to which the developing individual belongs. From the primitive undifferentiated cells of the blastoderm, development leads to the special cell types of muscle tissue, of bone tissue, of nerve tissue; and from the generalized condition of the embryo in its early stages, development leads to the specialized condition of the body of the adult animal. Development is from the general to the special, as was said years ago by von Baer, the first great student of development.

"A starfish, a beetle, a dove, and a horse are all alike in their beginning -- that is, the body of each is composed of a single cell, a single structural unit. And they are all alike, or very much alike, through several stages of development; the body of each is first a single cell, then a number of similar undifferentiated cells, and then a blastoderm consisting of a single layer of similar undifferentiated cells. But soon in the course of development the embryos begin to differ, and as the young animals get further and further along in the course of their development, they become more and more different until

each finally reaches its fully developed mature form, showing all the great structural differences between the starfish and the dove, the beetle and the horse. That is, all animals begin development apparently alike, but gradually diverge from each other during the course of development.

"There are some extremely interesting and significant things about this divergence to which attention should be given. While all animals are apparently alike structurally at the beginning of development, so far as we can see, they do not all differ noticeably at the time of the first divergence in development. The first divergence in development is to be noted between two kinds of animals which belong to different great groups or classes. But two animals of different kinds, both belonging to some one great group, do not show differences until later in their development. This can best be understood by an example. All the butterflies and beetles and grasshoppers and flies belong to the great group or class of animals called *insecta*, or insects. Another great group of animals is known as the *Vertebrata* or backboned animals. . .Now, an insect and a vertebrate diverge very soon in their development from each other; but two insects, such as a beetle and a honeybee, or any two vertebrates, such as a frog and pigeon, do not diverge from each other so soon. That is, all vertebrate animals diverge in one direction from the other great groups, but all the members of the great group keep together for some time longer. Then the subordinate groups of the Vertebrata, such as the fishes, the birds, and the others, diverge, and still later the different kinds of animals in each of these groups diverge from each other.

"The significance of the developmental phenomena is a matter about which naturalists have yet very much to learn. It is believed, however, by practically all naturalists that many of the various stages in the development of an animal correspond to or repeat, in many fundamental features at least, the structural condition of the animal's ancestors. Naturalists believe that all backboned or vertebrate animals are related to each other through being descended from a common ancestry, the first or oldest backboned animal. In fact, it is because all these backboned animals -- the fishes, the batrachians, the reptiles, the birds, and the mammals -- have descended from a common ancestor that they all have a backbone. It s believed that the descendants of the first backboned animal have in the course of many generations branched off little by little from the original type until there came to exist very real and obvious differences among the backboned animals -- differences which among the living backboned animals are familiar to all of us. The course of development of an individual animal is believed to be a very rapid and evidently much condensed and changed recapitulation of the history which the species or kind of animal to which the developing individual belongs has passed through n the course of its descent through a long series of gradually changing ancestors. . .If this is true, then we can readily understand why a fish and a salamander, a tortoise, a bird, and a rabbit, are all much alike, as they really are, in their earlier stages of development, and gradually come to differ more and more as they pass through later and later developmental stages."

-- D. S. Jordan and V. L. Kellogg, quoted by Horatio Hackett Newman, *Evolution Genetics and Eugenics* (Chicago: The University of Chicago Press, 1956), pp. 106-112.

"Embryology, or developmental anatomy, is a highly specialized branch of anatomy, and comparative embryology furnishes such important evidence for evolution that Darwin referred to it as 'second to none in importance.' Ernst Haeckel brought this field into prominence in the immediate post-Darwinian period by the development of his Biogenetic Law, which states that 'Ontogeny recapitulates phylogeny.' Paraphrased, this simply means that embryos, in their development, repeat the evolutionary history of their ancestors in an abbreviated form. Described in outline according to this concept, the ontogeny of man indicates a long and complicated history. The fertilized egg is a single cell, and so corresponds to a protozoan ancestor. This soon becomes multicellular, and corresponds to a primitive metazoan grade of construction. Upon gastrulation, the embryo is coelenterate-like, but it soon reaches a triploblastic grade of construction comparable to the Platyhelminthes, or better, to the Nemertinea. Fundamental chordate characters (dorsal nerve tube, notochord, and pharynx specialized for respiration) are then developed. Fish-like characters are developed, such as gill slits and aortic arches, and a fish-like kidney (first a pronephros, then a mesonephros). Later tetrapod characters are developed, such as the pentadactyl type of limb, and a metanephric kidney. Finally mammalian, then primate, and at last specifically human characters appear . . .

"All vertebrate embryos develop a series (most commonly six) of aortic arches, each of which runs unbroken from the ventral aorta to the dorsal aorta, much as in adult Amphioxis. In the fishes, these arches are modified in several ways, all of which involve the separation of each aortic arch into a ventral efferent branchial artery and a dorsal efferent branchial artery, the two being connected by a capillary network in the gill filaments. In the Choanichthyes, the group of fishes most closely related to the Amphibia, the first arch drops out, and is largely missing in the adult, but its ventral and dorsal roots, together with new growths from them, form the major arteries of the head (the external and internal carotids.). The sixth arch has given rise to a pulmonary branch which supplies the lungs. This tendency for parts to drop out after having been formed in the embryo, and for the remaining parts to be diverted to completely different functions from the original purely respiratory function, is the principal factor in the embryology of this part of the circulatory system of all tetrapods. Among the urodeles, the main portions of the first and second arches drop out, so that now the carotids arise from the third arch. The third arch is broken by a capillary network early in development, but it soon becomes continuous again. The forsal connection between arches three and four disappears, with the result that the ventral connections now appear as common carotid arteries on either side, while the two fourth arches now supply the major circulation to the body. The fifth arch becomes reduced in size and may be lost altogether, while the sixth arch again gives rise to a pulmonary branch. In the Anura and in the reptiles, this process goes a little farther, with the fifth arch being lost completely and with the dorsal part of the sixth arch being lost, so that all of the blood entering the sixth arch must go into the pulmonary artery. The birds have essentially the reptilian system, with, however, the left fourth aortic arch degenerating, thus leaving the right fourth arch to carry the entire systemic circulation. In the mammals, it is the right fourth arch which degenerates and the left one which persists. Thus, of the six original pairs of aortic arches, only three persist in the highest classes of vertebrates. . . Arch three serves the head region, arch four

(but only one of the pair) serves the systemic circulation, and arch six serves the lungs. Yet all six pairs are developed in the embryos of birds and mammals.

"A similar story could be told with respect to almost any organ system in any major group. The details differ, but the general facts are the same. When, in the course of embryonic development, a new organ system is formed, its structure is closely similar even in the most widely dissimilar species of the same class, or even phylum in many instances."

-- Edward 0. Dodson, *A Textbook of Evolution* (Philadelphia: U. B. Saunders Company, 1952), pp. 56-61.

"At a certain stage of the ontogeny the embryo of a mammal has gill-pouches like fish, the skeletal supports of the gill-pouches, the arteries and veins which supply them with blood, the structure of the heart, in short, the entire plan of the circulatory system is fish-like. At a later stage most of the gill-pouches have been obliterated, but one is retained and converted into the Eustachian canal, which connects the throat with the middle ear, inside of the eardrum. Similarly, the embryological evidence shows that the lungs of air-breathers have been derived from the swim-bladder of fishes, a conclusion which had already been reached by comparative anatomy, for in a remarkable group, known as the Dipnoi or lung-fishes, the air-bladder s utilized for purposes of respiration.

"Vestigial or Rudimentary Organs

"Another very persuasive aspect of comparative anatomy concerns vestigial or rudimentary organs. These are dwarfed and generally useless organs which are found in many plants and animals, relatives of which may have the same organ in a fully developed and functional condition. Perhaps the most widely known example is the vermiform appendix of man. This small structure is without any known function in man, and it is notorious as a seat of disease. In other Primates, however, this organ is considerably larger than in man. And in mammals which eat a coarse diet, involving considerable amounts of cellulose, the appendix and cecum form a large sac in which mixtures of food and enzymes can react for long periods of time. The appendix of man is easily understandable as a degenerating legacy from ancestors with a much coarser diet; but it is inexplicable why a useless and disease-ridden structure should have been created especially to plague him.

"Weidersheim has listed nearly 100 such vestigial characters in man, and a few more of these may be discussed. In the inner corner of the eye of all vertebrates there is a transparent membranous fold, the nictitating membrane. In most vertebrates, this 'third eyelid' can be swept clear across the eyeball to cleanse the latter, much like the blinking of a mammal. In birds, the nictitating membrane is particularly well-developed. Its use can be easily observed if a captive owl is watched by daylight. But in mammals, it forms a mere crescentic fold at the Inner corner of each eye. This rudiment has no known -- or probable -- function. It Is understandable, like the vermiform appendix, only as a degenerating inheritance from an ancestral line to which the nictitating membrane was actually useful, as it now is to the majority of vertebrates. The ear muscles of man present a similar situation. Many mammals are able to move the external ear freely in order to detect sounds efficiently. The complete muscular apparatus for these movements is present in man, but the muscles are quite vestigial. While school

boys sometimes pride themselves on their ability to wiggle their ears, no one has suggested that the ability has any real usefulness, and even this limited ability is not shared by everyone, the presence of these muscles, then, suggests descent from an ancestor to which the muscles were really useful.

"Similarly, the majority of mammals have a well-developed tail. In all of the higher Primates, the tail is lacking. But it is represented in these organisms by a variable number, from three to five in man, of incompletely formed caudal vertebrae. Usually, no rudiment of the tail appears externally, but rarely a fleshy tall, lacking vertebrae, does extend a few inches beyond the caudal vertebrae. Whether or not an external tall is present, the same muscles which, in other mammals, move the tall are also present in all of the Primates.

"A final example from man concerns the Wisdom teeth. The wisdom teeth, or third molars, are the posterior-most teeth, as well as the last to erupt. In other Primates, these teeth are as sound and as fully developed as the rest of the dentition. But in man, they are far more variable than are the other teeth with respect to size and time of eruption. Frequently, they fail to erupt altogether. And when they are present, they are far more subject to all types of dental defect than are the other teeth. Thus it is probable that these teeth should be regarded as vestigial, and, in view of the frequency with which they fall to erupt, that they will in time be completely lost to man.

"Many examples of vestigial characters may also be found among lower animals. The external ears of whales are completely of the type to be expected of a terrestrial mammal, but they are much reduced in size, and it seems unlikely that they are efficient auditory organs. Also among the whales, the hind limbs are completely missing, yet in some species rudiments of the pelvic girdle still remain, but these have lost their connection to the vertebral column. In ungulates (horse, deer, and other hoofed animals), the smaller bone of the lower rear leg, the fibula, has been reduced to a mere splint on the larger bone, the tibia. A similar reduction of the fibula has occurred in the birds. Perhaps no feature of the anatomy of snakes is so generally known as their leglessness. So far as the forelimbs are concerned, no snake shows any vestige. In the majority of snakes, the same is true of the hind limbs, but some, including the pythons and boas, have small, ineffective rudiments of the hindlimbs. These are capped by claws which show externally, but they are so reduced that they appear at a glance as scarcely more than raised scales.

"Many animals, both vertebrates and invertebrates, have become adapted to life in deep caves, where the light of the sun never reaches. Living thus in perpetual darkness, there is no adverse selection against degenerative changes of the eyes, and in fact blindness is a general characteristic of such cave dwellers. Their eyes show all degrees of degeneration from just short of the typical functional condition to complete absence of the eyes. Examples include the blind, cave-dwelling salamander of central Europe, Proteus Anguineus the many species of cave-dwelling fishes of the United States as well as other parts of the world; and the blind crayfishes. The latter have eyestalks which do not, however, bear eyes. While such degenerated eyes are easily understandable on the basils of descent from ancestors with functional eyes, their presence is inexplicable, indeed it is contradictory, by any other theory."

-- Edward O. Dodson, *A Textbook of Evolution* (Philadelphia. W. B. Saunders Company, 1952), pp. 525e.

"During the past century, the German biologist Ernst Haeckel proposed that developing embryos retrace the evolutionary history of their species. For example, say that a reptile represents a third major stage in evolutionary development and that a bird represents a fourth, more advanced stage. Haeckel proposed that an embryonic bird would retrace all three earlier stages and then proceed to the fourth stage. Likewise, human embryos were thought to pass through all of the stages representing less sophisticated creatures and to add to their development a fifth or sixth stage. This idea, called the 'principle of recapitulation' and later the 'law of biogenesis', was extremely popular until well into the twentieth century. Textbooks commonly expressed this principle by saying that 'ontogeny recapitulates phylogeny' or, in simpler terms, that 'the development of an individual (ontogeny) retraces the evolutionary descent of the entire species (phylogeny).' The concept is an over-simplification, however; and today it is only historically significant. Today, the important point about recapitulation is that all vertebrate embryos pass through similar developmental phases, which suggests a strong evolutionary relationship."

-- Jack A. Ward & Howard R. Hetzel, *Biology Today & Tomorrow* (St. Paul, Minnesota: West Publishing Company, 1980)) p. 214.

"Drawing parallels between development and evolution was much in vogue a century ago -- as captured in the tongue-twisting slogan still memorized by students, 'Ontogeny recapitulates phylogeny.' But interest shifted away from development in the period following the widespread acceptance of Darwin's theory of evolution. To scientists who viewed an adult organism as a set of optimized parts comprising the best possible design, development was irrelevant, explains Stephen J. Gould of Harvard's Museum of Comparative Zoology.

"Now, a rebirth of interest in embryology has occurred among biologists who think about evolution, and many of them are beginning to believe once again that important clues to the evolution of a living organism lie in its development. While scientists are not readapting the exact rule that a developing organism works its way through ancestral forms, biologists armed with new analytic methods are resurrecting the spirit underlying the ontogeny-phylogeny motto.

"The philosophical shift that has renewed interest in embryology is a concern for large and relatively sudden changes that take place in evolution. Darwin and his followers occasionally admitted that major, discontinuous changes occur, but the emphasis was squarely on natural selection among small changes and thus gradual evolution. Now many scientists believe that a species spends most of its existence in a steady state; the small changes are generally fluctuations that don't build into a trend. And the major changes which can create a new species, all crowd into a relatively short period. Then the discontinuous change creates a 'hopeful monster,' which can adapt to a new mode of life.

"'Both modes of evolution occur in nature; there is a full continuum from gradual to punctuated,' says Tony Hoffman, a paleontologist from Warsaw. While most of the scientists at the meeting agreed, each holds a strong opinion about which end of the spectrum is the most important, and that opinion influences his or her choice of research topic.

"'Embryology is now mainline biology again,' says Gould, who was one of the originators of the evolutionary mode) called 'punctuated equilibrium'.

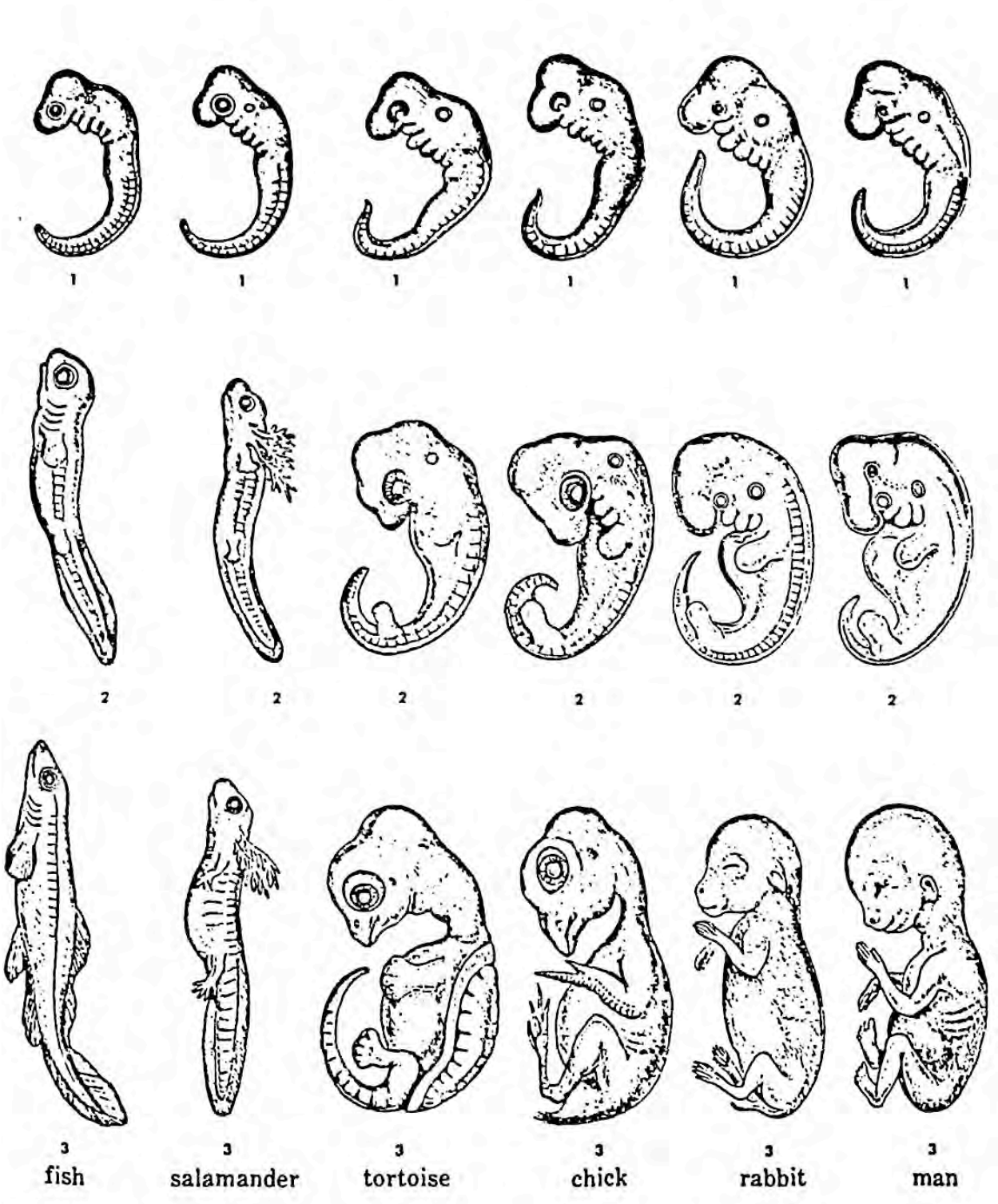


Fig. 16.15. A comparison of vertebrate embryos at three stages of development. [Reprinted from C. J. Romanes, Darwin and After Darwin, Open Court Publishing Co., 1901.]

Focus on sudden change in evolution provokes interest in biological development for several reasons. One is that changes in an organism's development can be envisioned as a mechanism by which a small genetic change can be amplified into a major difference in the adult. A small genetic change that delays or enhances pigmentation early in development of a moth, for example, can cause large differences in the color pattern of the fully grown caterpillar. Delayed metamorphosis may be the origin of the axolotl, which reproduces in a form resembling a salamander tadpole. And prolonged brain growth may be the major difference between monkey and human brain size."

-- Julie Ann Miller, "Evolution: Return of the Embryo," in *Science News* Vol. 120: July 4, 1981, p.12.

3. A Creationist Interpretation of the Data

"In view of the resemblances between adult animals, one would expect their embryos to be similar also. For development to occur at all, it must begin with a single cell fertilized by a sperm. The processes leading to the differentiation of the germ layers are fundamentally the same in all animals as also are processes which produce the organs.

"All vertebrates are characterized by a dorsal nerve cord, an internal skeleton and 'gill slits opening from the throat to the outside or touching the outside wall in at least the developmental stages.' In the human embryo, 'the ectoderm of each groove and entoderm of its complementary pouch then meet and unite; the thin plates thus formed only rarely rupture and complete the gill slit condition.' Associated with these pouches are blood vessels, muscles, cartilaginous arches and grooves entering between the arches from the outside. A study of the derivatives of the gill arches will convince one that practically all of the material which becomes gills in a fish is used for the construction of certain of the structures of the throat region in man. A common plan is followed in all vertebrates and modified for the needs of the developing individual and the fully formed organism. This common plan may be attributed to descent from an ancient vertebrate or to a Creator who uses the same fundamental process for all vertebrates but varies it at will for specific purposes

"Such modification of a common plan to the needs of the organism surely could be the result of thought. Each class of vertebrate, whether fish, amphibian, reptile, bird or mammal, has an efficient circulation. Creative activity is not bound to make an entirely different arrangement of blood vessels for each class. It has done well if it makes an efficient arrangement. if certain of the blood vessels are found only for a short time in the embryo and then degenerate, one need not say this is to a Creator's discredit. Rather let him notice that the Creator is more sparing of His plans than of material."

-- Russell L. Mixter, *Creation and Evolution* (Monograph Two of the American Scientific Affiliation, 1953), p. 11.

"An organ which remains undeveloped in the adult is celled vestigial. Creationists have felt that vestigial organs are evidence of degeneration in animals whose former condition was nearer perfection . . . 'Genesis 3:14 may be interpreted as perhaps implying that there was a time when the snake did not crawl in the dust but walked.' (F.E. Hamilton) 'The

existence of true vestiges . . . is not inconsistent with the theory that every main organic type has been specially created end that some types have degenerated.' (0. Dewar) On the other hind vestigial structures are held by evolutionists to indicate relationship.

"Actually not all organs claimed to be vestigial are useless. 'It is not well to call an organ functionless prematurely and it has ever been the history. of anatomy to discover new functions for so-called vestigial structures -- witness the present interest in the endocrine glands.' (W. Shumway) 'So many of the so-called vestiges of embryology may prove to play leading roles in the development of the individual.' (W. Shumway)

"The appendix, generally regarded as vestigial, is a pouch ending blindly at the beginning of the large intestine. In the same position, an adult rabbit has a caecum nearly a foot long in which vegetable material ferments in order to be more completely digested. But the human appendix averages 3 1/2 inches, although it may be absent or as long as 9 inches. Its cavity is too small to permit digestive activity within it. It produces a slight amount of digestive fluid. There are many lymphocytes in the connective tissue. One opinion of the function of lymphocytes is that they are the stem cells from which arise all other types of blood cells, both red and white. It may be that a convenient supply of these cells at the beginning of the large intestine is helpful in combating the action of the numerous bacteria found there. To be sure, the appendix becomes inflamed, necessitating removal. In this, it shares the lot of nearly all the parts of the body, for scarcely any organ is free from the possibility of infection. The appendix may not even be a vestigial structure. In a review of the book *Up From the Ape* by Hooten, William L. Straus, Jr. has commented that 'There is no longer any Justification for regarding the vermiform appendix as a vestigial structure.'

"The coccyx . . . 'corresponds to the tail vertebrae of other mammals. It is much reduced in size.' (A.F. Shull) To it are attached two muscles (levator ani and sphincter ani) which act as a cradle for the pelvic contents, constrict the anal opening and assist in the expulsion of the fecal mass. A portion of the heaviest muscle of the thigh is attached to the coccyx, as well as a rudimentary muscle (coccygeus) which assists one of the cradle muscles in upholding the pelvic floor. 'in rare instances the coccyx is overdeveloped and produces a tall-like projection.' (A.F. Shull) 'Specimens as long as 3 inches have been recorded in the newborn; most of these are soft and fleshy, but a few have contained skeletal elements.' (L.B. Arey) In a motion picture made by Dr. P. Kenneth Gieser, there was a Chinese baby with a very evident tail. But should it be presumed that because a part of the body was developed in a manner resembling some animal, that the body is therefore derived from that animal? There are abnormalities of the bodily development that cannot be taken to refer to any ancestral condition, but are merely disarrangements-of the embryological process. To what ancestor does hair-lip point? Are we descended from an animal with an open-roofed skull and virtual absence of brain because the human newborn occasionally has the anomaly called cranioschisis? Because the limbs may fail to develop, were our ancestors limbless? There are no criteria for judging whether an anomaly points to inheritance from a remote ancestor or to a deranged development.

"The external ear muscles are considered vestigial by evolutionists. One extends from the skull to the ear and covers the posterior auricular vessels and nerve; the other two go from the ear to the tough connective tissue of the scalp. These muscles and the epicranius muscle aid in

keeping the scalp tense. This is necessary because where the scalp is not attached to the skull directly by connective tissue, It is held by muscle. Another suggested use for the external muscles is that the ear has an Increased blood supply by way of them.

"The slender red crescent at the inner corner of the human eye called the semilunar fold resembles the third eyelid found in both birds and some modern reptiles. Birds are not in our ancestry, and 'we do not really know whether the paleozoic reptiles possessed this particular feature, or not. At any rate, the fold serves to regulate the flow of tears.' (G.B. O'Toole)

"The hind legs of whales are so reduced that In some species they do not appear on the surface. Regarding them Hamilton asks, 'Suppose a whale originally had hind legs. Does that mean that it Is a descendant of reptiles who walked on land? Perhaps. But is It not more reasonable to suppose that such rudimentary bones were used In a fin as a means of swimming and that such a fin was later on lost through a mutation? There is no reason for thinking that because the animal possessed such organs it was ever anything but a whale. As for the snake, the same thing can be said.' Examples are known of the loss of limbs by mutations. Snyder pictures a family In which the father and children have neither hands nor feet. (L.H. Snyder) Vestigial wings are not descended from a long series of species whose wings gradually became smaller; the transition occurred in one species by a germinal change that caused reduction of wings in one generation.

"The splint bones at the sides of the feet of horses recall the ancestral condition in which there were at least four toes.' (A.F. Shull) The splints are vestiges, but also structures serving useful purposes. These, as Hayes points out, (1) strengthen the leg, (2) serve as an attachment for certain muscles, (3) in conjunction with the cannon bone form a groove in which lies the upper part of the suspensory ligament -- an elastic brace supporting the fetlock and counteracting the effects of weight."

-- Russell L. Mixter, *Creation and Evolution* (Monograph Two of the American Scientific Affiliation, 1953), pp. 11-13.

"There are several unanswered questions in this whole line of reasoning. First, if the developing embryo is supposed to re-enact the stages in the evolutionary history of the race, why are so few stages included? Why should we find some of them appearing in the wrong order? Why should we not find thousands of steps, rather than only a few? Why does the embryo go through some steps that could not possibly have been included in the evolutionary history of the animal? How can such stages as the egg, larva, pupa, and adult stages of a butterfly be explained? Why do only some parts of the embryo show recapitulation and other parts never show it?

"However, there are likenesses. But some of those noted by evolutionists are only superficial: in spite of the apparent similarities, each embryo invariably develops into the kind of individual from whose egg it came. Chicken eggs develop into chickens, and frog eggs develop into frogs.

"The real likenesses can be attributed, as in the adult, to the fact that the Maker followed a general plan, with modifications, to fit the particular need of each animal. As was pointed out in connection with similarities of adults, similarities among embryos might just point to a

common plan in the mind of God.

"Just because we do not know the function of some part of the body is no reason for stating that it is useless. Some organs that were thought for years to be useless have been found useful in the embryo. If any part functions in the developing animal, even though it may not in the adult, it cannot be called vestigial. Our list of 'useless' structures decreases as our store of knowledge increases.

"Some of these organs . . . might have degenerated from a more perfect condition."

-- Cora A. Reno, *Evolution Fact or Theory* (Chicago: Moody Press, 1953), pp. 69, 66, 67743, 50.

The argument from recapitulation may be stated as follows:

If ES, then ER
If ER, then GR
ES
Therefore GR

where:
ES = embryonic similarity
ER = embryonic recapitulation
GR = genetic relationship

Of course, the conclusion (ES, therefore GR) is simply a restatement of the principle of homology on the embryonic level of similarity. And the principle of homology, above a certain level of classification, is a postulate an assumption a first principle that is chosen rather than proved and established!

From a creationist stance, the argument from recapitulation may be countered with the following two facet argument:

If ES, then DnM and
If ES, then DtM
ES
Therefore DnM; Therefore DtM

where:
ES = embryonic similarity
DnM = design with modification
DtM = descent with modification.

in this argument, some embryonic similarity is explained on the basis of design with modification (God designed, e.g., various vertebrates with a basic design configuration, and modified that configuration for various forms); other embryonic similarity is explained on the basis of descent with modification (some vertebrate embryos are similar because they are genetically related).

The part of the argument from recapitulation that pertains to vestigial organs may be countered by the observation that 'as our knowledge increases, our stock of useless organs decreases." The over 100 useless organs in man once enumerated by Weidersheim has been decreased to five or six, end it is by no means certain that these are vestigial. To illustrate this point, note the following excerpt from an article in Newsweek of November 8, 1965:

TONSILLECTOMY -- IN OR OUT?

Doctors used to take out tonsils at the first flush of a sore throat. Those two small clumps of spongy pink flesh lying on either side of the throat, so the doctrine went, were nothing more than traps for germs and a constant source of trouble. Nowadays, doctors are losing their contempt for tonsils as expendable tissue; last week, in fact, a University of Minnesota investigator presented evidence that, in childhood at least, the tonsils may be vital organs.

At the annual meeting of the American Academy of Pediatrics in Chicago, Dr. Robert A. Good suggested that during infancy the tonsils help establish the body's ability to produce disease-fighting antibodies. In experiments with chickens, Good found that the thymus, a gland in the chest, seems to trigger the development of immunity, and plays a special role in teaching the tissues how to produce certain needed antibodies in the cells. Another organ, called the bursa of Fabricius, is responsible for the animal's ability to produce "circulating" antibodies in the blood. Experimental removal of either organ in the young animal, said Good, produces "an immunologic cripple."

Such findings, Good believes, have important application to humans. He is convinced that the tonsils are the human equivalent of the chicken's bursa. Both the tonsils and bursa, he notes, develop embryologically from the intestine and share similarities in structure. in trying to relate the tonsils to disease in humans, the Minneapolis physician has studied children with an inability to produce antibody-carrying gamma globulin. In some he found the tonsils were poorly developed.

In the normal child, Good believes, the tonsils have probably completed the task of initiating the production of circulating antibodies by the age of 5. But he argues that until more is known about the role the tonsils play, tonsillectomies should not be done indiscriminately at any age. "We should be extremely conservative," he told the pediatricians in Chicago, "in dealing with these systems which we do not understand."

C. THE EVIDENCE FROM BLOOD PRECIPITATION (SEROLOGY)

1. The Argument Stated

In 1904, G. H. F. Nuttall of Cambridge University published the results of his experiments in blood precipitation as an indicator of blood (and therefore genetic) relationship. He reported that the strength of the chemical reaction in each experiment was very closely related to the nearness of genetic relationship (as previously determined by comparative anatomy and paleontology). Thus blood tests were viewed as bringing very strong confirmation to the theory of evolution, even coming as near to giving a definite demonstration of the theory as was likely to be found.

2. The Evidence Adduced to Support the Evolutionist Interpretation

"Ordinary chemical analysis is unable to determine the differences in blood-composition between various animals, but that there were important differences had long been understood. This was shown by the fact that, in performing the operation for the transfusion of blood, it was not practicable to substitute animal for human blood, since the former might cause serious injury to the patient.

"The precipitation method of making blood tests is as follows: Freshly drawn human blood is allowed to coagulate or clot, which it will do in a few minutes, if left standing in a dish, and then the serum is drained away from the clot. Blood-serum is the watery, almost colorless part of the blood, which remains after coagulation. Small quantities of this serum are injected, at intervals of one or two days, into the veins of a rabbit and cause the formation in the rabbit's blood of an antibody analogous to the anti-toxin which is produced in the blood of a horse by the injection of diphtheria virus. After the last injection the rabbit is allowed to live for several days and is then killed and bled, the blood is left until it clots and the serum drained off and preserved. The serum obtained thus from a rabbit is called 'anti-human' serum and is an exceedingly delicate test for human blood, not only when the latter is fresh, but also when it is in the form of old and dried blood-stains, or even when the blood is putrid. Stains, for example, are soaked in a very weak solution of common salt and, if necessary, the blood solution is filtered until it is quite limpid and clear. Into the blood solution a few drops of the anti-human serum are conveyed and, if the stains are of human blood, a white precipitate is formed and thrown down, but if the stains are of the blood of some domestic animal, such as a pig, sheep, or fowl, no such reaction follows. In the same manner as above described, we may prepare anti-pig, anti-horse, anti-fowl, etc., etc., sera by injecting the fresh-drawn serum of a pig, horse, fowl, or any other animal into the rabbit, instead of human blood-serum, in some countries, notably in Germany and Austria, this test has already been adopted by the courts of justice and has been found extremely useful in the detection of crime.

"Further investigation showed that these blood tests might be employed to determine the degrees of relationship between different animals, for, although a prompt and strong reaction is usually obtained only from the blood of the same species as that from which the original injection into the rabbit was taken, the blood of nearly allied species, such as the horse and donkey, for example, gives a weaker and slower precipitation. By using stronger solutions and allowing more time, quite distant relationships may be brought out. Nuttall and his collaborator, Graham-Smith, made many thousands of such experiments bearing upon the problems of relationship and classification and it is of great significance to note that their highly interesting and important results contain few surprises, but, in almost all cases, merely serve to confirm the conclusions previously reached by other methods, such as comparative anatomy and palaeontology. It will be instructive to quote some of these results, the quotations being taken from 'Blood Immunity and Blood Relationship,' by G. H. F. Nuttall, including Original Researches by G. L. Graham-Smith and T. S. P. Strangeways, Cambridge, 1904.

"'In the absence of paleontological evidence the question of the interrelationship amongst animals is based upon similarities of structure in existing forms. in Judging of these similarities, the subjective element may largely enter.' 'The very interesting observations upon the eye made by Johnson also demonstrate the close relationships between the Old World forms and man, the macula lutea tending to disappear as we descend in the scale of New World Monkeys and being absent In the Lemurs. The results which I published upon my tests with precipitins directly supported this evidence, for the reactions obtained with the bloods of Simiidae (i.e., Man-like Apes) closely resemble those obtained with human blood, the bloods of Cercopithecidae (Old World Monkeys) came next, followed by those of Cebidae and Hapalidae (New World Monkeys and Marmosets) which gave but slight reactions with anti-human serum, whilst the blood of Lemuroidea gave no indication of blood relationship.' 'A perusal of the pages relating to the tests made upon the many bloods I have examined by means of precipitating anti-sera, will very clearly show that this method of investigation permits of our drawing certain definite conclusions. It is a remarkable fact . . . that a common property has persisted in the bloods of certain groups of animals throughout the ages which have elapsed during their evolution from a common ancestor, and this in spite of differences of food and habits of life. The persistence of the chemical blood relationship between the various groups of animals serves to carry us back into geological times, and I believe we have but begun the work along these lines, and that it will lead to valuable results in the study of various problems of evolution.'

"The genera) conclusions on interrelationships, so far as they are of particular interest for our purpose, reached by Nuttall and Graham-Smith as the result of many thousands of blood tests, may be summarized as follows:

"1. If sufficiently strong solutions be used and time enough be allowed, a relationship between the bloods of all mammals is made evident.

"2. The degrees of relationship between man, apes, and monkeys have already been noted.

"3. Anti-carnivore sera show 'a preponderance of large reactions amongst the bloods of Carnivora, as distinguished from other Mammalia; the maximum reactions usually take place amongst the more closely related forms in the sense of descriptive zoology.'

"4. Anti-pig serum gives maximum reactions only with the bloods of other species of the same family, moderate reactions those of ruminants and camels, and moderate or slight reactions with those of whales. Anti-llama serum gives a moderate reaction with the blood of the camel, and the close relationship between the deer family and the great host of antelopes, sheep, goats and oxen is clearly demonstrated.

"5. Anti-whale serum gives maximum reactions only with the bloods of other whales and slight reactions with those of pigs and ruminants.

"6. A close relationship is shown to exist between all marsupials, with the exception of the Thylacine, or so-called Tasmanian Wolf.

"7. Strong anti-turtle serum gives maximum reactions only with the bloods of turtles and crocodiles; with those of lizards and snakes the results are almost negative. With the egg-albumins of reptiles and birds a moderate reaction is given.

"8. Anti-lizard serum produces maximum results with the bloods of lizards and reacts well with those of snakes.

"9. These experiments indicate that there is a close relationship between lizards and snakes, on the one hand, turtles and crocodiles on the other. They further indicate that birds are more nearly allied with the turtle-crocodile series than with the lizard-snake series, results for which palaeontological studies had already prepared us.

"10. 'Tests were made by means of anti-sera for the fowl and ostrich upon 792 and 649 bloods respectively. They demonstrate a similarity in blood constitution of all birds, which was in sharp contrast to what had been observed with mammalian bloods, when acted upon by anti-mammalian sera. Differences in the degree of reaction were observed, but did not permit of drawing any conclusions.'

"11. I have already called attention to the fact that the problematical Horseshoe-crab is indicated by its embryology to be related to the air-breathing solders and scorpions rather than to the marine Crustacea. It is of exceptional interest to learn that embryology is supported by the results of the blood tests.

"it must not be supposed that there is any exact mathematical ratio between the degrees of relationship indicated by the blood tests and those which are shown by anatomical and palaeontological evidence. Any supposition of the kind would be immediately negatived by the contrast between the blood of mammals and that of birds. It could hardly be maintained that an ostrich and a parrot are more nearly allied than a wolf and a hyena and yet that would be the inference from the blood tests. . . The results of blood tests must be critically examined and checked by a comparison with the results obtained by other methods of investigation, but after every allowance has been made, these tests are very remarkable."

-- W. B. Scott, *The Theory of Evolution* (New York: The MacMillan Company, 1917), chapter entitled "Evidence from Blood Tests"

"Comparative Serology. Much the most impressive physiological evidence is drawn from the field of comparative serology. If a small amount of the blood serum of an animal is injected into a guinea pig (or other test animal), the foreign blood acts as an antigen that is, it causes the production in the serum of the guinea pig of antibodies which will precipitate and destroy the antigen if a second inoculation should occur. The guinea pig is then said to be immunized to the kind of blood which was injected. The precipitation reaction will occur in a test tube as well as in the bloodstream. Thus, if one prepares an antiserum from an immunized animal and adds to it a few drops of antigenic serum, a precipitate will be formed. This can be measured by two principal methods. The first of these is the ring test method. A small quantity of undiluted antiserum is placed in a test tube, and diluted antigenic serum is then carefully layered over it. A ring of precipitate then forms at the interface between the two sera. The greatest dilution of the antigenic serum at which a ring is obtained gives a measure of the strength of the reaction, with a high dilution corresponding to a strong reaction. if, however, the two sera are mixed, the precipitate will make the solution turbid, and the photometric measurement of the absorption of light gives an excellent measurement of the strength of the reaction.

". . . If serum from an animal immunized against human blood were divided among five tubes, and serum added from man, an anthropoid ape, an

old world monkey, and new world monkey, and a lemur, the amount of precipitate formed would also decrease in that order. Thus, the results of serological tests support the theories of relationship which were originally based upon comparative morphology. That this should be just a coincidence is not imaginable, yet it is just what would be expected on the basis of Darwin's theory that similar species have been formed by descent with modification from a common ancestor. "The above examples are both taken from among the vertebrates, and indeed this is the group which has been most thoroughly investigated. But extensive studies have also been made in the serological systematics of the Crustacea, Insecta, and Mollusca. Everywhere, the same fundamental result is obtained: animals which had been regarded as closely related on morphological grounds also show close serological affinity. In general, species of a single genus show very close serological similarity; genera of the same family show moderate serological similarity; and families of the same order show slight but detectable similarity. Usually, different orders of the same class show too little similarity to permit useful comparisons, but there are exceptions, especially among the birds, which have diverged less serologically than have other classes of vertebrates."

-- Edward O. Dodson, *A Textbook of Evolution* (Philadelphia: W. B. Saunders Company, 1952), pp. 67-69.

3. A Creationist interpretation of the Data

". . . When we come to examine the tabulated results of Prof. Nuttall's experiments we find that there are many contradictions. The tests with anti-pig serum, for example, which were carried out, quantitatively reveal that the whalebone whale, one species of baboon, the tiger, the African antelope and man give the same amount of precipitation (.003). The anti-serum of hoofed animals (Ungulates) indicated that their nearest relatives were whales but the anti-serum of whales showed that bats were their nearest relatives. Prof. Nuttall himself stated that 'in view of the crudity of our methods, it is not surprising if certain discrepancies may be encountered.'

". . . The similarity between the body fluids of various species affords evidence of design by the one Creator, rather than ancestral relationship."

-- *Evolution* (booklet), 13th Edition, revised (Ontario, Canada: The International Christian Crusade, 1955), pp. 21-22.

Newsweek, March 2, 1964

Blood protein samples from man, gorilla, and gibbon: Evidence that two are closer on the family tree

Blood Brothers

Ten minutes' thoughtful observation of the primates on both sides of the cages at the zoo will reveal the essential similarities among man, chimpanzees, and gorillas. But the closeness of this relationship, which was always subject to some debate, is now being dramatically demonstrated by new and precise methods of inquiry that go beyond visual and fossil evidence. The new evidence not only cements the kinship beyond all doubt but also suggests that man and ape are much closer together on the family tree than originally believed. As chemist Emile Zuckerkandl of Caltech says somewhat wryly, in certain respects "it appears that the gorilla is just an abnormal human, or man an abnormal gorilla."

The new discipline that is producing this evidence is called molecular anthropology—the investigation of man's evolutionary relationships through analysis of the proteins that all animals manufacture within their cells. Because of the intricate composition and distinctive pattern of protein molecules (for example, each albumin molecule contains more than 20,000 atoms) there is no possibility that two completely unrelated animals could possess similar proteins solely by chance. The supposition is, therefore, that similarities in living creatures indicate kinship; the greater the similarity, the closer the kinship.

Techniques: One prime example of the work being done on proteins is contained in a volume just published, entitled "Classification and Human Evolution" *(371 pages. Aldine Publishing Co. $7.50).* Among its contributors is Dr. Morris Goodman, an immunologist at Wayne State University Medical School in Detroit. Goodman began by obtaining blood samples from chimps, gorillas, orangutans, gibbons, man, and other members of the superfamily Hominoidea. These samples were found to contain such proteins as albumin, gamma globulin, and hemoglobin.

To test them, Goodman used a technique called two-dimensional starch-gel electrophoresis, which makes use of the fact that different proteins have different sizes and varying electrical charges. First, a small bit of a protein-bearing plasma is dropped on an ordinary piece of filter paper, which is then stretched between electrodes. After sixteen hours, the different proteins will have migrated toward one or the other pole, depending on their charges. Then the filter paper is placed at one edge of a dish of jellied starch. This time, the proteins migrate not only according to their charge, but also their size: the smaller ones are able to move through the jelly faster than the larger ones (migrating from bottom to top in the diagrams above). The result is a distinct pattern of blood proteins nicely spaced and easily compared among species.

Goodman and other researchers have done countless numbers of these tests, and the results show that so far as the blood proteins go, the apes that evolved in Africa—chimp and gorilla—are much more closely related to man than are the Asian apes—orang and gibbon.

Identical Twins: Caltech's Zuckerkandl notes in the same volume that the amino acids in gorilla and human hemoglobin have now been charted; both contain 146 building blocks, and there is only one point of difference in the two sequences. Throughout all these tests, the African apes and man appear so similar that they could virtually be called blood brothers.

No anthropologist, of course, is ready to classify chimp, gorilla, and man on equal levels in the scheme of nature. Man seems to be unique. But physical anthropologists are uniformly impressed with the molecular studies, and happy because it reinforces their own conclusions reached through imaginative deductions from woefully inadequate fossil evidence. As Sherwood Washburn, University of California anthropologist and editor of the volume, said simply last week: "That settles that. The evidence is overwhelming."

The striking closeness between the African apes and man has also raised another question. Just how long ago did the two species branch off from a common ancestor and go their separate ways? The traditional view has been that the divergence took place in Africa not long after the first apes evolved some 30 million years ago.

The new insight based on the closeness of blood lines suggests that man and chimpanzee took different paths much more recently. Some estimates now put the time of divergence only 5 million years ago, with one branch of the family tree developing slowly along toward chimp, and the other evolving rapidly into Homo sapiens.

Newsweek
March 2, 1964

CREATION EVOLUTION AND MOLECULAR BIOLOGY -- PROTEINS

American Scientific Affiliation Annual Meeting, August 2, 1973 by Wayne Frair, The King's College, Briarcliff, New York 10510

Comparative studies of similar proteins produced by different organisms may be thought of as comparative anatomy at the molecular level, for we may consider comparative anatomical research to be macroscopic, microscopic or molecular. Also we may evaluate various physiological phenomena as having resulted from interactions among structures having particular chemical configurations ("molecular anatomy"). We consider proteins to be homologous, in the classical sense of the term, if they demonstrate essential "anatomical" similarity.

Comparative studies on proteins have included use of blood serum and extracts of various organs from a variety of living things. Inferences have been made about degrees of similarity of the proteins depending upon quantities of precipitation obtained when different proteins reacted with a particular antiserum. In the earliest of such experimentation, investigators visually determined the amount of flocculation. Procedures have been refined to include the ring test, photoelectric quantitation of light scattered by the precipitate, diffusion in solid media (as agar and cellulose acetate), and agglutination of protein-coated particles.

In time other available analytical tools for carrying out comparative studies on whole and degraded proteins have included electrophoresis, immunoelectrophoresis, chromatography, isoelectric focusing, and radioimmunoassay. In addition, for a variety of organisms we now know the sequences of amino acids used in construction of many of the smallest homologous proteins, cytochrorne c being the most popular of these.

Studies on the molecular anatomy of proteins from various organisms generally have been in accord with data obtained from research on these organisms at microscopic and macroscopic levels. In integrating data from all levels, a creation model embodying limited changes (microevolution or diversification) has fewer difficulties than a macroevolutionary model. Rather than conceiving the world of life as terminal branches on one giant evolutionary tree, this model considers extant forms of life as belonging on a forest of trees having no physical connections. Each tree may be thought of in terms of kinds as conceptually presented in Genesis 1. Among reasons for preferring a limited-change creation model are the following

1. The Bible presents God as the Creator of life without giving details of how He did the creating. While encouraging expansion of frontiers in science, we may be relieved of the compulsion to explain everything mechanistically.
2. There are obvious reproductive barriers among groups of plants and animals, currently and historically.
3. Even though plants and animals similar at one anatomical level generally will be similar at the other two levels, there are enough exceptions to cause us seriously to question a macroevolutionary model. With a microevolutionary model we more easily can accommodate exceptions because we are obligated neither to bridge gaps nor to expand to supernumerary models of parallelism or convergence.
4. Most groups of organisms appear in the fossil record without obvious intermediates connecting them to other groups. With the limited-change model a researcher is relieved of the necessity of postulating a series of intermediate forms. When apparent intermediates become available, they readily may be incorporated into this creation model.

Three Possibilities of Interpretation of the Facts

Code: BP=Blood Precipitation C=Chance (as a causal explanation)
BS=Blood Similarity GR=Genetic Relationship (as a causal explanation)l
D=Design (as a causal explanation)

I.	II.	III.
If BP, then BS	If BP, then BS	If BP, then BS
If BS, then C	IF BS, then GR	If BS, then D
BP	BP	BP
C	GR	D

It would appear that a combination of III and II would synthesize all biblical data. Blood Similarity between "kinds" would thus be explicable on the basis of Design. Blood Similarity within a "kind" would be explicable on the basis of Genetic Relationship.

D. THE EVIDENCE FROM GEOGRAPHICAL DISTRIBUTION (BIOGEOGRAPHY)

1. The Argument Stated

"Just as palaeontology may be said to be a study of the vertical distribution (distribution in time) of organisms, so geographic distribution may be called a study of the horizontal distribution of organisms, on the earth's surface at any given time (spatial distribution)." (H. H. Newman)

This argument states that the facts of geographical distribution are such as to support the hypothesis that a species arises at one place, spreads out over large areas, becoming modified as it goes, and that new species are formed from old through modification after isolation from the parent-stock. This view is opposed to the view that each of the different plant and animal species was created in its present location (with the exception of migrants, of course), and also to the view that all of the same species that are in existence today, at some time in the past migrated from a common center to their present geographical location (thus positing the fixity of species).

"...when we examine the distribution of species over the surface of the earth, certain curious facts appear .... Regions that are very similar geographically often have very different populations. Where this is true, there are usually impassable barriers between the regions. On the other hand, regions that are very different often have the same kind of populations. In this case the two regions are either directly connected or have been sometime in the past. Facts of this kind can be explained if assume that all organisms are derived from ancient forms with modifications. But they cannot easily be explained in any other way." (Cora A. Reno, *Evolution, Fact or Theory*? pp. 57,58, quote)

2. The Evidence Adduced to Support the Evolutionist Interpretation

"The final category of geographical evidence, and the one which had the greatest effect upon the thinking of Darwin, is that of oceanic islands and their living inhabitants. Darwin observed that such islands are typically poor in numbers of species present, although the success of animals and plants introduced by man has proven that these islands are well-adapted to support a much greater variety of organisms than existed upon them aboriginally. He reasoned that, if all organisms had been created in their present localities, there is no reason why oceanic islands (islands, that is, which are located beyond the continental shelf) should not be as richly inhabited as comparable areas of the continents. Yet this is readily understandable upon his theory of migration from a common place of origin for all members of any group, with subsequent modification. For relatively few species could cross the great water barrier separating oceanic islands from the continental centers of origin.

"Of the few species found on oceanic islands, a large number are endemic, that is, found nowhere else. Darwin found twenty-six species of land birds in the Galapagos islands. Of these, twenty-one and possibly twenty-three are endemic. But of the eleven species of marine birds, only two are endemic. This is again just what one would expect in accordance with Darwin's theory. For, the occasional immigrants from the distant mainland (South America) would, upon arrival in their new environment, compete with quite different species from their cousins on the mainland, and so would be modified, eventually reaching the status of new and distinct species. But the great water barrier would greatly reduce the probability of these new species spreading to other localities. Yet for the marine birds the barrier ought to be less formidable, and hence the smaller proportion of endemics is not surprising. Lest thirty-seven species of birds for a small group of islands sound like a large number, the number of species on a restricted continental area may be given for comparison. The 1944 checklist of birds on the campus of the University of California at Berkeley lists 105 regular residents or seasonal migrants and forty species which have been recorded as occasional visitors.

"The Amphibia and terrestrial mammals, though not the bats, are usually entirely absent from oceanic islands. When they have been introduced by man, they frequently have multiplied so greatly as to become a nuisance. The west coast toad, *Bufo marinus* for example, was introduced into Hawaii in the hope that it would aid in the control of insects; but the toads themselves have now become a nuisance in the islands. Yet these groups are unable to cross large water barriers (or salt water barriers in the case of the Amphibia, which are quickly killed by salt water). But a barrier across which a mouse, for example, could not swim, might be easily flown by a bat. Had all species been created in the places where they now exist, then Amphibia and terrestrial mammals should be as frequent on oceanic islands as on comparable continental areas. Certainly terrestrial mammals should have been created on these islands as frequently as were bats. But bats are the very mammals which should reach the islands most readily if all mammals arose first on the continental land masses and then subsequently invaded such territories as they could.

"Finally, the inhabitants of the several islands of an archipelago are commonly specifically distinct, yet plainly closely related; all of them, however, show a less close relationship to the inhabitants of the nearest mainland. Thus, when the Beagle visited the Galapagos Archipelago, located between 500 and 600 miles west of South America, Darwin felt that he was stepping upon American soil because of the obvious similarity of the plants and animals of these islands to those of the South American continent. The Galapagos islands include 332 species of flowering plants. Of these, 172 species, more than half of the total, are endemic, and many species are restricted to one or a few islands in the archipelago. Yet all of these plants show close relationship to South American plants. But the climate and the geological character of the islands are utterly different from those of South America, hence the relationship of their plants cannot be understood on the basis of creation of similar plants for similar lands, but only on the basis of migration of plants from the continent to the outlying islands, with subsequent differentiation. The Bermuda islands are located about 700 miles off the coast of North Carolina, and its inhabitants are all North American in character. Many terrestrial vertebrates have been successfully introduced into the islands, but only one, a lizard, is native there. It belongs to a North American genus, but the species is endemic. Land birds are represented by many species, but none are endemic, for Bermuda is on one of the major migration routes for North American birds; hence it is not at all isolated from the viewpoint of the birds. Bats are also common to the mainland and the islands because these flying mammals can readily cross the water barrier. But the land molluscs include a high proportion of endemics, no doubt because of the rarity of a successful crossing of the water barrier.

"The only understandable basis for these facts is Darwin's hypothesis, that the islands were colonized from the mainland, with the colonists becoming modified subsequently. As they spread to the various islands of the archipelago, each isolated population was modified independently, with the result that groups of closely related, endemic species were formed. The connection, then, between the various similar species of an archipelago and of the nearest continent is simply heredity.

"These, then, are the main outlines of the biogeographical evidences for evolution. It is little wonder that first hand experience with so impressive and persuasive a series of facts should have suggested to Darwin the possibility that species are mutable."

-- Edward O. Dodson, *A Textbook of Evolution* (Philadelphia: W. B. Saunders Company, 1952), pp. 28-32.

"Therefore, what I propose to do is to select for such exhaustive analysis a few of what may be termed the most oceanic of oceanic islands -- that is to say, those oceanic islands which are most widely separated from mainlands, and which, therefore, furnish the most unquestionable of test cases as between the theories of special creation and genetic descent.

"**Azores**. -- A group of volcanic islands, nine in number, about 900 miles from the coast of Portugal, and surrounded by ocean depths of 1,800 to 2,500 fathoms. There is geological evidence that the origin

of the group dates back at least as far as Pliocene times. There is a total absence of all terrestrial Vertebrata, other than those which are known to have been introduced by man. Flying animals, on the other hand, are abundant: namely, 53 species of birds, one species of bat, a few species of butterflies, moths and hymenoptera with 74 species of indigenous beetles. All these animals are unmodified European species, with the exception of one bird and many of the beetles. Of the 74 indigenous species of the latter, 36 are not found in Europe; but 19 are natives of Madeira or the Canaries, and 3 are American, doubtless transplanted by drift-wood. The remaining 14 species occur nowhere else in the world, though for the most part they are allied to other European species. There are 69 known species of land-shells, of which 37 are European, and 32 -- peculiar, though all allied to European forms. Lastly, there are 480 known species of plants of which 40 are peculiar, though allied to European species.

"**St. Helena**. -- A small volcanic island, ten miles long by eight wide, situated in mid-ocean, 1,100 miles from Africa, and 1,800 from South America. It is very mountainous and rugged, bounded for the most part by precipices, rising from ocean depths of 17,000 feet, to a height above the sea-level of nearly 3.000. When first discovered it was richly clothed with forests; but these were all destroyed by human agency during the 16th, 17th, and 18th centuries.

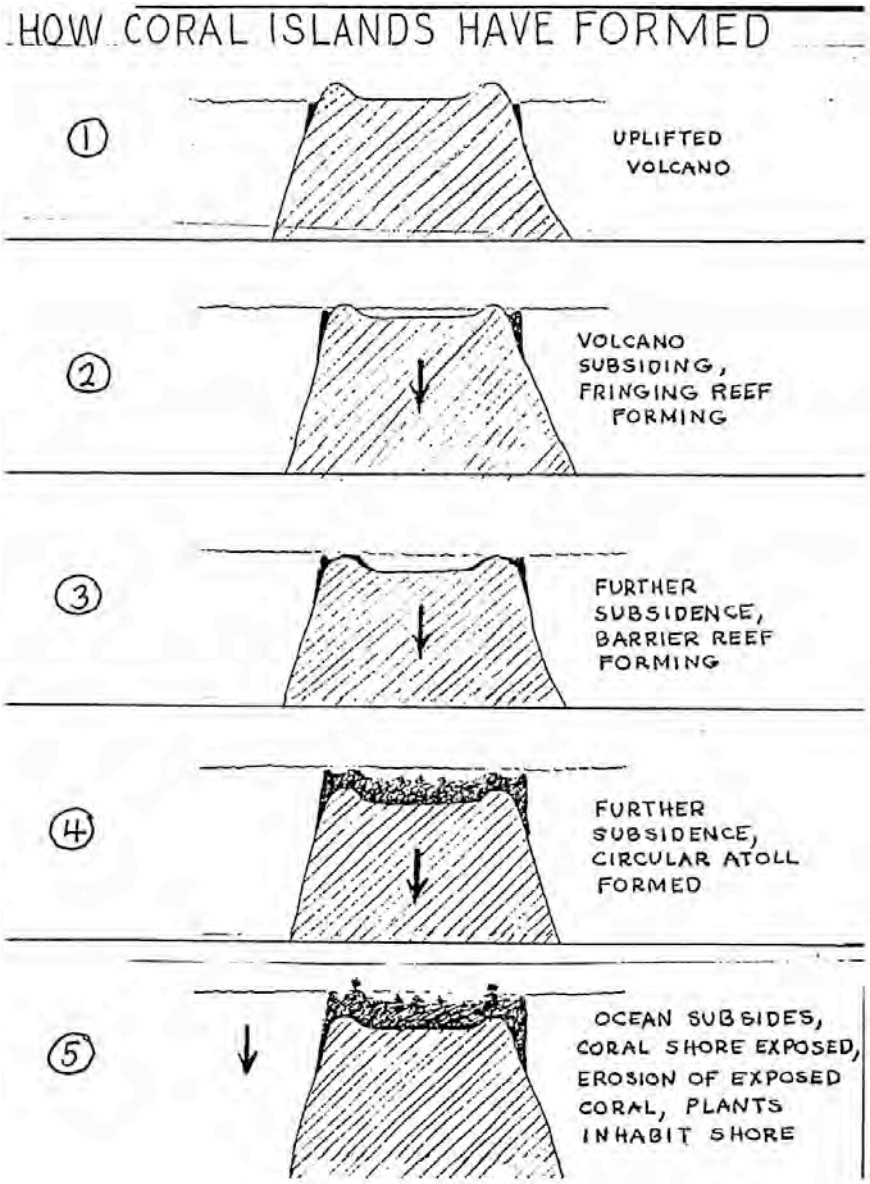
"There is a total absence of all indigenous mammals, reptiles, freshwater fish, and true land-birds. There is, however, a species of plover, allied to one in South Africa; but it is specifically distinct, and therefore peculiar to the island. The insect life, on the other hand, is abundant. Of beetles, no less than 129 species are believed to be aboriginal, and, with one single exception, the whole number are peculiar to the island. 'But in addition to this large amount of specific peculiarity (perhaps unequalled anywhere else in the world) the beetles of this island are remarkable for their generic isolation, and for the altogether exceptional proportion in which the great divisions of the order are represented. The species belong to 39 genera, of which no less than 25 are peculiar to the island; and many of these are such isolated forms that it is impossible to find their allies in any particular country.' (Wallace) More than two-thirds of all the species belong to one group of weevils -- a circumstance which serves to explain the great wealth of beetle-population, the weevils being beetles which live in wood, and St. Helena having been originally a densely wooded island. . . About two-thirds of the whole number of beetles, or over 80 species, show no close affinity with any existing insects, while the remaining third have some relations, though often very remote, with European and African forms. . . -

"Lastly, the plants likewise tell the same story. The truly indigenous flowering plants are about 50 in number, besides 26 ferns. Forty of the former and ten of the latter are peculiar to the island, and, as Sir Joseph Hooker tells us, 'cannot be regarded as very close specific allies of any other plants at all.' Seventeen of them belong to peculiar genera, and the others all differ so markedly as species from their congeners, that not one comes under the category of being an insular form of a continental species. So that with respect to its plants, no less than with respect to its animals, we find that the island of St. Helena constitutes a little world of unique species, allied among themselves, but diverging so much from all other known forms that in many cases they constitute unique genera.

"**Sandwich Islands** -- These are an extensive group of islands, larger than any we have hitherto considered -- the largest of the group being about the size of Devonshire. The entire archipelago is volcanic, with mountains rising to a height of nearly 14,000 feet. The group is situated in the middle of the North Pacific, at a distance of considerably over 2,000 miles from any other land, and surrounded by enormous ocean depths. The only terrestrial vertebrates are two lizards, one of which constitutes a peculiar genus. There are 24 aquatic birds, five of which are peculiar; four birds of prey, two of which are peculiar; and 16 land-birds, all of which are peculiar. Moreover, these 16 land-birds constitute no less than 10 peculiar genera, and even one peculiar family of five genera. This is an amount of peculiarity far exceeding that of any other islands, and, of course, corresponds with the great isolation of this archipelago. The only other animals which have here been carefully studied are the landshells, and these tell the same story as the birds. For there are no less than 400 species which are all, without any exception, peculiar; while about three-quarters of them go to constitute peculiar genera. Again, of the plants, 620 species are believed to be endemic; and of these 377 are peculiar, yielding no less than 39 peculiar genera.

"in the comparatively limited -- but in itself extensive -- class of facts thus presented, w have a particularly fair and cogent test as between the alternative theories of evolution and creation. For where we meet with a volcanic island, hundreds of miles from any other land, and rising abruptly from an ocean of enormous depth, we may be quite sure that such an island can never have formed part of a now submerged continent. In other words, we may be quite sure that it always has been what it now is -- an oceanic peak, separated from all other land by hundreds of miles of sea, and therefore an area supplied by nature for the purpose, as it were, of testing the rival theories of creation and evolution. For, let us ask, upon these tiny insular specks of land what kind of life should we expect to find? To this question the theories of special creation and of gradual evolution would agree in giving the same answer up to a certain point. For both theories would agree in supposing that these islands would, at all events in large part, derive their inhabitants from accidental or occasional arrivals of wind-blown or water-floated organisms from other countries == especially, of course, from the countries least remote. But, after agreeing upon this point, the two theories must part company in their anticipations. The special-creation theory can have no reason to suppose that a small volcanic island in the midst of a great ocean should be chosen as the theatre of any extraordinary creative activity, or for any particularly rich manufacture of peculiar species to be found nowhere else in the world. On the other hand, the evolution theory would expect to find that such habitats are stocked with more or less peculiar species. For it would expect that when any organisms chanced to reach a wholly isolated refuge of this kind, their descendants should forthwith have started upon an independent course of evolutionary history. Protected from inter-crossing with any members of their parent species elsewhere, and exposed to considerable changes in their conditions of life, it would indeed be fatal to the general theory of evolution if these descendants, during the course of many generations, were not to undergo appreciable change."

-- George John Romanes, *Darwin and After Darwin* (The Open Court Publishing Company, 1892), "The Fauna of Oceanic Islands."



"How do the facts of distribution look when examined in detail?

"1. Cosmopolitan groups, those with the widest distribution, are those to whom no barriers are sufficient to check migration, e.g., strong fliers, Man, earthworms carried by Man.

"2. Restricted groups are usually those to which barriers are readily set up and are frequently the last remnants of a formerly successful fauna or flora, which continue to survive only in some restricted area where the conditions are rather more favorable than elsewhere.

"3.The study of the distribution of species belonging to a single genus reveals that the more primitive or generalized species occupy a central position and the most specialized species are at the outer boundaries of the distributional area.

"4. The faunas and floras of continental islands are just what we should expect on the basis that there was at one time a land connection with the nearest continent; that at this time the faunas and floras were the same on both island and continent; that, later, the continent and island were separated by an impassable barrier of ocean; and that the inhabitants of the two bodies evolved separately.

"5. The faunas and floras of oceanic islands are like those of the nearest mainland and are of those types, for the most part, that might most readily have been blown there by the wind or carried on floating debris.

"6. The conclusions arrived at by students of geographic distribution, past and present, as to the existence of former land connections, now broken, are borne out by the independent findings of geologists and geographers."

-- Hans Gadow, *Wanderings of Animals* (Cambridge University Press, 1913), "Summary of Mammalian Dispersal."

"During the voyage of the Beagle I had been deeply impressed by discovering in the Pampean formation great fossil animals covered with armour like that on the existing armadillos; secondly, by the manner in which closely allied animals replace one another in proceeding southwards over the continent; and thirdly, by the South American character of most of the productions of the Galapagos archipelago, and more especially by the manner in which they differ slightly on each island of the group; none of the islands appearing to be very ancient in a geological sense.

"it was evident that such facts as these, as well as many others, could only be explained on the supposition that species become modified and the subject haunted me."

-- Charles Darwin, *Autobiography*

"if animals can move freely from one place to another, then the tendency is for the same species to play the same role in both places. If, however, there is a barrier to movement between the two places, then it is more common than not for different animals to have more or less similar roles in the two. Such pairs of species are called vicarious because one takes the place of the other in its particular community. They characterize strictly geographic differences between faunas that live in similar environments and are not markedly different ecologically, the origin and persistence of such differences depends on the existence of a geographically localized barrier of some sort.

"Barriers are of many different kinds. For a lowland animal, a mountain range is a formidable barrier. For a steppe animal, a dense forest is a barrier. For a species adapted to warm water, a cold current is an effective barrier. For land mammals, my special topic here, the most important barriers are wide bodies of water. The broad outlines of the historical geography of mammals are concerned mainly with the development of the faunas of the various continents. and the barriers most important for this study are the stretches of sea that have at different times separated one continent from another

"The probability of spread of a group of animals from one region to another may have, any level from nearly impossible to nearly certain, depending on the geographic and other environmental conditions between the two regions. Although any degree of probability may occur and no sharp distinctions are possible, it is convenient to consider three main sorts of paths of faunal interchange: corridors, filters and sweepstakes routes.

"A corridor is a route along which the spread of many or most of the animals of one region to another is probable.

"A filter is a route across which spread of some animals is fairly probable but spread of others is definitely improbable. Hence some elements of a regional fauna expand readily across the filter and into another region, but other elements do not. The route is a Semi-barrier that permits parts of faunas to pass but filters out others. (Of course this is still a matter of degree; a corridor usually filters out some animals, and a strong barrier does not necessarily hold back all animals.) A filter may be a desert, such as the Sahara and adjacent deserts, or a mountain range, such as the Himalayan system. Between different continents, a filter is generally a land bridge, an isthmian connection narrower and more specific in environmental conditions than a corridor and hence a stronger impediment to faunal interchange. That intercontinental land bridges do have strong filtering action, that they are filter bridges, is one of the most important conclusions from the study of faunal interchanges. The connection between North and South America is a filter bridge now in existence

"At the other end of the scale from a corridor, a sweepstakes route is one across which spread is highly improbable for most or all animals but does occur for some. In other words, a sweepstakes route is a formidable barrier that is nevertheless occasionally crossed. The implication of the term is that as in a lottery or sweepstakes the odds against winning are enormous but nevertheless someone does win. Another point is the element, apparent at least, of chance in following a sweepstakes route. Where a corridor or a filter exists, most or all of the groups adaptively capable of following the route will do so rather promptly. With a sweepstakes route, probabilities are so much against all groups that crossing may be long delayed. What groups do, in fact, cross, which do so first, and when they do so seem to be largely matters of chance, determined almost at random.

"For land animals the most obvious and important sweepstakes routes involve spread across channels, straits, or still wider sea barriers . . ."

-- George Gaylord Simpson, *Evolution and Geography* (Eugene, Oregon: University of Oregon, 1962), pp.18-24.

"SCHOOLS OF PALEOGEOGRAPHIC THEORY

"It has long been known that the geography of the earth has changed greatly during the course of its history. Seas often occurred where now is land. Continents have changed in shape and in their connections with each other. Paleogeography, the historical approach to physical geography, has as its aim the reconstruction of all such geographical events. It also has deeper implications, for it involves an understanding of the whole construction of the earth and especially of the nature and mechanics of the crust of the earth. Here historical biogeography has a crucial part to play. The sequences and relationships of past faunas are always pertinent evidence and sometimes the only good evidence of ancient geographical conditions. Hence not only must paleogeography be used as framework for biogeography, but also biogeography must be used as a criterion for theories of paleogeography.

"Some earlier paleogeographers postulated that land and sea segments of the earth's crust differ in no really essential way. Which is land and which is sea was supposed not to depend on local characteristics of the crust itself but simply on whether segments happened to be uplifted or not. Theorists of that school envisioned the presence of vast continents where now are the Pacific, Atlantic, and Indian Oceans. Earlier geographical developments of faunas were supposed to have occurred on a map unrecognizably different from that of today. Such extreme views no longer have any informed supporters. Land and sea segments of the crust are known to be different in average composition. Practically everyone now agrees that during most of the history of life there has been some degree of constancy or continuous identity in the continental and oceanic segments of the earth's crust, despite great changes in outline and other details.

"That conclusion still leaves room for disagreement as to the nature and position of past connections between continental blocks. One school of theory has indulged in the extravagant postulation of land bridges between the continents. No two students of that school have agreed precisely as to when or where the bridges existed, but their maps show the oceans crisscrossed with isthmian connections, from Europe across the mid-Atlantic to America, from Africa across the South Atlantic to South America and across the Indian Ocean to India, from Asia or Australia across the Pacific to America, from Australia and South America to Antarctica, and so on.

"Another school, especially associated with the name of the German geologist Wegener although others before and after him have developed similar theories, holds that the continental segments have been floating blocks drifting on the deeper parts of the crust. The theory is that the continental segments once formed a single mass, or two of then, which then broke up into the present continents. The separation and present placing of the continents are supposed to have resulted from slow drifting apart of fragments of the original block or blocks.

"Finally there is a school which holds, with the land bridge builders, that continents and oceans have tended to maintain their identities and positions through most of geological history, but which minimizes the number of vanished connections between the continents. The former existence of any bridge over what is now an ocean is considered highly doubtful or rejected altogether. The past existence of a few bridges across what now are island arcs or straits is considered sufficient to account for all known biogeographical events.

"EVIDENCE FROM HISTORICAL BIOGEOGRAPHY

"The numerous different theories of paleogeography are susceptible to crucial testing by the facts of biogeography. If a South Atlantic bridge once arose between South America and Africa, the faunas of that time should attest the fact, just as the faunas of North and South America plainly show the rise of a bridge between them in the Pliocene. If South America and Africa were parts of a single continent, as both the transoceanic continent and the drifting continent schools have claimed for various times in the past, then the faunas of that time should be related more or less as are the faunas of single continents today. As has been shown above, it is possible to measure faunal interchanges and resemblances. It is not necessary, as was so often done in the past, to argue vaguely 'I think the faunas are so similar that they belonged to one continent,' and counter with 'I think they are not.' The data of Table 10 should, for instance, end all argument that Africa and South America were connected to each other at any time during the Cenozoic, because in contrast with those figures the index of generic resemblance for all known Cenozoic faunas of the two continents is zero.

"The pertinent evidence and conclusions have in large part already been summarized on previous pages. An instructive further step is to make diagrams of continental relationships according to the various theories and according to concretely measured faunal interchanges and resemblances. The precise outlines of the continents do not matter for this purpose, and even their positions on the surface of the globe may be ignored provided that supposed or inferred corridors, bridges, and sweepstakes routes are appropriately represented in the diagrams.

"All the biogeographic features in the known history of mammals are best accounted for on the theory that the continents have had their present identities and positions and that there have been no land bridges additional to those that now exist (North-South America and Eurasia-Africa) except for a northern Asia-North America bridge. Additional features are largely matters of local detail. The connection between eastern and western Eurasia has not always been a corridor and may even have been briefly broken. The Eurasia-Africa bridge has varied in extent and in position, and other bridges have also varied in these respects. An Asia-Australia bridge may well have existed some time before the Cenozoic. There were probably early sweepstakes routes (but not complete bridges) from Antarctica to Australia and South America.

"With such amplifications, the conclusion seems to apply not only to the biogeography of mammals but also to that of all contemporaneous forms of life. It remains possible that there were transoceanic continents or bridges or that continents drifted in the Triassic or earlier, but there is little good evidence that such was the fact. In any case such remote events would have little or no bearing on the present distribution of living things."

-- George Gaylord Simpson, *Evolution and Geography* (Eugene, Oregon: University of Oregon, 1962), pp. 60-63.

Continental Drift and Plate Tectonics -- A Brief Overview

The planet Earth is a zoned or layered or shelled body consisting of a solid iron core, a liquid iron core, a lower mantle of heavier rocks, a transition zone of lighter rocks, the Aesthenosphere (a weak, partially molten layer of lighter rocks), and the Lithosphere (the strong, solid outermost shell of the earth, which is topped by a thin crust at the bottom of the oceans and a thicker continental crust).

The Lithosphere is comprised of a dozen solid plates which comprise the surface of the Earth; and the continents are like large rafts embedded in various plates of the Lithosphere. These plates have been given the following names:

Antarctic Plate	Cocos Plate
Australian Plate	Caribbean Plate
Philippine Plate	North American Plate
Pacific Plate	South American Plate
Gorda Plate	African Plate
Nazca Plate	Eurasian Plate

The concept of Plate Tectonics has become the great unifying theory in geology in the 1970's and 1980's. In this theory, the solid plates of the Lithosphere ride on top of the partially molten Aesthenosphere, and slowly move on the surface of the earth. Some plates diverge or move apart. The opening between the receding plates is filled with melted material that rises from the Aesthenosphere. This material solidifies in the crack and the plates grow as they separate. When plates open in the ocean, the rift is characterized by earthquake activity, volcanism, and a mid-ocean ridge, and the process results in sea-floor spreading. Since same plates diverge, it follows that others must converge. They crash head-on into each other, and create all sorts of geologic activity. The heavier of the plates buckles downward and descends under the edge of the lighter plate into the Aesthenosphere, while the lighter, overriding plate is crumpled and uplifted. At the region of convergence, deep-sea trenches, high mountain chains, volcanoes, and the greatest earthquakes occur. Some plates slip past one another along transform faults, such as the San Andreas fault of California, where the Pacific plate slides past the North American plate in a northwesterly direction. Resultant geological features include large, shallow-focus earthquakes, such as the San Francisco earthquake of 1906.

Plate Tectonics and Geographical Distribution

Plate tectonic theory holds that the solid plates of the Lithosphere have moved considerable distances during the history of the planet Earth. In the pre-Cambrian, it is believed that all of the continents formed one continuous land mass -- a super-continent which geologists call Pangaea -- surrounded by a universal ocean, called Panthalassa. At the beginning of the Cambrian (600 million years ago), Pangaea split apart, and the ancestral Atlantic Ocean opened. In the early Ordovician (500 million years ago), the process reversed, and the ancestral Atlantic began closing again. By the middle Devonian

(375 million years ago) North America collided with Europe and Africa, thus forming Pangaea once again. In the middle Triassic (about 200 million years ago), Pangaea once again began to break up. By the end of the Jurassic (135 million years ago), South America spilt from Africa, and the South Atlantic Ocean was born. At the close of the Cretaceous (65 million years ago), Madagascar split from Africa, the Tethys Sea (between Africa and Eurasia) closed to form the Mediterranean. During the Tertiary and Quaternary (the past 65 million years), India has collided with Asia, Australia has separated from Antarctica, and half of the present-day ocean floor has been created.

All of this movement of land masses must have had some serious effects upon the geographic distribution of animals and plants, especially during those periods when continents were widely isolated from each other, and separated by the most formidable barriers.

3. A Creationist interpretation of the Data

"It takes very little discernment to observe that certain animals are found only on certain continents or parts of continents. Our problem is to explain the things we observe. How could this condition have come about?

"There are several possibilities to consider. First of all there is the solution proposed by the evolutionist; where barriers existed, the species developed new forms. A second but unlikely possibility is that God might have created each of the different plants and animals as they are found in their present location. A third explanation, the best in view of our present knowledge of facts, is that God created only the large ancestral groups. From these, over long periods of time and in different places, there have developed the great variety of individual plants and animals we find today."

-- Cora A. Reno, *Evolution Fact or Theory* (Chicago: Moody Press, 1953), p. 59.

"The flora and fauna of oceanic islands, therefore, seem to indicate that the new species and genera, and possibly two sub-families, have arisen by evolution."

-- Douglas Dewar, *Difficulties of the Evolutionary Theory* (London: Edward Arnold & Co. Ltd., 1931), p. 23.

"Apparently extensive changes in the distribution of plant and animal forms have occurred, but such changes have been limited (although not prevented) by barriers. Unfortunately some writers have stated that the concept of creation necessarily means that all forms of life are now in the location where they were originally created. No such restrictions can be read into the Bible account. The story of the flood (whether one believes it to be local or universal) suggests a re-dispersal of animals from a refugium (as the ark could be designated).

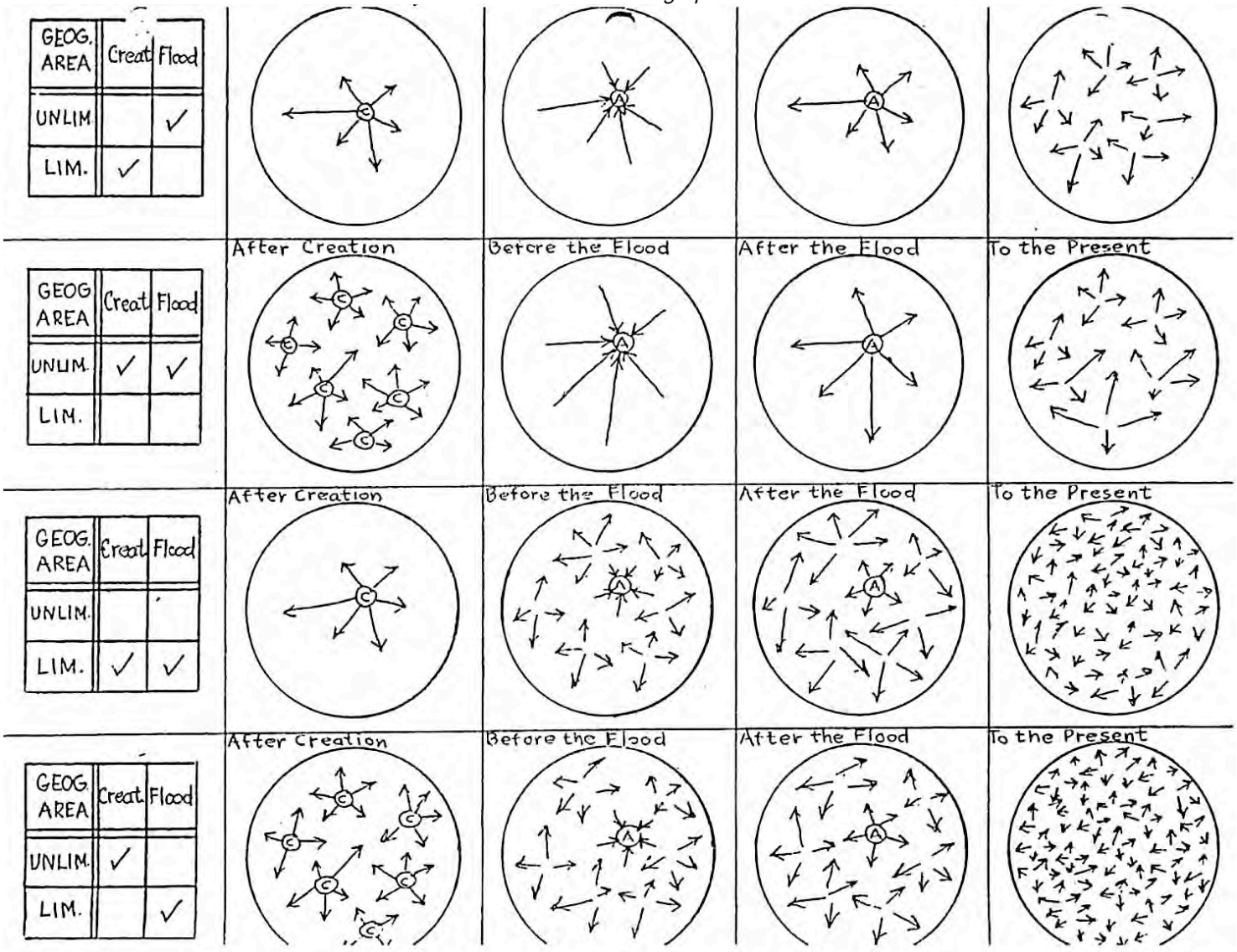
Furthermore, in the course of time volcanic and coral islands have emerged from the oceans and have become populated."

-- V. Elving Anderson, "The Distribution of Animals" in *Evolution and Christian Thought Today*, edit. Russell L. Mixter (Grand Rapids, Michigan: Eerdmans Publishing Company, 1959), p. 125.

TWO BIBLICAL EVENTS AND THEIR RELATIONSHIP TO GEOGRAPHICAL DISTRIBUTION

Two biblical events and their interpretation relate to this question of geographical distribution. These events are the Creation of living things and the Noachian Flood. The first question, which must be raised is whether the Creation account is to be understood to teach the creation of living things in one geographical center or in many centers. The second question which must be raised is whether the Flood account is to be understood to teach the destruction of all living things (outside of the ark) universally or within a limited geographical area. A combination of these two questions yields four basic positions:

FIGURE Four Positions in Geographic Distribution



Which of these four diagrams best fits the biblical and Scientific data? Which view of Creation and of the Flood is best able to explain the biblical and Scientific data in their integrity?

With respect to the biblical data, the question whether God created all living things in one or many geographic centers appears to be open. Of course, it is possible to assert that God created all of the animals in one location -- the Garden of Eden -- and that Adam therefore named the more than one million species of animals living today. On the other hand, it is possible to believe that God created various assemblages of animals in various ecological niches, according to the environment needed for each grouping: the specific type of terrain (or body of water), the altitude (or depth), the climate, and the food supply. In this latter case, Adam named only the animals which were in his immediate vicinity.

The question whether the Flood was global or limited to a substantial portion of the Middle East (not whether it was local) is a matter of dispute among biblical scholars. Of course, if the announced purpose of the Flood is given proper emphasis, this helps somewhat. In Genesis 6:3, 5-7, 11-13 we find this purpose:

> "And the Lord said, My Spirit shall not always strive with man, for that he also is flesh: yet his days shall be a hundred and twenty years. . . .
>
> And God saw that the wickedness of man was great in the earth, and that every imagination of the thoughts of his heart was only evil continually. And it repented the Lord that he had made man on the earth, arid it grieved him at his heart. And the Lord said, I will destroy man whom I have created from the face of the earth; both man, and beast, and the creeping thing, and the fowls of the air; for it repenteth me that I have made them. . . .
>
> The earth also was corrupt before God; and the earth was filled with violence. And God looked upon the earth, and behold, it was corrupt; for all flesh had corrupted his way upon the earth. And God said unto Noah, The end of all flesh is come before me; for the earth is filled with violence through them; and behold, I will destroy them with the earth."

The purpose of the Flood was to destroy man in view of man's great wickedness, corruption, end violence in the earth. If the Flood is viewed as having been anthropologically universal, destroying all mankind (except for Noah and his family) and all terrestrial and celestial animals living in association with mankind (except for those Noah took aboard the ark), then it is not necessary to view it as having been geographically universal. However. In order to be anthropologically universal, it must have covered an area large enough to include all extant human beings, wherever they may have migrated during the time since Eden.

With respect to the scientific data, the question whether God created all living things in one or many geographical centers appears to be answered by the data of biogeography, which support the view that God created living things in many geographical centers at various times. The question whether the Flood was global or limited to a substantial portion of the Middle East is not answerable by means of the

data of geology or paleontology. In fact, these data do not reveal the existence of a universal Flood during the history of man's existence upon the earth, or of a widespread Flood in the Middle East of approximately one year's duration during man's sojourn in the world. These data reveal many local floods and many instances in which large areas of the earth's surface were covered by shallow seas. But these do no count as evidence for the Flood, especially since such local floods differ widely from each other in their dating, and such shallow seas were generally present for long periods of time.

Although anthropology provides us with many data concerning Flood legends in many cultures, and archeology provides us with clear evidence of local floods in the Middle East, these do not appear to constitute strong scientific evidence for a Flood covering the entire surface of the planet Earth.

In Modern Science and Christian Faith, in the article entitled "A Christian View of Anthropology," the authors take up the question of the anthropology of the Flood. They state:

> "The widespread distribution of the Flood account among historical and contemporary peoples is likewise pertinent here. Kroeber states that 'Flood myths are probably told by the majority of human nations . . . . Formerly this widespread distribution was thought to prove the actuality of the Biblical Flood, or to be evidence of the descent of all mankind from a single nation that had once experienced it. Refutation is hardly necessary.' Although the situation should not be dismissed as summarily as that, there are some important considerations which should be made before the wide distribution of the Flood account should be taken as proof that all peoples have legendary recollection of it. It has been a painful lesson in anthropology that because a characteristic is widespread we cannot thereby infer that those peoples brought that characteristic with them as they migrated. Far more often it diffuses without migration. Stories, tales, and myths are especially prone to diffuse even across marked language barriers.
>
> Furthermore, some of the Flood stories are not alike. Some might better be called 'creation myths,' because they have to do with 'primeval waters' rather than destructive flood. One version has the earth formed out of sands which were brought up from the bottom of the waters under the fingernails of a giant turtle who dived for lt. The sand grew to be the earth. . . .Although we recognize that stories may and do change through time, there is little in the 'primeval water' type of tale to warrant including it in a consideration of the distribution of the Flood account. Furthermore, the point of change in tales cannot be carried too far, as other widespread legends are amazingly uniform. A famous case is the Magic Flight or the Obstacle Flight which has a distribution completely around the globe among both aboriginal and historic peoples, particularly Europe, Asia, North America, Africa, and Indonesia. In this tale there is a specific structure with a flight away from an ogre and 'objects thrown back over the shoulder forming obstacles -- a stone which becomes a mountain; a comb which becomes a thicket, oil which becomes a body of water.' The details are always

specific with only minor changes such as a forest for a thicket and some other liquid for oil. This tale is ancient, widespread, and uniform. The multiplicity of Flood themes is likewise ancient and widespread, but not quite so uniform.

Anthropologists in general feel that the widespread and often geographically continuous distribution of both the Magic Flight and the various Flood accounts is due to the transmission of the tale from one group to another, slowly spreading out from the centers of origin. The universal prevalence of Flood legends cannot be considered 'proof' of the actual reality of the Flood, or that all peoples who have Flood accounts most similar to the Biblical accounts have passed them on through their generations from time immemorial. If it is so considered, there is as strong a proof for the occurrence of the Magic Flight!"

-- William A. Smalley and Marie Fetzer, "A Christian View of Anthropology," in Modern Science and Christian Faith Second Edition, by members of the American Scientific Affiliation (Wheaton, Illinois: Van Kampen Press, 1950), pp. 187-189.

Additional scientific information on Flood traditions is provided by Dorothy B. Vitaliano, a professional geologist with the U.S. Geologic Survey, in her book Legends of the Earth Their Geologic Origins. In the chapter entitled "The Deluge," Mrs. Vitaliano surveys the Flood traditions from around the world. The following section attempts to present some of her material in excerpt form:

"There is a series of traditions which stands apart from all others in that these traditions appear in every part of the world -- or, to be more exact, in almost every part of the world. These are the traditions of a great flood which destroyed either all mankind, or at least a substantial number of the earth's inhabitants. Such traditions are so widespread that many believe them to be a 'racial memory' of some catastrophic inundation which affected at least a very considerable portion of the globe simultaneously. At the other extreme are those who believe that all the different flood traditions stem from a single local flood, the deluge of the Bible, the memory of which was disseminated as man migrated from the original scene. Does the geologic evidence support either of these diametrically opposed viewpoints, and if not, what does it tell us? . . .

"Because it is impossible to produce a truly universal flood by any normal geologic process, some highly ingenious attempts have been made to invoke extraterrestrial agencies as the cause. Such theories always cite folklore as evidence and bolster their arguments with incorrect or farfetched interpretations of geologic features which can be explained far more easily in terms of the normal action of geologic agencies. But the universality of flood traditions can be explained very easily without requiring a widespread flood of cosmic or any other origin, if we bear in mind that floods, plural, are a universal geologic phenomenon. . .there is virtually no part of the globe where there could

not at some time have been a flood potentially dangerous to humans in the vicinity. . . .

"All in all, then, from the purely geologic point of view we should expect independent flood traditions to have arisen almost anywhere in the world at almost any time, engendered by flood catastrophes stemming from perfectly natural causes, and of all the possible causes of floods, only tsunamis are capable of giving rise to flood legends in widely separated places at the same time. Although many different floods are required to account for the many traditions known, there is no reason to be surprised that flood traditions from all over the world may bear notable resemblances to one another. For when we come right down to it, there are only two basic ways in which people can survive a flood: by getting above it, or by riding it out on some floating object. Thus there are legends in which the survivors take to high ground or climb exaggeratedly tall trees, and there are legends in which the survivors float to safety in an ark, a canoe, a chest, or what have you. In most flood traditions a vessel is the means of salvation, and that too is not surprising, In view of the fact that the water depth is often exaggerated to the point where everything is submerged and there would be no other way to account for anyone's being saved to carry on the human race . . . . Nevertheless it is undeniable that many flood traditions in widely separated parts of the world do show similarities in detail, highly reminiscent of the biblical deluge, which cannot be explained entirely by the general similarity of floods and the general similarity of human reactions to floods.

"There are only two ways in which the story of Noah's flood, whatever its local source, could have been spread around the world: by diffusion, as the people to whose culture t originally belonged migrated to new lands, or by transmission, which requires contact between at least one narrator and one listener from different cultures.

". . .it seems quite natural that certain details of the biblical story should turn up all over the world. For more than nineteen centuries missionaries have been carrying it to every corner of the earth. . . Missionaries have always been among the first to brave the wilderness to bring the Gospel to primitive peoples, and in many instances they were the first to take down the legends of the people among whom they worked. in other cases, however, the legends were collected by ethnologists and others who came well after the missionaries. Because it often was the missionaries who first devised written forms of obscure languages, it is impossible to prove whether a flood story really predates the missionary influence or whether it is just Noah being given back with local color.

"The British anthropologist Sir James Frazer, and others before him, notably the German geographer and anthropologist Richard Andree, compiled flood legends from all parts of the world and examined them for evidence of local origin versus transmission. To try to cite them all would fill a sizable volume and be very repetitious withal. So let us examine just a few typical examples from all over, in the light of their geologic setting. . . .

"The oldest known flood story is that of Noah. . .

"The Babylonian version is virtually identical except that the name of the chief character is Utnapishtim. The story of Utnapishtim is incorporated in the Gilgamesh epic, recorded in tablets unearthed at Nineveh in the library of Ashurbanipal (668-633 B.C.). Enough bits and pieces of older versions have been found in different places to prove that Ashurbanipal's version in turn is based on a Sumerian story which goes back to about 3400 B.C., in which the hero is called Ziudsuddu or Xisuthrus. Utnapishtim was a good man who was warned by the sea god Ea that the world was destined to be destroyed by a flood in punishment for the wickedness of mankind. As instructed, he built a boat into which he repaired with his family, skilled artisans, and animals. After seven days of tempest their vessel grounded on 'Mount Nisir.' Utnapishtim sent out a dove, which found no land and returned; then a swallow, which also returned; and finally a raven, which did not come back. Upon disembarking Utnapishtim sacrificed to the gods, who 'smelt the sweet savor,' promised that there would be no repetition of the deluge, and ultimately took Utnapishtim to dwell among them. . .

"Attempts have been made to discredit Mesopotamia as the source of the biblical flood tradition, on the grounds that the rainfall is not heavy enough there to cause floods. However, the rains that cause a river to flood in its lower course can fall anywhere in its catchment area, and the Tigris and Euphrates are very long rivers indeed; there is also archeological evidence that floods have occurred there not once, but many times. A ten-foot layer of flood silt has been found at Ur in the Obeid level, indicating a flood during the fourth millennium B.C.; at Kish there is evidence of a flood which occurred considerably after 3,000 B.C.; at Fara there is a two-foot layer of alluvium representing a flood which came some time after the one at Ur but before the one at Kish; and at Nineveh there is a layer six to seven feet thick which could be of the same age as the one at Ur, or nearly so. These layers constitute a record of perfectly expectable, more or less local floods of the Tigris or Euphrates or both at once.

"Best known to most of us after the Babylonian-Hebrew flood tradition is that of classical mythology, Deukalion's deluge. Of the several Greek flood traditions, it is the only one in which the flood is said to have been worldwide . . . . Ogyges' flood, the best known Greek flood tradition after Deukalion's, was not as widespread or as serious as Deukalion's . . . . The third greatest flood in Greek tradition is the one associated with a king Dandanos of Arcadia. . . . There are many other Greek flood traditions concerning purely local floods. . . .

"Outside of Greece, flood legends are surprisingly rare in Europe. There is one from Wales, one from Lithuania, two in Norse mythology; a gypsy legend from Transylvania involving a fish, which may have been derived from the indian legend; and one from the Voguls, a tribe living on both sides of the Ural Mountains. . . .

"The flood traditions of Asia are very diversified. The Persian myth from the Bundahish. . .the Hindu flood tradition. . Kashmir. . .

"The Buddhist traditions of China and Japan contain no mention of a universal flood. There is a Chinese legend which concerns the flooding of one particular river. . .the Hwang Ho (Yellow River).

"Flood traditions are lacking in semi-arid Central Asia which is hardly surprising. Southeast Asia does have flood traditions, many of them showing biblical influences. One of the more interesting is that of the Lobos, an independent, literate, aboriginal race living in southwestern China. . . .

"Very conspicuous by its absence is an Egyptian flood legend; but likewise conspicuous by their absence in Egypt are disastrous floods. Every year the Nile overflowed its banks gently and predictably . . . .

"The only legend from southern Africa involving any sort of inundation is not a typical deluge tradition at all, but one which seeks to explain the origin of a particular lake, lake Dilolo on the boundary between Angola and Zaire. . . According to this tale, a chieftainness named Moena Monenga once sought food and shelter in a certain village. Not only was she refused, but when she reproached the villagers for their selfishness they mocked her and said, in effect, 'What can you do about it?' So she showed them; she began a slow incantation, and on the last long-drawn-out note the whole village sank into the ground, and water flowed in to fill the depression. When the chieftain of the village returned from the hunt and saw what had happened to his family, he drowned himself in the lake in despair. This tale was collected by Livingstone, and was the only one he encountered in all his years of missionary work which had any resemblance to a flood tradition.

"The lack of flood traditions in Egypt and the rest of Africa has been a definite stumbling block to theories requiring tremendous volumes of water sloshing over the whole face of the globe as a result of cosmic collisions . . . . In his well-known *Worlds in Collision* Immanuel Velikovsky gets around the lack of African flood traditions with an ingenuity that must be admired: he invokes a 'collective amnesia' which very conveniently blotted the disaster out of the memory of certain whole societies.

"Turning to the other side of the world, Australia has several different flood traditions which have little in common with each other and nothing in common with the Bible story; these could be independent recollections of local floods.

"The South Seas also provide abundant flood traditions in very diverse forms. Aside from some biblical parallels, which can easily be attributed to missionary influence, many of these traditions are remarkably consistent with the local geologic setting. Very often the flood is said to have come from the sea, as would be expected in islands frequently subjected to earthquake-generated tsunamis or typhoon-lashed waves.

". . .The general resemblance of many of the American Indian flood traditions to each other can readily be explained in terms of migration and contacts between tribes, and frequent resemblances to the Bible story are not at all difficult to attribute to the efforts of missionaries. . . .

"Flood traditions are prolific throughout Latin America. There are numerous legends in which the survivors of the deluge, either

> a couple or a family, escape in a calabash, a canoe, or a raft, or climb mountains or trees. Biblical overtones are very recognizable in some cases. . . .
>
> "To cite further examples of flood traditions would become tedious, if it has not done so already. Enough instances have been given, I hope, to demonstrate that when viewed from their geologic context, many flood traditions have originated on the spot. . .
>
> ". . . there is not one deluge legend, but rather a collection of traditions which are so diverse that they can be explained neither by one general catastrophe alone, nor by the dissemination of one local tradition alone. . . One of the oldest of the remembered flood disasters occurred a long, long time ago in Mesopotamia, and it made such an impression on the dwellers in the city of Ur that the tale was handed down from generation to generation and carried with the Patriarchs when they migrated toward the Mediterranean. The legend born of that long-ago flood might never have wandered very much farther from its source were it not for the fact that it became a part of the Scriptures, and thus in later ages was zealously carried to every corner of the world by Christian missionaries, often to become merged with pre-existing traditions indigenous to their localities. Flood traditions are nearly universal, partly because of the efforts of these missionaries, but mainly because floods in the plural are the most nearly universal of all geologic catastrophes.

-- Dorothy B. Vitallano, *Legends of the Earth: Their Geologic Origins* (Bloomington, Indiana: Indiana University Press, 1973), pp. 142-178.

When the data of the present-day geographical distribution of animals are compared with the data of geographical distribution in the past, it becomes apparent that some animals currently live in only one part of the world and have never lived anywhere else, that some animals have at sometime in the past migrated to their present habitat, and that some animals are and have been fairly ubiquitous throughout their history. The fossils of many animals are found in only one location in the world; there is no evidence of even a partial migration of these animals to a staging area somewhere in the Middle East so as to be preserved in the ark with a subsequent migration back to the land of their origin. In addition, the data of oceanic islands, with their populations of unique animals, would strongly argue for the populating of these habitats, not from one location and at one time, but from various locations and at various times.

All of these scientific data, from the fields of biogeography, archeology, geology, paleontology, and anthropology would appear to lean heavily in the direction of a Flood which was limited to a portion of the earth. When we combine the biblical and the scientific data, we arrive at a Flood which was anthropologically universal but geographically limited in extent.

Combining the conception of a Creation of living things in many geographical centers at various times, with the conception of a Flood which was geographically limited, we arrive at a view which allows for most of the facts of geographical distribution. Some of

the facts, especially the presence of unique species and genera on oceanic islands which have come into geologic existence at different times, can be accounted for by positing the development of new species and new genera in extreme isolation.

FOOTNOTE #1

"If the difficulties be not insuperable in admitting that in the long course of time all the individuals of the same species, and likewise of the several species belonging to the same genus, have proceeded from some one source; then all the grand leading facts of geographical distribution are explicable on the theory of migration, together with subsequent modification and the multiplication of new forms."

-- Charles Darwin, "Summary" to Chapters XII and XIII of *The Origin of Species*

FOOTNOTE #2

"Darwin regarded fresh-water organisms as the most noteworthy exception to the principle that organisms separated by a barrier are quite different. River systems and lakes are, of course, separated from one another by barriers of land. While many fresh-water systems frequently empty Into the same ocean, salt water is a barrier to most fresh-water organisms which is no less formidable than land. Hence one might expect an unusual degree of differentiation in fresh-water floras and faunas. But the opposite is the case. There is great similarity between fresh-water organisms throughout the world, and many individual species are world-wide in distribution. Darwin believed that this could be accounted for by the fact that most fresh-water organisms must, in order to survive, be adapted for frequent short migrations from pond to pond or from stream to stream within a limited locality. But these migrations will inevitably lead to longer ones occasionally. Given time on a geological scale, this should result in very widespread species.

"All of this is not to say that there is a single, world-wide fresh-water flora and fauna. Discontinuities do exist among the inhabitants of fresh-water systems. But they are less marked than night at first be expected, and they correspond to the most ancient and imposing geographical barriers."

-- Edward O. Dodson, *A Textbook of Evolution* (Philadelphia: The W. B. Saunders Company, 1952), pp. 27-28.

What are the facts of geographical distribution? Some animals are found only in certain parts of the world. For example, armadillos, sloths, and anteaters are found only in South America, except for a few that have migrated to Central America and southern North America; and kangaroos are found only in Australia. Many unique species, some unique genera, and a few unique subfamilies are found on oceanic islands, whether volcanic or coral built on volcanic substrata.

The fossil record witnesses to the fact that some animals have always been where they are presently (vertical distribution); and the biogeographical record witnesses to the fact that some animals (and plants) have migrated across corridors, filters, and sweepstakes routes to new locations(horizontal distribution).

It is apparent that either by means of migration or by the development of natural barriers, some animals and plants have become isolated from their population groups. It would also appear apparent that the descendants of animals and plants isolated from their population groups have tended, over a period of time, to become specifically and sometimes generically distinct from their originally isolated ancestors. It thus appears that isolated animals and plants tend to speciate (develop into new species).

The evolutionist then argues as follows

If I, then S	"I" = isolation
If S, then UE	"S" = speciation
I	"UE" = unlimited evolution
UE	

The special creationist counters this argument as follows:

If I, then S	"I" = isolation
If S, then LD	"S" = speciation
I	"LD" = limited development
LD	

Notice that in his second premise ("If S, then UE") the evolutionist extrapolates from evidence of limited speciation to an unlimited conclusion. in doing so, he goes beyond the evidence.

Notice that the special creationist argues only as far as the evidence will carry him.

Of course the question is how much development has occurred. The evidence supports the assertion that a number of new species, some genera, and perhaps a few subfamilies have developed from the plants and animals that have migrated to, populated, and become isolated on oceanic islands.

The facts of geographic distribution argue for the creation of various "kinds" of plants and animals in a number of locations throughout the world, and for a Flood somewhat limited in extent. A combination of God's immediate creative activity employing similar designs among some created "kinds" and God's mediate creative activity employing the potential of genetic variability inherent in some created "kinds" would appear to explain all of the facts of geographical distribution.

E. THE EVIDENCE FROM PALEONTOLOGY (FOSSILS)

1. The Argument Stated

"The word palaeontology means literally the science of ancient life. Practically, it is the study of the fossil remains of extinct animals and plants, including any traces of their existence, such as footprints, impressions in slate, clay, or coal. The evidence from the fossils has definite elements of strength in that it deals with actual organisms that formerly inhabited the earth's surface. Many of these species must have left descendants, some of which are doubtless living in a modified condition today. Palaeontology should be able either strongly to support or to contradict the idea of evolution. if its data accord with the evolution idea and are opposed to the special creation idea, the fossils may be said to be evidences of evolution." (H. H. Newman)

"The primary and direct evidence in favour of evolution can be furnished only by palaeontology. The gelogical record, so soon as it approaches completeness, must, when properly questioned, yield either an affirmative or a negative answer: if Evolution has taken place there will its mark be left; if it has not taken place there will be its refutation." (Thomas H. Huxley)

"Fossils provide one of the strongest lines of evidence to support the theory of organic evolution. . . . The older rocks contain the remain, of organisms which differ considerably from living forms, and younger rocks contain fossils that appear to be more closely related to the plants and animals that are living today. This succession of fossils clearly indicates that life has slowly evolved from a few simple ancestors to the many different types of organisms that inhabit the earth today." (William H. Matthews III)

"Fragmentary though the fossil record is, it is striking that it gives clear testimony to the fact of evolution, and considerable detail can be worked out in many lines of descent. The most ancient fossils include only invertebrates. Then primitive fish-like vertebrates appear, and these gradually blend into true fishes, similar to some species now living. Later, amphibians and reptiles appear in the fossil record, and birds and mammals finally appear quite late. Thus the simplest animals appear in the most remote geological eras, while the most complex appear late in geological history. In most major groups (order, class, and phylum), there is marked change from one geological period to the next, but always a particular fauna resembles that of another period near it in time more closely than it does that of any other period remote from it in time. Finally, the fossils of recent organisms blend into our present living flora and fauna, with often the same genera and even the same species being represented." (Edward O. Dodson)

"The only possible direct evidence for a specific line of descent is a series of fossils leading stepwise from an ancestral to a

descended species. Hence the science of paleontology, which deals with fossil remains, has unique importance for evolution." (Edward O. Dodson)

"Evolutionary implications of Fossils. -- It is clear from the very much abbreviated account in this chapter that the animals and plants living on the earth at one time differed markedly from those of other ages. if it be assumed that there is a genetic continuity among these forms, or among any considerable portion of them, there can be no denial that evolution has occurred . . . .Biologists have assumed this genetic continuity because the alternative explanations have seemed incredible or impossible." (A. Franklin Shull)

"In the study of embryology and comparative anatomy we have only circumstantial evidence of evolution, but in the fossil remains of evolving species we have the actual documentary evidence that the changes have occurred." (C. O. Dunbar)

2. The interpretation of Fossils

"The remains of, or the record made by, an ancient living thing constitutes a fossil. The catch in this definition is the word 'ancient,' which is a very flexible one. In this context it is generally conceded to mean 'originating before the time of written history.' The footprint of some prankster in a cement sidewalk is not a fossil, but the footprint of a dinosaur is.

"Ordinarily, when an animal dies its flesh is eaten by scavengers, and its hide and bones crumble under the combined attack of sun, rain, bacteria, and chemicals. Dead plant material also decomposes and vanishes quickly. Under these conditions no fossil could form. But if the dead organism were to be protected from such thorough destruction, there would be the possibility that some record of it might remain through the ages. Quick burial in a favorable medium affords such protection. The sedentary clam living in an estuary and overwhelmed with mud during a spring flood; the hapless beast mired in an asphalt pool; the unwary insect trapped in a secretion of resin; all of these are potential fossils. Dry sand and cave deposits also may provide protective environments. Some fossils have been preserved in more rare media, such as ice and its opposite extreme, lava. This latter occurrence seems almost incredible, but it happened at least once; a rhinoceros engulfed in molten rock in the state of Washington left behind some charred bones and the imprint of its skin in the cavity which marked where it once lay.

"Those animals which possess hard parts stand the best chance of leaving behind some documentation of their existence. Fossils of entirely soft-bodied creatures have been discovered, but it is more surprising that any such animals have escaped total destruction than that so few of them have been preserved.

"All fossils belong to one of two categories: they are either the direct remains, altered or unaltered, of once living things; or they are less direct evidence of their existence."

-- Cordella Erdman Barber, "Fossils and Their Occurrence," in *Evolution and Christian Thought Today* edit. Russell L. Mixter (Grand Rapids, Michigan: Eerdmans Publishing Company, 1959). pp. 136-7.

"Fossils are either actual remains of bones or other parts preserved intact in soil or rocks, or else, end more commonly. parts of animals which have been turned into stone, or of which stony casts have been made. All such remains buried by natural causes are called fossils." (Jordan and Kellogg)

Thus Fossils include
(1) actual remains
(2) petrifactions
(3) molds and casts
(4) prints of leaves, etc.
(5) tracks, trails, and burrows

Many Greek philosophers were puzzled by the presence of typical marine shells, enclosed in rocks far removed from any body of salt water. Some were of the opinion that the sea may have originally occupied these areas. More often, however, the presence of these fossils was explained as the results of supernatural agents. Aristotle believed that fish fossils had originated in the rocks. His student, Theophrastus, observed fossil bones and believed them to be the products of certain "plastic forces" at work within the earth. Strabo noted the remains of marine organisms at altitudes well above sea level and inferred that these lands had once been under the sea but had later been elevated above sea level.

Among the Roman writers, Calus Suetonius Tranquillus (ca. A.D. 72-123) mentioned a collection of bones at the villa of Emperor Augustus. These bones, which were quite large, were believed to be the remains of an extinct race of human giants -- a belief commonly associated with such fossils as late as the eighteenth century.

During the Middle Ages, the Arab scholar, Avicenna (A.D. 979-1037), was of the opinion that "plastic forces" within the earth's crust were capable of modeling all types of plants and animals. During this period fossils were usually referred to as "figured stones." Some churchmen believed fossils to be the work of the devil, placed in the rocks to confuse or mislead men. The star-like shape of certain fossils led others to believe that the stars were responsible for the origin of these forms. Still others argued that fossils were "jokes" or "freaks of nature," or that they were types of life discarded by the Creator during experimental attempts. "Perhaps God Himself, while learning the trade of creating, first made models Out of earth; those which satisfied Him were changed into living things and the rest, or sketches, became stony fossils." The theory was also propounded that vapors from within the earth produced all fossils, by acting upon the "plastic forces."

During the Renaissance the term fossil, which had once been applied to all objects dug out of the ground, gradually came to be applied exclusively to organic remains, it was customary during this period to explain fossils as remnants of the great flood of Noah's day. There were a number of nonscientific interpretations which explained fossils as the remains of dragons, giants, and monsters. Leonardo da Vinci rejected the views that fossils are the result of "plastic forces" or a result of the Biblical Flood, and reaffirmed the theory

that fossils were existence of pest marine life *in situ*. Giralamo Fracastoro published his opinion that fossils could not have been the result of the Biblical Flood. Many scientists were persecuted, and a few burned at the stake, for holding similar opinions. A Swiss scholar, Konrad von Gesner (AD. 1516-1565), the author of the first illustrated and descriptive work dealing with fossils, believed that fossils were imitations of organisms rather than actual organic remains.

In the Seventeenth Century, Nicolaus Steno (A.D. 1638-1687), a Danish bishop, physician, and professor of anatomy, dissected sharks, compared their teeth to the "tongue-stones" which were believed to have fallen from heaven during the dark of the moon, and proved that the "tongue-stones" were actually the teeth of fossil sharks. Martin Lister, famous English physician, did not believe that fossils had ever been part of any animal, but preferred to consider them as "cocklelike stones." Robert Plot (A.D. 1640-1696), an English naturalist, was of the opinion that fossils may have been created as "ornaments' for the interior of the earth, and that they had no other significance. Edward Lhuyd (A.D. 1660-1709), Plot's successor and the author of a large illustrated catalogue of English fossils, concluded that fossils may have originated from spore-bearing vapors which were derived from the sea, which carried with them the seeds of animal life, and which condensed and fell to the earth's crust, there to develop in the earth to form fossils.

In the late eighteenth and early nineteenth centuries paleontology became firmly established as a science. The organic origin of fossils was generally accepted.

3. The Geologic Time Scale

"The study of fossils is actually a subdivision of historical geology -- the history of the earth and its inhabitants as it is recorded in the rocks of the earth's crust. The earth historian, like the historian dealing with the development of civilization, must have same method of relating important events to each other. For this purpose the geologist has developed a special time scale consisting of large and small units of geologic time. . . .

"in constructing this time scale and naming its units, geologists developed another subdivision of historical geology, namely, stratigraphy. Stratigraphy is concerned with the composition, arrangement, and correlation of the rock layers of the earth's crust. The arrangement of these layers in an orderly sequence is based upon the law of superposition This law states that in a normal sequence of beds, younger rocks are always found on top of older rocks, since that was the original order of their deposition. What this means, of course, is that in order to read earth history from its beginning we must read from the bottom of the scale upward.

"When the geologist speaks of the geologic column he means the total succession of rocks, from the oldest to the most recent, that are found in the entire earth or in a given area. . . .

"The geologic time scale is composed of named intervals of geologic time, during which similarly named groups of rocks were deposited in the geologic column. As noted earlier, these time units are used to refer to events that have taken place in the geologic past. Unlike

years, however, geologic time units are arbitrary and of unequal duration; the geologist cannot be positive about the exact amount of time involved in each unit. The time scale does, however, provide a standard by which he can discuss the age of the rocks and the fossils they contain."

-- William H. Matthews III,, *Fossils* (New York: Barnes & Noble, Inc., 1962), pp. 30-32.

The geologic time scale is divided by a number of time units, classified as follows:

TIME SCALE CATEGORIES	ROCK SCALE EQUIVALENTS
Era	Group
Period	System
Epoch	Series
Age	Stage

"...it has been possible to determine the sequence in which the various strata of the earth's surface have been laid down, from very ancient rocks right up to those of very recent origin. Particular strata are identifiable not only by the fossils which they contain. Thus it has been possible to divide geological time into a series of eras, the sequence of which is undoubted. The first two eras, the Archeozoic and the Proterozoic, are not of great interest for the present discussion, because the rocks deposited in these eras contain very few fossils, and those are generally of doubtful character. During the Paleozoic Era, fossils were deposited in great abundance, but only archaic types were present. At first, only invertebrates were represented, but fishes, amphibians, and finally reptiles made their appearance during the Paleozoic Era. The next great era was the Mesozoic, or Age of Reptiles, during which birds and small mammals also arose. Finally, the Cenozoic Era, which is still in progress, has been marked by the rise to dominance of the mammals and man." (Edward O. Dodson)

THE GEOLOGIC TIME SCALE

The names and meaning of the units of the geologic time scale are given below, beginning at the bottom of the geologic column:

ARCHEOZOIC ERA (Archean era) -- Oldest known rocks. Highly metamorphosed equivalents of all types of sedimentary and igneous rocks; but predominance of the latter. No fossils. Divided into:

- Keewatin Period -- Preponderance of metamorphosed basaltic (basic) lava flows and tuffs with some metamorphosed sediments.
- Laurentian Period -- Preponderance of granitic (acid) gneisses and schists in the form of batholiths intruding the Keewatin.

PROTEROZOIC ERA (Algonkian era) -- Separated from the Archeozoic by a profound nonconformity. Widespread development of red sandstones and shales suggesting seasonal change. Tillites, proving glacial climates In Eastern Canada, Australia, Tasmania, Norway, South Africa, and India. Only life, low forms of plants (calcareous algae).

Archeozoic and Proterozoic rocks are commonly grouped together and referred to as Precambrian in age. Since the Precambrian rocks have been greatly contorted and altered, the record of this time is most difficult to interpret. Precambrian time is that part of the geologic time from the beginning of earth history until the deposition of the earliest fossiliferous Cambrian strata. If the earth is as old as is believed, it may represent as much as 85 percent of all geologic time. (This portion of geologic time has also been referred to as the Azoic ["without life"], a term which has fallen into disuse in the United States.)

PALEOZOIC ERA (Age of Ancient Life) -- Separated from the Proterozoic by a major nonconformity. Divided into seven periods of geologic time:

Cambrian Period -- from the Latin word Cambria, meaning Wales. Geologic conditions: lands low, climate mild; earliest rocks with abundant fossils. Plant life: marine algae, fungi. Animal life: trilobites, brachiopods dominant; almost all of the modern phyla appear.

Ordovician Period -- for an ancient Celtic tribe which lived near the type locality in Wales. Geologic conditions: great submergence of land; warm climates even in Arctic. Plant life: land plants probably first appeared; marine algae abundant. Animal life: first fishes, probably fresh-water; corals, trilobites abundant; diversified molluscs; all of the modern phyla are present.

Silurian Period -- for the Silures, an ancient tribe of Wales. Geologic conditions: extensive continental seas; lowlands increasingly arid as land arose. Plant life: first definite evidence of land plants; algae dominant. Animal life: marine arachnids dominant; first (wingless) insects; rise of fishes.

Devonian Period -- for Devonshire, England. Geologic conditions: smaller inland seas; land higher, more arid; glaciation. Plant life: first forests; land plants well-established; first gymnosperms. Animal life: first amphibians, lungfishes, sharks abundant.

Mississippian Period -- for the Upper Mississippi Valley (also called Lower Carboniferous). Geologic conditions; climate warn and humid at first, cooler later as land rose. Plantlife: lycopods and horsetails dominant; gymnosperms increasingly widespread. Animal life: sea lilies at height; spread of ancient sharks.

Pennsylvanian Period -- for the State of Pennsylvania (also called Upper Carboniferous). Geologic conditions: lands at first low; great coal swamps. Animal life: first reptiles appear; insects are common; ancient amphibians spread.

Permian Period -- for the province of Penn in the Ural mountains of Russia. Geologic conditions: continents rose; Appalachians formed; increasing glaciation and aridity. Plant life: decline of lycopods and horsetails. Animal life: many ancient animals died out; primitive mammal-like reptiles and modern insects arose.

MESOZOIC ERA (Age of Reptiles) -- Separated by a major nonconformity from the Paleozoic. Divided into three periods of geologic time:

Triassic Period -- from the Latin word *trias* meaning "three," referring to the natural threefold division of these rocks in Germany into the Bunter, the Muschelkalk, and the Keuper. Geologic conditions: continents exposed; widespread desert conditions; many land deposits. Plant life: gymnosperms dominant, declining toward end; extinction of seed forms. Animal life: first dinosaurs, pterosaurs and egg-laying mammals; extinction of primitive amphibians.

Jurassic Period -- for the Jura mountains between France and Switzerland. Geologic conditions: continents fairly high; shallow seas over some of Europe and western United States. Plant life: increase of dicotyledons; cycads and conifers common. Animal life: earliest known bird, archaeopteryx, with reptilian affinities. Sharks and modern fishes abundant. Specialization of the reptiles, including ichthyosaurs (fish lizards), plesiosaurs (marine lizards), teleosaurus (ancestral crocodiles), pterosaurs (flying reptiles); and a number of terrestrial herbivorous and carnivorous dinosaurs, such as diplodocus, stegosaurus, ceratosaurus, and allosaurus. Reptilian-like and egg-laying mammals, including insectivores and marsupials.

Cretaceous Period -- from the Latin word creta meaning "chalk"; refers to chalky limestones such as those exposed in the White Cliffs of Dover on the English Channel. Geologic conditions: Andes, Alps, Himalayas, Rockies formed late; earlier, inland seas and swamps; chalk, shale deposited. Plant life; first monocotyledons; first oak and maple forests; gymnosperms declined. Animal life: dinosaurs reached peak, became extinct; toothed birds became extinct; first modern birds; archaic mammals common.

CENOZOIC ERA (Age of Mammals) -- Separated by a major nonconformity from the Mesozoic. Divided into two periods of geologic time:

Tertiary Period -- Implying "third division," from an outdated system of dividing all of the earth's rocks into four groups. The Primary and Secondary divisions of this system have been abandoned, but the Tertiary and Quaternary divisions still persist. The Tertiary Period is further subdivided into five epochs:

Paleocene Epoch ("ancient recent") -- Geologic conditions: sediments mainly terrestrial in North America. Plant life: similar to those in the Cretaceous. Animal life: no dinosaurs; dominance of the archaic mammals; appearance of creodonts (archaic carnivores) and the condylarths (primitive hoofed mammals).

Eocene Epoch ("dawn of recent") -- Geologic conditions: mountains eroded; no continental seas; climate warmer. Plant life: many of the modern genera, such as the beeches, dogwoods, walnuts, maples, and elms. Animal life: many modern orders of reptiles and birds; placental mammals diversified and specialized; progenitors of the modern mammals, including the ancestors of the camels, pigs, horses, and primitive monkeys.

Oligocene Epoch ("slightly recent") -- Geological conditions: lands lower, climate warmer; sedimentation well-developed in easterly Great Plains and Oregon; much fossilization in Bad Lands of South Dakota, in Eastern Wyoming, and in Black Hills of North Dakota; greatest development in Germany, with important sections in the Alps. Plant life: maximum spread of forests; rise of monocotyledons, flowering plants. Animal life: archaic mammals become extinct, the true carnivores replace the creodonts; rise of anthropoids; forerunners of most living genera of mammals appear; characteristic mammals are archaeotherium (giant pig), poebrotherium (ancestor of the camels), mesohippus (early horse), hyracodon (cursorial rhinoceros), and hoplophoneus (progenitor of the saber-toothed cats).

Miocene Epoch ("less recent") -- Geological conditions: Sierra and Cascade mountains formed; volcanic activity in northwest United States, great accumulation of volcanic agglomerates in the Yellowstone Park region; period of mountain building in the Alps, Apennines, and Himalayas; climate cooler. Plant life: plants very similar to modern types, including the grasses, pines, and hard woods, such as sumac, beech, elm, and oak. Animal life: great development of modern mammals, especially in North and South America; primitive types of dogs, camels, horses, antelope, elephants, and rodents in North America; first manlike apes.

Pliocene Epoch ("more recent") -- Geologic conditions: continued rise of mountains of western North America; considerable volcanic activity, especially in the Rocky Mountain region. Plant life: decline of forests, spread of grasslands; flowering plants, monocotyledons developed; fossil plants abundant in Europe. Animal life: numbers of mammals very similar to the Pleistocene and Recent, including all types of carnivores, horses, browsing camels, antelopes, and mastodons.

Quaternary Period -- implying "fourth derivation,' from the outdated four-division system. Divided into two epochs:

Pleistocene Epoch ("much recent") -- Geological conditions: repeated glaciation; four ice ages, with glaciation confined to northern North America and Europe, with sympathetic mountain glaciation well to the south; increased humidity in former arid regions, climatic zones; continued volcanic activity. Plant life: great extinction of plant species. Animal life: extinction of great mammals; great reduction in number of remaining larger mammals, except in portions of Asia and Africa; characteristic mammals of North America include elephas (elephant), the mastodon, a giant stag-moose, a number of true horses, smilodon (last of the saber-toothed tigers), and megalonyx (giant ground sloth).

Recent Epoch (formerly called Holocene) -- Geological conditions: end of last ice age; climate warmer. Plant life: decline of woody plants, rise of herbaceous ones. Animal life: species now found in the same country; domestic animals; Age of Man.

Archeological divisions (Palaeolithic, Mesolithic, Neolithic, Age of Metals) begin with the ending of the Pliocene and extend to the present age.

STANDARD GEOLOGIC RELATIVE TIME SCALE				
TIME SCALE (Years BP)	ERAS	PERIODS	EPOCHS	FOSSIL RECORD OF THE APPEARANCE OF NEW FORMS OF LIFE
**********				
			Recent	No new basic forms
10,000		Quaternary	Pleistocene	Most modern families, genera, and species present, first men
2,000,000				
		**********		
12,000,000			Pliocene	All types of carnivores, many types of horses and browsing mammals
26,000,000			Miocene	First mastodons, giant ground sloths, primitive dogs, horses, antelopes
36,000,000		Tertiary	Oligocene	First true carnivores, first cats (saber-toothed), first apes
54,000,000			Eocene	First rodents, first rhinoceroses, first monkeys
65,000,000			Paleocene	First hoofed mammals, first eating mammals, first lemuroids
**********				

Standard Geologic Relative Time Scale -- cont.			
135,000,000		Cretaceous	Last dinosaurs, last toothed birds, first modern birds
180,000,000	MESOZOIC	Jurassic	First flowering plants, giant dinosaurs, first birds, first mammals
225,000,000		Triassic	Last seed ferns, first dinosaurs
280,000,000		Permian	Last trilobites, last eurypterids, first modern insects
310,000,000		Pennsylvanian Mississippian	First conifers, first primitive insects (wingless), first reptiles First bryophytes (mosses and liverworts)
355,000,000	PALEOZOIC	Devonian	First fungi, first seed-bearing plants, first amphibians
405,000,000		Silurian	First land plants, first land animals
440,000,000		Ordovician	First bryozoans, first vertebrates (jawless fishes)
500,000,000		Cambrian	Almost every major phylum of living things
600,000,000			
	PROTEROZOIC		Brachiopods Marineworms (trails, burrows)
	ARCHEOZOIC		Marine bacteria Marine algae
3,500,000,000	(age of oldest rocks on the surface of the earth)		
4,500,000,000	(age of the earth)		

[TABLE FROM FUNDAMENTAL ASTRONOMY]

STANDARD GEOLOGIC RELATIVE TIME SCALE

TIME SCALE (Years BP)	ERAS	PERIODS	EPOCHS	FOSSIL RECORD OF THE APPEARANCE OF NEW FORMS OF LIFE
			Recent	No new basic forms
10,000				
		Quaternary	Pleistocene	Most modern families, genera, and species present, first men
2,000,000				
			Pliocene	All types of carnivores, many types of horses and browsing mammals
12,000,000				
	CENOZOIC		Miocene	First mastodons, giant ground sloths, primitive dogs, horses, antelopes
26,000,000				
		Tertiary	Oligocene	First true carnivores, first cats (saber-toothed), first apes
36,000,000				
			Eocene	First rodents, first rhinoceroses, first monkeys
54,000,000				
			Paleocene	First hoofed mammals, first eating mammals, first lemuroids
65,000,000				
		Cretaceous		Last dinosaurs, last toothed birds, first modern birds
135,000,000				
	MESOZOIC	Jurassic		First flowering plants, giant dinosaurs, first birds, first mammals
180,000,000				
		Triassic		Last seed ferns, first dinosaurs
225,000,000				
		Permian		Last trilobites, last eurypterids, first modern insects
280,000,000				
		Pennsylvanian		First conifers, first primitive insects (wingless), first reptiles
310,000,000				
		Mississippian		First bryophytes (mosses and liverworts)
355,000,000	PALEOZOIC			
		Devonian		First fungi, first seed-bearing plants, first amphibians
405,000,000				
		Silurian		First land plants, first land animals
440,000,000				
		Ordovician		First bryozoans, first vertebrates (jawless fishes)
500,000,000				
		Cambrian		Almost every major phylum of living things
600,000,000				
	PROTEROZOIC			Brachiopods Marine worms (trails, burrows)
	ARCHEOZOIC			Marine bacteria Marine algae
3,500,000,000	(age of oldest rocks on the surface of the earth)			
4,550,000,000	(age of the earth)			

A chronology of the universe from FUNDAMENTAL ASTRONOMY: SOLAR SYSTEM AND BEYOND:

Time: 13 billion B.C.	The universe is created (probably through the explosion of a cosmic primeval "atom," a fireball of energy out of which all matter ultimately was formed).
Time: 10 billion B.C.	The first stars of the Milky Way Galaxy begin to shine by energy released from nuclear reactions deep within their cores.
Time: 5 billion B.C.	The newly-born sun joins the galaxian assemblage of stars.
Time: 4½ billion B.C.	The earth is consolidated from cold, solid debris within the gas and dust clouds of the Milky Way.
Time: 3 billion B.C.	The oceans, covering 71 per cent of the earth's surface, are formed.
Time: 2 billion B.C.	The first living plants begin to release oxygen into the atmosphere.
Time: 600 million B.C.	Fossils begin to collect on the seas' floors.
Time: 150 million B.C.	Dinosaurs dominate the animal world.
Time: 80 million B.C.	A great uplift occurs in North America and the Rocky Mountains are born.
Time: 35,000 B.C.	Modern (Cro-Magnon) man makes his appearance.
Time: A.D. 1726—1974	Pluto makes one revolution around the sun.
Time: 1.3 seconds ago	The central star in the Crab Nebula in the constellation Taurus just spun on its axis through 39 complete revolutions.

A CHRONOLOGICAL SURVEY OF THE APPEARANCE OF CERTAIN MAJOR GROUPS IN THE FOSSIL RECORD

CAMBRIAN PERIOD
- ALGAE (many types)
- ARTHROPODS (Trilobites, first Crustaceans)
- BRACHIOPODS
- CHORDATES (Hemichordates)
- PORIFERA (Sponges)
- COELENTERATES (Hydrozoa)
- ANNELIDA (Worms)
- MOLLUSKS (Pelecypods, Gastropods, Cephalopods)
- ECHINODERMS (Cystoids)
- PROTOZOANS (Radiolaria)

ORDOVICIAN PERIOD
- ARTHROPODS [Merostomata:-Eurypterids (Scorpion-like Crabs)]
- BRYOZOANS
- COELENTERATES [Anthozoa (corals)]
- ECHINODERMS [Blastoids, Crinoids (Sea Lilies), Asteroids (Starfish), Echinoids (Sea Urchins and Sand Dollars)]
- MOLLUSKS [Amphineura (Chitons)]
- CHORDATES [Agnatha (jawless fishes)]

SILURIAN PERIOD
- ARTHROPODS [Arachnids (Scorpions)]
- PSILOPSIDS (simplest vascular plants; oldest known land plants)
- CHORDATES [Placoderms (Plate-skinned fishes)] (only vertebrate class to become extinct)

DEVONIAN PERIOD
- FUNGI
- HORSETAILS and SCOURING RUSHES
- CLUB MOSSES
- SEED FERNS (First known seed-bearing plants)
- ARTHROPODS (Arachnids (Spiders), Insects (wingless)]
- MOLLUSKS (Scaphopods, Cephalopods:-Ammonites)
- CHORDATES [Chondrichthyes (Sharks), Osteichthyes (first bony fishes)]
- CHORDATES [Amphibians]

MISSISSIPPIAN PERIOD
- BRYOPHYTES [Mosses and Liverworts]
- Echinoderms [Sea Cucumbers]

PENNSYLVANIAN PERIOD
- CORDAITES, CONIFERS
- ARTHROPODS [Millipeds, Insects:-Cockroaches]
- CHORDATES [Reptiles:-Cotylosaurs, Pelycosaurs]

PERMIAN PERIOD

CYCADS CYCADEOIDS
GINKGOS
CHORDATES (Reptiles:-Therapsida)

TRIASSIC PERIOD

CHORDATES (Reptiles:-Chelonia, Ichthyosauria, Sauropterygia, Rhymchocephalia, Squamata, Thecodontia, Crocodilia, Saurischia)

JURASSIC PERIOD

ANGIOSPERMS (First flowering plants)
CHORDATES (Reptiles:-Pterosauria, Ornithischia)
CHORDATES [Aves (first birds)]
CHORDATES [Mammals (first forms)]

CRETACEOUS PERIOD

CHORDATES (Reptiles:-Ornithischia---Ankylosauria, Ceratopsia)

TERTIARY PERIOD

CHORDATES (Mammals:-Carnivora, Pantodonta, Edentata, Dinocerata, Proboscidea, Perissodactyla, Artiodactyla, Primates)

QUATERNARY PERIOD

CHORDATES (most modern families, subfamilies, genera, and species of plants and animals; and man)

4. Chronology of Geologic Time

"The age of the earth has been estimated by several different methods. Some of these, such as computing the salinity of the sea or the rate of erosion, only serve to indicate that our planet is very, very old. On the other hand, the so-called 'radioactive clock' can give us rather accurate age determinations based upon the rate of disintegration of certain radioactive minerals. The oldest rocks yet tested by the latter method indicate that the earth is between three and five billion years old.

"Salt Content of the Sea. It is believed by many geologists that the oceans were originally composed of fresh water and that the salt was dissolved from the soil and carried to the sea by streams. The conversion of such large bodies of fresh water to salt water must, of course, have taken a long period of time. Age estimates based on this method indicate that it must have taken approximately one hundred million years for the oceans to reach their present degree of salinity.

"This method cannot be used with any degree of accuracy because (1) much of the salt has been subjected to several cycles of deposition; (2) much of the original salt is in water locked deeply in buried marine sedimentary rocks; and (3) the age of the oceans is necessarily less than the age of the earth.

"Rate of Deposition of Sediments. This method assumes that if the rate of deposition of sediments is known, the total thickness of these sediments will give some indication as to the age of the earth. Estimates derived by this method range from one hundred to six hundred million years.

"There are three major disadvantages to this type of estimate: (1) different types of sediments accumulate at different rates; (2) typical rates of deposition for different rock types are not known with any accuracy; and (3) no allowance is made for rocks that were not deposited or that were deposited and were later removed by erosion.

"Rate of Erosion. This method, based on attempts to determine how long ago erosion began on the earth, is the reverse of the sedimentation method discussed above. The main procedure is to determine the number of years required to erode one foot of rock from the earth. The estimated number of years divided into the number of feet calculated to have been removed in the past will give some idea as to how long the earth's surface has been subjected to erosion. Although this estimate can provide no accurate indication of the earth's age, it does indicate that the earth is extremely old.

"The principal disadvantages of this method are: (1) there is no way of knowing the total amount of sedimentary rock in the earth's crust; (2) much of the sediment derived from sedimentary rocks has been eroded and redeposited many times; and (3) the present rate of erosion is not necessarily the average rate of erosion for all geologic time.

"Disintegration of Radioactive Minerals. in the application of this method, rocks containing radioactive minerals are used. These radioactive minerals, such as uranium or thorium, have large unstable atoms which undergo slow, spontaneous disintegration. The rate of disintegration, or 'decay,' is not affected by changes in temperature, pressure, or chemical conditions. As the mineral disintegrates, helium is released and a series of new elements is formed, the last of which is lead. Using a mathematical formula whereby the ratio between the radioactive lead and the remaining amount of uranium can be calculated, it is possible to determine the age of the radioactive mineral. The oldest rock definitely dated by radioactive means are certain Precambrian rocks in South America which indicate an age of about 3,300 million years.

"While this method s the most accurate yet developed, it is, of course, limited to those rocks containing radioactive minerals. These rocks are usually difficult to correlate with fossil-bearing sedimentary rocks, and the latter must therefore be dated indirectly.

"The radioactive minerals mentioned above are useful in dating the more ancient rocks, but they disintegrate so slowly as to be useless in dating younger deposits. The discovery of radiocarbon dating by the Carbon-14 method (C^{14}) has provided scientists with a valuable means of obtaining relatively precise measurements of rocks less than thirty to forty thousand years old.

"Radiocarbon dating is based on the discovery that all organisms contain a constant amount of Carbon-14, a radioactive isotope. However, when an organism dies radiocarbon is gradually lost, and the disintegration of this radioactive carbon proceeds at a known rate. This rate is such that one-half of the radioactive material has decayed at the end of about 5,568 years. In using this method the amount of Carbon-14 remaining in the sample is measured, and the approximate age of the specimen is ascertained by comparing the ratio of the radioactive carbon remaining in the specimen to the amount present in most living things.

"This method was discovered by Dr. W. F. Libby, who was awarded the Nobel prize in chemistry for his outstanding work in this field. The radiocarbon technique has been of particular value in dating archaeological objects, as well as wood, bone, or shells of less than forty thousand years in age.

"The following quotation will help us to appreciate the enormous amount of time involved in the history of the earth:

"'If we imagine the whole of earth's history compressed into a single year, then on this scale, the first eight months would be completely without life. The following two months would be devoted to the most primitive creatures ranging from viruses and single-celled bacteria to Jellyfish, while mammals would not have appeared until the second week in December. Man, as we know him, would have strutted onto the stage at about 11:45 p.m. on December 31. The age of written history would have occupied little more than the last sixty seconds on the clock.'

-- William H. Matthews III, Fossils (New York: Barnes & Noble, inc., 1962), pp. 36-38.

"Fortunately, there are methods of determining the ages of rock deposits in the earth's crust. The oldest method is applicable only to sedimentary rocks -- those successive layers or strata of rocks which are formed by slow settling out of sediments from the oceans or other large bodies of water. The use of the method for dating purposes is based upon the assumption that those geological processes which are observable in action now are the same ones which have determined the past history of this earth, and that they have in the past acted at rates comparable to those now observable. As applied to the problem at hand, this simply means that the sedimentary rocks of the past were deposited at rates comparable to those which are now being deposited. in a purely comparative way, dating by this means is fairly satisfactory. The deepest strata are the oldest, while the most superficial strata are quite recent. Thick strata represent long continued deposition, while thin strata represent short periods of deposition. Thus same relative concepts of geological time are readily gained from an inspection of the sedimentary rock deposits. But more exact ideas are difficult to obtain because it is clear that sedimentation is now progressing at very different rates in different parts of the world, and there is no reason to doubt that the variation in the rate of sedimentation has been as great over much of the world's history. It may well have been greater at times. Hence calculations

of age based upon the thicknesses of stratified rocks lead to such statements as that the Mesozoic Era began somewhere between 190,000,000 and 240,000,000 years ago. But the difference between these figures is more than 25 percent of the smaller one. In addition to this difficulty the strata have been changed by such geological processes as folding and erosion, so that often the record is fragmentary and confused. There are a few instances in which stratified rocks appear to have been laid down in definite annual layers, the varves, more or less comparable to the annual growth rings of trees. In such cases, the extent of the periods of sedimentation can be determined with great exactness, if the varves actually do represent annual layers. But this is by no means certain. And even if it were certain, the number of known examples is so small that it could have little importance for the general problem of dating geological history. . . .

"The Lead Method. In 1907, Boltwood introduced a method for dating geological strata based upon radioactive elements. The conclusions to which the new method led indicated that the earth was vastly older than had been generally believed, and the method was received with skepticism. But it has since become the standard by which the accuracy of other methods of dating is judged. . . .

"While this so-called 'lead' method is now generally accepted as being highly accurate, it has some serious limitations. Uranium is not a common element. But in addition to this, it is most commonly associated with geological formations which have not been successfully fitted into their proper places on the geological time scale. Only a very few uranium deposits have been found which are actually useful for dating the main stages in geological history, but the importance of these outweighs their numbers. It appears that the oldest rocks which could possibly have supported life are 2,000,000,000 years old. As the oldest dated rocks are probably of much more recent origin than the world itself, it seems probable that the world is as old as 3,000,000,000 years. Around three-quarters of that 2,000,000,000 years during which life might have existed passed before the beginning of the Cambrian Period, with which the useful fossil record begins, for a lead measurement of the age of a late Cambrian deposit gave a figure of 440,000,000 years. The next exact determination is in the early Permian Period, at an age of 230,000,000 years. Thus the entire Paleozoic Era probably lasted about 300,000,000 years; the Mesozoic about 130,000,000 years; and the Cenozoic about 75,000,000 years up to the present. There is an accurately dated deposit from the beginning of the Eocene Epoch which places this at 58,000,000 years ago. This is all that the lead method has yielded thus far. The dates are few, but fortunately they are scattered widely in geologic time. But as yet, accurate determinations are not available for the extent of any of the Periods or epochs."

-- Edward O. Dodson, *A Textbook of Evolution*, 1952, pp. 70, 71, 74, 75.

The four glacial ages of the Quaternary, by which fossil man has been dated, are:

Glacial Age	European Name	North American Name
1st Glacial	Günz	Nebraskan
1st interglacial	Günz-Mindel (Norfolkian)	Aftonian
2nd Glacial	Mindel	Kansan
2nd Interglacial	Mindel-Riss (Tyrolian)	Yarmouth
3rd Glacial	Riss	Illinoian
3rd Interglacial	Riss-Wurm (Dumtenian)	Sangamon
4th Glacial	Wurm	Wisconsin
Postglacial		

5. The Fossil Evidence for Human Evolution

"...there appears now to be no theoretical objection to the derivation of the Hominidae and the Recent Pongidae from a common ancestry at least as late as Early or Middle Miocene times, and possibly even later. It was perhaps subsequent to this time, therefore, that, In association with opposing trends in adaptation to posture and gait, the divergent evolutionary development of characteristic growth rates of the limb and trunk in the Hominoidea marked the initial phylogenetic separation of the earliest precursors of the Hominidae from the Pongidae. . . .

"Those anatomists who have persuaded themselves of the 'uniqueness' of man's anatomical structure have commonly assigned to him a vast geological antiquity. But, as already pointed out. . . , there is no objective reason for assuming that the family of the Hominidae, morphologically speaking is more 'unique' than any other family of the Mammalia. So far as the evidence at present available can be assessed, the origin of the Hominidae and the Pongidae from a common ancestral stock seems well assured."

-- W. E. Le Gros Clark, *The Fossil Evidence for Human Evolution* (Chicago: The University of Chicago Press, 1955), pp. 169-171.

"Among the most controversial aspects of Charles Darwin's ideas on evolution was his recognition that man was closely allied to other animals and appeared to have evolved from them. Although detailed fossil evidence was lacking, Darwin freely predicted on the basis of morphology and behavior that stages intermediate between apes and men would ultimately be discovered. During the century since the publication of The Origin of Species this concept has been repeatedly attacked on nonscientific and metaphysical grounds. Concurrently, however, fossil materials of apes, ape-men, and men have been gathered from a wide variety of sources, and both the cumulative evidence and recant finds unequivocally support the theory of human origin from the higher apes.

"Human evolution as seen in its basic outlines does not involve processes or mechanisms unique in the biotic world. In fact, compelling evidence for human evolution from other organisms is the fact

that our historical development exhibits the same general patterns of linear and divergent evolution characteristic of all life. Man is, of course, a unique product of evolutionary forces and has attributes not found in other species; but so is every other species of living organism unique in its particular characteristics and evolutionary development. Human beings are interested in human evolution not because of any special evolutionary forces responsible for our origin and development, but because as one of our biological attributes as men we are egocentrically anthropomorphic. in some individuals our egocentrism is carried to the extreme in a complete denial of our biological relations and repeated statement that we are so peculiar that we cannot be the products of biological development and cannot be descended from other animals. Unfortunately, such statements are not based upon evaluation of the evidence but rather upon emotional or mystical grounds. As will be readily apparent in the discussion below, the crucial evidence of human evolution and the essential outlines of man's evolutionary progress are overwhelmingly convincing to all men with open minds. Those people who continue to insist that recognition of evolution from other animals somehow debases us or destroys in same unknown manner those biological attributes that have made us successful and unique evolutionary products, prefer to disregard the evidence.

"it has long been recognized that man as a species is related to a rather diverse group of mammals, placed by modern biologists in the order Primates. This order is regarded as being among the more primitive groups of placental mammals and is characterized by retention of many generalized features that in more highly evolved mammal orders have taken on extreme specializations. . . .

"The course of evolution among the primates other than man may be sketched in broad outline on the basis of the structure of living forms and a fragmentary but convincing fossil record. . . .

"....Numerous ape remains are known from Miocene and Pliocene times. Significantly, although they are definitely apelike in most regards, all these ancient apes exhibit few of the extreme specializations of the modern gibbon, orangutan, chimpanzee, or gorilla but have characteristics somewhat similar to those found in man . . . .The similarities between men and the manlike or anthropoid apes have led to a general theory of a common ancestry of the two groups, a theory enhanced by the striking similarities between primitive fossil apes and the human species. It has been only recently, however, that the crucial fossil evidence of man's origin has been uncovered in a series of exciting discoveries in central and southern Africa.

"The most important differences between apes and men are summarized below as a basis for evaluating the position of the newly discovered fossil primates so critical to our understanding of human origins.

	Apes		Man
1.	Cranium expanded; maximum brain size 600 cc	1.	Cranium greatly expanded; maximum brain size 1600 cc
2.	Occipital condyles posterior	2.	Occipital condyles anterior
3.	Strong nuchal crest	3.	Low nuchal Crest
4.	Palate long	4.	Palate reduced
5.	incisor and canine teeth large	5.	Incisor and canine teeth reduced
6.	Anterior premolar in lower Jaw strong and pointed	6.	Anterior premolar in lower Jaw small and bicuspid
7.	Pelvis narrow and elongated	7.	Pelvis broad and flattened
8.	Limited use and no manufacture of tools	8.	Extensive use and manufacture of tools

"Correlated with the expanded cranium and large brain size of man are his ability to reason, his fine memory, and his use of language, all of limited significance among the apes. The features of condyle location, nuchal crest development, and pelvic structure are associated with bipedal locomotion. The first two are related to the position of the head and its muscular supports in an upright stance; the last with support of the body and muscular attachments for the hind limbs in bipedal locomotion. Apes occasionally are bipedal, but normally walk on all fours when on the ground. The structural differences between apes and men in palatal and dental characteristics appear to show correlation with food habits. Man is more thoroughly omnivorous than the apes and is unable to kill animal prey with his inadequate teeth and Jaws. Tool manipulation and construction in man are attributes made possible by his upright stance that frees the fore limbs for uses other than locomotion and by the large brain centers devoted to manual control. These broad correlations between brain size, bipedalism, tool manipulation, and associated features suggest that the characteristics evolved more or less in conjunction with one another over a brief period of time. Strong positive selection for all the characteristics essential to man's dominance of his environment probably explains the rapid shift from ape to man during the last one million years.

"Although the similarities in many features and the obvious relationship between apes and modern man supported the theory of common ancestry, the differences between the two groups in the essentials discussed above had still to be explained. Among biologists in the early part of the present century, these differences provided some basis for doubt as to the evolution of man from higher apes. Then a series of extremely important finds gradually filled in the gap between the two groups."

-- Jay N. Savage, *Evolution* (New York: Rinehart and Winston, Inc., 1963), pp. 110-115.

"We have followed the stages in the progressive evolution of the Primates which culminated in the appearance of human beings. We have seen that it is possible to illustrate, by reference to comparative

anatomical and fossil evidence, the gradual transformation of small generalized mammals similar to tree-shrews into the higher Primates, and even into Man himself. Although the fossil record is still far from complete, It is yet sufficient to allow us to link up one evolutionary stage with another in a natural sequence. The gaps which remain in this sequence are no longer of such an order as to demand any great effort of scientific imagination to fill them with hypothetical 'missing links.' We can readily conceive the transition from a tree-shrew type of ancestor to the primitive lemuroids and tarsioids of Eocene times, from these small Primates to progressive tarsioids with many simian features, from these again to the small gibbon-like animals of the Oligocene, to the larger generalized apes of the Miocene, to the remarkable *Australopithecinae* of South Africa, and to primitive men of the *Pithecanthropus* group. In Pleistocene times the transition from these primitive types of Man to Mousterian Man of the extreme Neanderthal type in one direction, and to the less specialized Acheulian Man in another, is equally easy to follow. Lastly, the structural contrast between Acheulian Man and modern representatives of Homo sapiens is so slight as to be quite unobtrusive."

-- W. E. Le Gros Clark, *History of the Primates* (Chicago: The University of Chicago Press, 1957), pp. 177-178.

"The bearing of the three great classes of facts now given is unmistakable. But it would be superfluous fully to recapitulate the line of argument given in detail in my 'Origin of Species.' The homological construction of the whole frame in the members of the same class is intelligible, if we admit their descent from a common progenitor, together with their subsequent adaptation to diversified conditions. On any other view, the similarity of pattern between the hand of a man or monkey, the foot of a horse, the flipper of a seal, the wing of a bat, etc., is utterly inexplicable. it is not scientific explanation to assert that they have all been formed on the same ideal plan. With respect to development, we can clearly understand, on the principle of variation supervening at a rather late embryonic period, and being inherited at a corresponding period how it is that the embryos of wonderfully different forms should still retain, more or less perfectly, the structure of their common progenitor. No other explanation has ever been given of the marvelous fact that the embryos of a man, dog, seal, bat, reptile, etc., can at first hardly be distinguished from each other. In order to understand the existence of rudimentary organs, we have only to suppose that a former progenitor possessed the parts in question in a perfect state, and that under changed habits of life they became greatly reduced, either from simple disuse, or through the natural selection of those individuals which were least encumbered with a superfluous part, aided by the other means previously indicated.

CLASSIFICATION OF THE HOMINIDAE

"At least 105 different species have been created in this family, of which 63 are invalidated by the rules of nomenclature. The creation of the majority of the remainder (38 out of 42) is considered unjustified.

"The following classification summarizes the conclusions reached in this discussion (the international symposium on the classification of fossil men held in the summer of 1962 at Burg Wartenstein, Austria, the European conference center of the Wenner-Gren Foundation), and represents a statement of the situation which is broadly accepted by many workers at the present time.

Family: Hominidae (Gray, 1825)

Genus: Australopithecus (Dart, 1925)

Species: Australopithecus africanus (Dart, 1925)
Australopithecus robustus (Broom, 1938)

Genus: Homo (Linnaeus, 1758)

Species: Homo erectus (Dubois, 1892)

Subspecies: Homo erectus erectus (Dubois, 1892)

Species: Homo sapiens (Linnaeus, 1758)

Subspecies: Homo sapiens steinheimensis (Berekhemer, 1936)
Homo sapiens neanderthalensis (King, 1864)
Homo sapiens soloensis (Openoorth, 1932)
Homo sapiens rhodesiensis (Woodward, 1921)
Homo sapiens sapiens Linnaeus, 1758)"

[taken from *Classification and Human Evolution* ed. Sherwood 1. Washburn (Chicago Aldine Publishing Company, 1963), p. 69 of Bernard Campbell's article, "Quantitative Taxonomy and Hunan Evolution]

CHRONOLOGICAL CLASSIFICATION OF THE HOMINIDAE FOSSIL RECORD		
Name	**Date**	**Cranial Capacity**
Australopithecus africanus	1,750,000 -- 1,000,000 BP	482-675 cc.
Australopithecus robustus	1,750,000 -- 500 ,000 BP	530-650 cc
Homo erectus erectus	710,000 -- 500,000 BP	815-940 cc
Homo erectus pekinenss	490,000 -- 370,000 BP	915-1225 cc
Homo sapiens steinheimensis	400,000 -- 200,000 BP	1150-1175 cc
Homo sapiens intermediate	200,000 BP	1325 cc
Homo sapiens neanderthalensis	150,000 -- 40,000 BP	1234-1641 cc
Homo sapiens rhodesiensis	100,000 -- 70,000 BP	1250-1280 cc
Homo sapiens sapiens	45,000 -- 10,000 BP	1250-1650 cc
RANGE OF CRANIAL CAPACITY IN MODERN HOMO SAPIENS		
Hulse, 1963 -- 900-2200 cc. Buettner-Janusch, 1966 -- 850-1700 cc. Clark, 1967 -- 900 cc. or even less to almost 2000 cc.		

BRAIN WEIGHTS AND BODY WEIGHTS IN CERTAIN MAMMALS

Comparison of Brain Weights (estimates of averages)

Mammal	Brain Weight	Mammal	Brain Weight
(1) Beaver	30 g	(10) Orangutan	400 g
(2) Sykes Monkey	60 g	(11) Chimpanzee	400 g
(3) Capuchin Monkey	70 g	(12) Gorilla	500 g
(4) Macaque Monkey	100 g	(13) Australopithecus	500 g
(5) Gibbon	100 g	(14) Homo erectus	1000 g
(6) Night Monkey	115 g	(15) Mono sapiens	1400 g
(7) Bushbuck	140 g	(16) Porpoise	1750 g
(8) Baboon	200 g	(11) Indian Elephant	3120 g
(9) Deer	210 g	(18) African Elephant	4675 g

Comparison of Body Weights (estimates of averages)

Mammal	Brain Weight	Mammal	Brain Weight
(1) Capuchin Monkey	3,100 g	(10) Chimpanzee	45,000 g
(2) Sykes Monkey	4,900 g	(11) Homo erectus	50,000 g
(3) Gibbon	5450 g	(12) Deer	65,100 g
(4) Beaver	5,800 g	(13) Homo sapiens	68,000 g
(5 Night Monkey	9,000 g	(14) Orangutan	68,000 g
(6) Macaque Monkey	10,000 g	(15) Porpoise	150,000 g
(7) Baboon	20,000 g	(16) Gorilla	250,000 g
(8) Australopithecus	20,000 g	(17) Indian Elephant	3,636,000 g
(9) Bushbuck	35,400 g	(18) African Elephant	5,455,000 g

Ratios of Brain Weights to Body Weights (estimates of averages)

Mammals	Brain-Body Ratio	Mammal	Brain-Body Ratio
(1) Australopithecus	1:40	(10) Baboon	1:100
(2) Capuchin Monkey	1:43	(11) Chimpanzee	1:115
(3) Homo sapiens	1:49	(12) Orangutan	1:170
(4) Homo erectus	1:50	(13) Beaver	1:197
(5) Gibbon	1:55	(14) Bushbuck	1:253
(6) Night Monkey	1:80	(15) Deer	1:310
(7) Sykes Monkey	1:81	(16) Gorilla	1:500
(8) Porpoise	1:86	(17) Indian Elephant	1:1167
(9) Macaque Monkey	1:100	(18) African Elephant	1:1167

Brain Weights of Homo Sapiens at Various Ages

		Absolute Weights	
Absolute Age	% Adult Weight	Homo Sapiens Species	Modern Homo Sapiens
birth	24%	312 g	348 g
3 years	82%	1066 g	1160 g
10 years	95%	1235 g	1378 g
adult	100%	1300 g	1450 g

FOSSIL DISCOVERIES OF THE HOMINIDAE

I. FOSSILS OF AUSTRALOPITHECUS

FINDER	DATE FOUND	SITE	SKELETAL REMAINS	ASSOCIATED CULTURE	CRANIAL CAPACITY	AGE
R. A. Dart	1924	Taung, Bechuanaland	skull, jaw, with teeth	none found	440 cc.	Lower Pleistocene
Robert Broom	1936-48	Sterkfontein, South Africa	skulls, jaws, 120 teeth	?	480 cc.	Lower Pleistocene
Robert Broom	1938	Kromdraai, South Africa	partial skull, jaw, etc.	?	------	Middle Pleistocene
R. A. Dart	1947	Makapansgat, South Africa	skull, jaw, teeth, etc.	utilized bones?	435 cc.	Lower Pleistocene
Robert Broom, J. T. Robinson	1949	Swartkrans, South Africa	skull	Oldowan?	530 cc.	Second Glacial
Margaret Leakey	1959	Olduvai, Tanzania	skull (Zinjanthropus) (Australopithecus boisei)	Oldowan	530 cc.	1,750,000
. Merinsky	1959	Ubeidiya, Israel	2 skull fragments, tooth	Oldowan?	-------	Lower Pleistocene
L. S. B. Leakey Margaret Leakey Jonathan Leakey	1960	Olduvai, Tanzania	skull, foot bones, jaw (Homo habilis)	Oldowan	687 cc.	1,750,000
Richard Leakey	1964	Lake Natron, Tanzania	lower jaw with teeth	none found	-------	
Bryan Patterson	1965	Lake Rudolf, Kenya	arm bone	none found	-------	4,000,000
Bryan Patterson	1967	Lothagam, w. of Lake Rudolf, Kenya	lower jaw, with one molar	none found	-------	5,500,000
F. Clark Howell	1967-68	Omo River, Ethiopia	two lower jaws	none found	-------	2,000,000
F. Clark Howell	1967-68	Omo River, Ethiopia	fifty teeth	none found	-------	3,000,000
Richard Leakey	1972	E. of Lake Rudolf, Kenya	talus (ankle) bone	none found	-------	2,600,000
Richard Leakey	1972	E. of Lake Rudolf, Kenya	skull (skull 1470) (KNM-ER 1470) (Homo habilis)	none found	800 ~~775~~ cc.	2,800,000
Richard Leakey	1972	Lake Turkana	skull (KNM-ER 732) (Australopithecus boisei)	none found	530 cc.	

I. FOSSILS OF AUSTRALOPITHECUS continued

FINDER	DATE FOUND	SITE	SKELETAL REMAINS	ASSOCIATED CULTURE	CRANIAL CAPACITY	AGE
D. Carl Johanson	1973	Afar-Awash Valley, Ethiopia	skull fragment, leg bones	none found	-------	3,000,000+
D. Carl Johanson	1974	Hadar River, North-Central Ethiopia	upper jaw, halves of upper and lower jaws, all with teeth	none found	-------	3,100,000-3,250,000
Richard Leakey	1975	Laetolil, s. of Olduvai	jaw bones, teeth, of 11 individuals	none found	-------	3,350,000-3,750,000
Richard Leakey	1976	N. Kenya	skull	none found	?	1,600,000
D. Carl Johanson	1976	Afar, Ethiopia	remains of 5-7 individuals	?	-------	
Richard Leakey	1976	N. Kenya	skull	none found	?	2,500,000-3,000,000
D. Carl Johanson	1976	Hadar River, Afar Triangle North-Central Ethiopia	parts of vertebrae, limb bones, part of lower jaw (40% of a complete skeleton) (Lucy)	none found		3,500,000

II. FOSSILS OF HOMO ERECTUS

Eugene Dubois	1891	Trinil, Java	cranium, femur	none found	940 cc.	710,000 (K/A)
O. Schoetensack	1907	Mauer bei Heidelberg, Germany	lower jaw	none found	-------	500,000
J. G. Anderson W. C. Pei	1921-37	Choukoutien (near Peking) China	14 skulls, 11 jaws, teeth	stone choppers, fire hearths	915 cc.-1225 cc.	370,000 (K/A)
C. ter Haar . H. R. von Koenigswald	1931-33	Ngandong (Solo River) Java	11 skulls, 2 tibiae	none found	?	30,000

II. FOSSILS OF HOMO ERECTUS continued

FINDER	DATE FOUND	SITE	SKELETAL REMAINS	ASSOCIATED CULTURE	CRANIAL CAPACITY	AGE
J. Duyfjes	1936	Modjokerto, Java	skull of two-year infant (75% adult size)	none found	700 cc. (adult = 933 cc.)	550,000
G. H. R. von Koenigswald	1937	Sangiran, Java	skull	none found	815 cc.	500,000
G. H. R. von Koenigswald	1937-39	Sangiran, Java	skull	none found	900 cc.	500,000
P. Biberson	1954	Sidi-Abderrahman (near Casablanca) Morocco	jaw section	Acheulian-Rahmanian	--------	400,000
C. Arambourg	1954-56	Ternifine, Algeria	3 jaws, parietal bone	Acheulian-Rahmanian	--------	400,000
J. T. Robinson	1957	Sterkfontein, South Africa	------	stone tools	--------	450,000
L. S. B. Leakey	1960	Olduvai, Tanzania	skull sections, hand, foot bones	Chellean III	1067 cc.	490,000
Chinese workers	1963-64	Lantian District, Shensi, China	skull cap, lower jaw	?	?	700,000
Henry de Lumley, Georges Laworsky	1966	Nice, France	------	large huts, fire hearths, pebble, flake tools	--------	300,000
A. G. Thorne, P. G. Macumber	1968-71	Kow Swamp, Victoria, Australia	15 skulls, bones of 25 other individuals	stone tools, lumps of ocher	?	10,000
Richard Leakey	1975	East Turkana, N. Kenya	skull (KNM-ER 3733)		850 cc.	1,500,000
Richard Leakey	1975	East Turkana, N Kenya	skull (KNM-ER 3883)		probably about 850 cc	1,500,000
Richard Leakey and Alan Walker	1984-85	West Turkana, N Kenya	almost complete skeleton of 12-year-old boy (KNM-WT 15000)	none found thus far	? (but boy was 5'3" [at age 12!])	1,600,000

"Thus we can understand how it has come to pass that man and all other vertebrate animals have been constructed on the same general model, why they pass through the same early stages of development, and why they retain certain rudiments in common. Consequently we ought frankly to admit their community of descent; to take any other view, is to admit that our own structure, and that of all the animals around us, is a mere snare laid to entrap our judgment. This conclusion is greatly strengthened, if we look to the members of the whole animal series, and consider the evidence derived from their affinities or classification, their geographical distribution and geological succession. it is only our natural prejudice, and that arrogance which made our forefathers declare that they were descended from demi-gods, which leads us to demur to this conclusion. But the time will before long come, when it will be thought wonderful that naturalists, who were well acquainted with the comparative structure and development of man, and other mammals, should have believed that each was the work of a separate act of creation."

-- Charles Darwin, *The Descent of Man*, Chapter I, concluding paragraphs.

6. Evaluation of the Fossils, in general

"The fossils are genuine evidences of animals which were formerly in existence." "Here we have actual proof of what living things were like in the past." "There are people who explain. . .by saying that God might have created the earth with these fossils already formed in place. There is no doubt at all that He could have done this, but there is no evidence to support any other view than that they were formed in the usual way."

The above statements can, we believe, be accepted by Christians at face value.

7. Evaluation of the Geologic Time Scale

it does not seem either wise or seemly to deny the stratigraphic arrangement and correlation of rock strata which can, in general outline, be seen with one's own eyes! (e.g.. in the Grand Canyon of the Colorado, the Appalachian Highlands, and the Northwest Highlands of Scotland.) The arrangement of the strata, based upon the law of superposition, would appear to be on solid footing.

8. Evaluation of the Chronology of Geologic Time

a. Geological Considerations

The methods of the degree of salinity of the oceans, the rate of deposition of sedimentation, the rate of erosion of rocks, etc. are recognized by men in the field to involve definite limitations. In addition, there are assumptions in each of these

methods, in addition to extreme variables, which could change conclusions by a rather large factor. It would seem, however, that whatever the percentage of error, the earth would appear to be much older than a few thousand years.

The radioactive dating methods, however, appear to put us on an entirely different basis. Samples can be weighed with exacting precision. Hypersensitive electronic equipment measures the rate of decay. Potassium, rubidium, thorium, and uranium disintegrate at a fixed rate which cannot be changed by any known force, whether heat, pressure, chemical conditions, or cosmic rays. In October 1961, following the reading of the current issue of *National Geographic* your professor wrote to Dr. Garniss H. Curtis, a professor in the Department of Geology in the University of California at Berkeley, asking the following question (among others):

"Assuming that samples of potassium 40 have been subjected to extreme physical and chemical conditions in order to determine the stability of the rate of decomposition, we wonder do you have any thoughts on the possible effects of variable atmospheric factors (such as cosmic-ray bombardment) on the question of constancy of rate? To what degree do you think such factors could affect the rate?"

Dr. Curtis graciously responded with a lengthy reply, in which he answered the above question as follows:

"Dear Reverend Dunzweiler:

"Concerning your interest in Potassium/Argon dating and the questions you asked about the method, I hope the following will be of help to you. . . .

"Within the range of physical and chemical conditions met with on earth, the decay of all radioactive elements is constant or varies so little as to be virtually undetectable. High energy bombardment can, of course, convert one element into another. Most of the cosmic ray bombardment that reaches the surface of the earth is soft and results only in stripping off electrons from the atoms it encounters. Destructive hits of nucleii are extremely rare. Occasionally, a K^{40} atom must be hit by a high energy cosmic ray and converted into other elements, probably neither calcium or argon. Just as often, however, the daughters, calcium and argon, are hit and converted into other substances. (I should say, are hit in proportion to the number of K^{40} atoms.) Thus the ratio is not changed. Short of the sun itself exploding, I do not believe that the decay of K^{40} on the earth can be appreciably changed by changes in cosmic ray flux."

-- Dr. Garniss H. Curtis, Department of Geology, University of California (Berkeley), In a letter to your instructor. (Dr. Curtis is the man who, using Potassium/Argon, dated Zinjanthropus -- see *National Geographic* October, 1961, for dating and method.)

it should also be noted, that admitting even a larger percentage of error than Dr. Curtis admits for the decay time of Potassium (plus/minus 5%), the earth, and the various strata, are older than ordinarily conceived to be. To review: A. Holmes. using radioactive methods, dated the beginning of the Cambrian (in round numbers) 500,000,000 years ago. An error of 5% could bring that figure down to 475,000,000. An error of 50% could bring it down to 250,000,000 years. Even an error of 2 would still date the beginning of the Cambrian at 5,000,000 years ago. And 5,000,000 years is quite a bit longer than a few thousand years!

Uniformitarianism versus Catastrophism

James Hutton, called by many the founder of modern geology, published his *Theory of the Earth* in 1788. in this work he recognized that the earth had undergone great changes, and that these changes were evident in the rocks of the earth's crust. He stated the principle that geologic phenomena should be explained in terms of everyday processes of nature:

> "in examining things present we have data from which to reason with regard to what has been; and, from what has actually been, we have data for concluding with regard to that which is to happen hereafter. Therefore, upon the supposition that the operations of nature are equable and steady, we find in natural appearances, means for concluding a certain portion of time to have necessarily elapsed, in the production of those events of which we see the effects."

In general, Hutton said, three kinds of agencies determined jointly the aspect of nature on the globe. First, regular strata were formed by gradual deposition in the ocean, second, these strata were consolidated, elevated, and altered by subterranean heat and pressure; third, the face of the earth was worn away by wind, water, and organic decay. These three types of processes, viewed in relation to each other, formed a self-regulating and self-preserving system of matter in motion. From the present state of the system its previous states could be inferred and its future states conjectured. This concept of the surface of the globe as a law-bound system of matter in motion Hutton regarded as his great achievement.

But what about the origin and purpose of the earth? Hutton declared that the perfect equilibrium and regularity of the terrestrial system proved that it was divinely created as a means for perpetually maintaining the surface of earth as a fit habitation for living beings. But why this perpetual destruction and creation of land masses? Because the dissolution of rock formations was essential to prepare soil for the growth of plants. Plants provided food for animals, and both plants and animals served the needs of man. Thus all the processes of the globe were related to each other and to the end for which they had been contrived. The harmony of the whole ministered to man's intellectual

and spiritual as well as to his physical needs by leading his inquiring mind to a knowledge of his Creator.

The notion of a succession of worlds, Hutton said, did not imply the eternity of the world. Millions of years did not add up to eternity. However long the system of the globe might have been in operation, it must have been created, since it bore the marks of intelligent design.

Hutton died in 1797 but his theory was championed by John Playfair, professor of mathematics and natural philosophy at the University of Edinburgh. In 1802 he published his *Illustrations of the Huttonian Theory of the Earth*, in which he presented and defended the new geology against scientific and religious objections. He granted the recent origin of man (c. 6,000 years) in order to gain acceptance for the indefinite antiquity of the earth.

Charles Lyell's *Principles of Geology* (1830-33). upheld and expanded the Huttonian geology to include the organic world as well as the inorganic. Lyell concluded that "the destruction of species must now be part of the regular and constant order of nature." Faced with the implication of the assumption that nature was a divinely ordained, self-balancing system of laws, elements, and forces, that natural causes should produce new species as rapidly as the old were eliminated, Lyell contented himself with suggesting that new species were "called into being" from time to time as needed, leaving it to future research to determine the time, place, and manner of their appearance.

Thus the uniformitarian catchword, "the present is the key to the past," is simply the view that the events of the past can be explained in the light of processes at work in the present. The uniform and dependable operation of natural processes is the foundation of modern experimental science, without which modern science would be quite impossible.

Georges Cuvier, a noted biologist and paleontologist, professor of natural history and anatomy in Paris, called "the father of vertebrate paleontology," proposed the theory of catastrophism. In his *Discourse on the Revolutions of the Surface of the Globe* (1812), he declared that it could no longer be doubted that the earth had undergone a series of revolutions, not only in its topography, but also in its flora and fauna. The strata of the earth's crust displayed unmistakable proofs of a series of geological epochs, each with its characteristic flora and fauna. Thus there had been several creations, separated by tremendous revolutions involving the wholesale extinction of species. The last revolution had taken place recently, not more than five or six thousand years ago (at the time of the great Flood). Cuvier believed that species are immutable, and that all organisms are the products of special creation. The view of catastrophism was thus a compromise between the requirements of scientific integrity and the demands of the traditional view of Scripture, holding that the strata were to be explained by a series of catastrophes or cataclysms, each of which was followed by a special creation of new organisms. Cuvier's theory dominated paleontologic thought until mld-nineteenth century.

Lyell could not accept this view of successive creations and extinctions, of regarding each new flora and fauna as a step upward in the progressive series leading to man and the world he inhabited. He rejected it for two reasons: first, because he believed that discontinuities in the fossil record arose from the imperfection of the record as then known; and second, because the supposed progression from epoch to epoch was contradicted by the record. As more and more evidence came to light, it became evident that, instead of the record's showing successive creations and extinctions of all living things, it showed some species continuing while others became extinct, some bridging major divisions of the record while others existed for only one period, and an orderly and continuous record instead of a series of breaks.

Special Creationists hold that God used both natural and supernatural means to shape the past geologic history of the earth. The ordinary mode of God's working may be described in terms of the orderly, uniform operation of natural, secondary causes. The extraordinary mode of God's working may be described in terms of the special, unique activity of God through the exercise of supernatural efficiency. Thus viewing God's activity through natural, secondary causes, the geologic history of the earth may be seen to have been generally uniform. (This includes the uniform operation of such gradual operations as sedimentary deposition, elevation and depression of the earth's crust, and erosion; as well as such abrupt and catastrophic events as earthquakes, floods, volcanic eruptions, and great tidal waves.) But in viewing God's activity through immediate, supernatural efficiency, the geologic history of the earth may be seen to have included miraculous interruptions, interpositions, and interventions.

b. Exegetical Considerations

How shall the contention of geology and paleontology that the strata and the fossils are very old be squared with the Scriptural data? There are a number of theories which attempt to reconcile the geological data with the Scriptures:

(1) Theories which hold that the geological strata are relatively young:

(a) Pro-Chronic Creation -- maintains that the earth was created with the appearance of age.
(b) Flood Geology -- the strata may all be explained as the effect of sedimentation laid down by the Noachian Flood.
(c) Successive Catastrophes -- that the strata may be explained on the basis of the effect of various catastrophes, especially that at the Fall of man, and that at the time of the great Flood.
(d) Chronological Gaps -- the strata were laid down by natural causes, during a somewhat longer period of time than 6,000 years, which period of time is implied from gaps in the genealogical tables of Genesis 5 and 11.

(2) Theories which hold that the geological strata are relatively old:

(a) Gap or Restitution Theory -- the strata were laid down in a pre-Adamic world. Between Genesis 1:1 and 1:2 this world was Judged, became 'waste and void," and remained in this condition for a vast time period. Thus the creative "days" of Genesis 1 are days of recreation or restitution.

(b) Local Creation Theory -- the Genesis account describes a remodeling of only a portion of the Near East. The strata everywhere else (and the lower strata here) are thus very old.

(c) Non-Judgment Gap Theory -- the strata were laid down in the vast time gap between Genesis 1:1 and 1:2 (or between 1:2 and 1:3).

(d) Day-Age or Divine Day Theory -- the strata were lad down during the creative days, which were vast periods of time.

(e) Literal Day with Gaps Theory -- the strata were laid down during the vast creative ages bounded by literal days.

(f) Literal Days within Creative-Aspect Periods Theory -- the strata were laid down during vast creative-aspect periods, which were marked by literal days of essential fulfillment of God's creative fiats.

(g) Pictorial Day Theory -- the six "days" of Genesis 1 are six days during which the writer of Genesis received the revelation of God's creative activity. Thus Genesis says nothing about the time duration of creation.

(h) Moderate Concordism -- the Genesis narrative is not arranged chronologically, but topically and logically. (This view is combined with various views of the six "days.") Thus nothing is said about the time duration of creation.

(I) Mythological or Symbolical Theory -- the Genesis account is not history, but myth or symbol (similar to Christ's parables). Thus nothing would be revealed about chronology.

(J) Framework-Hypothesis -- the Genesis account of creation in six days is a literary framework. The framework s composed of two trlduums in parallel -- the first three days parallel to the second three days. The days do not represent time periods.

Creation with the Appearance of Age -- If the question be asked, "What can God do?" It must immediately be answered that God can do all things (i.e. all things consistent with his attributes). And if it be asked, "Could God have created the earth with its strata and fossils in place to look old even though it is not old?" (in the sense of measured duration of time), it must be answered, "Yes, God could have done this." But the question which is really at issue is, "Has He in fact, done this?

In an article entitled "Apparent Age and its Reception in the 19th Century" (*Journal of the American Scientific Affiliation*, September 1980), David J. Krause quotes from advocates and opponents of the belief that the universe (or parts of it) was created with the appearance of an age greater than its actual age.

Viscount de Chateaubriand, for example, in his *Genius of Christianity* (1802) wrote:

> 'The earth,' it is said, 'is an aged nurse, who betrays her antiquity in everything. . .' This difficulty has been solved a hundred times by the following answer: God might have created and doubtless did create the world with all the marks of antiquity and completeness which it now exhibits

He added:

> The oaks, on springing from the fruitful soil, doubtless bore at once aged crows and the new progeny of doves . . . .the very day the ocean poured its first waves upon the shores, they dashed against rocks already worn, over strands covered with fragments of shell-fish. . .

The prime advocate of the theory of apparent age was Philip Henry Gosse, whose book *Omphalos: An Attempt to Untie the Geological Knot* (1857), Krause called "the high-water mark of the apparent age concept." Krause asserted that Gosse based his thinking on two major propositions. The first was that "All organic nature moves in a circle" of birth, life, death, and rebirth, with the result that for any living creature any stage of its existence automatically bears the evidences of its previous stages. The second proposition was that "Creation is a violent irruption into the circle of nature," and therefore all created living things must have possessed, at the time of their creation, all the evidences of a previous but unreal existence, these evidences being therefore "effects which never had causes." Adam, for example, although never born of a woman, clearly must have had a navel (thus the title of the book, *Omphalos*) Krause points out the fact that this led Gosse to draw a distinction between "diachronic" developments (those which occurred in real time) and "prochronic" developments (those which were unreal, whose apparent results were seen in organisms at the time of their creation). Gosse wrote:

> Hence the minuteness and undeniableness of the proofs of life which geologists rely upon so confidently, and present with such justifiable triumph, do not in the least militate against my principle. The marks of Hyaenas' teeth on the bones of Kirkdale cave; the infant skeletons associated with adult skeletons of the same species; the abundance of coprolites; the foot-tracks of Birds and Reptiles; the glacier-scratches on rocks and hundreds of other beautiful and most irresistible evidences of

> pre-existence, I do not wish to undervalue, nor to explain away. On the hypothesis that the actual commencing point of the world's history was subsequent to the occurrence of such things in the perfect ideal whole, these phenomena would appear precisely as if the facts themselves had been diachronic instead of prochronic, as was really the case.

But what about astronomical evidences for an old universe such as those cited by Sir William Herschel, the builder of large reflecting telescopes? In 1802 he stated that his instruments were capable of revealing objects at a distance of 12 million million million miles from earth, and that this distance was connected to vast periods of time. He wrote:

> Hence it follows, that when we see an object of the calculated distance at which one of these very remote nebulae may still be perceived, the rays of light which convey its image to the eye must have been more than nineteen hundred and ten thousand, that is, almost two millions of years on their way; and that, consequently, so many years ago, this object must already have had an existence in the sidereal heavens, in order to send out those rays by which we now perceive it.

Gosse replied:

> Beautiful, and at first sight unanswerable as this argument is, it falls to the ground before the spear-touch of our Ithuriel, the doctrine of prochronism. There is nothing more improbable in the notion that the sensible undulation was created at the observers eye, with all the prerequisite undulations prochronic, than in the notion that blood was created in the capillaries of the first human body. The latter we have seen to be a fact: is the former an impossibility?

Gosse summarized his argument as follows:

> Finally, the acceptance of the principles presented in this volume, even in their fullest extent, would not in the least degree, affect the study of scientific geology. The character and order of the strata; their disruptions and displacements and injections; the successive floras and faunas; and all the other phenomena, would be facts still. They would be still, as now, legitimate objects of examination and inquiry. I do not know that a single conclusion now accepted, would need to be given up, except that of actual chronology. And even in respect of this, it would be rather a modification than relinquishment of what is at present held; we might still speak of the inconceivably long duration of the processes in question, provided we understand ideal instead of actual time; -- that the duration was projected in the mind of God, and not really existent.

Krause provides clear evidence of the unfavorable reaction Gosse's book received. For example, a review in The Geologist stated that Omphalos was:

> . . .unworthy of Mr. Gosse, and indeed of anybody else, in its doctrine . . . .the world itself is thus, like everything else, made to offer a fallacious display of an antiquity it does not possess. As if God could create anything with the impression of untruth upon it. . . .

And Charles Kingsley, the Anglican clergyman who was a good friend of Gosse, wrote to him:

> If we accept the fact of absolute creation, God becomes a *Deus guidam deceptor*. I do not mean merely in the case of fossils which *pretend* to be the bones of dead animals, but in the one single case of your newly created scars on the pandanus trunk, and your newly created Adam's navel, you make God tell a lie. It is not my reason but my conscience which revolts here.

And Kingsley wrote: "I would not for a thousand pounds put your book into my children's hands."

Krause states that the belief in apparent age is an integral part of the world-view espoused by Whitcomb and Morris in their 1961 book, *The Genesis Flood* and observes:

> The version of apparent age advocated by Henry Morris and his followers seems to contain a fundamental flaw that was not present in the world of Gosse. Gosse accepted the reality of the evidence for great age and explained it, in a consistent manner, as 'prochronic.' in *The Genesis Flood* and *Scientific Creationism* (to pick just two examples) however, the authors confusedly oscillate between two incompatible positions. On the one hand, the claim is made that certain evidences seem to indicate that the world is 'young.' These evidences are then accepted as being the result of processes that actually occurred in real time. Faced with other evidences that indicate that the world is 'old,' however, the apparent age doctrine is then invoked to explain why the implications of these evidences need not be accepted. This seems to be an obvious attempt to both have and eat the proverbial cake. Thus, apparent age as utilized by present age 'creationists' does not correspond to its consistent use by Gosse, but rather bears a distinctly closer resemblance to its use by the early apologists of the 19th century who, when geology was first developing, invoked apparent age primarily to explain away data that could not be otherwise reconciled with a short time scale. While this oscillation between mutually incompatible alternatives may indeed provide a quick, convenient answer to any possible objection, it hardly seems to be an adequate base upon which to build a satisfying scientific worldview.

It is immediately admitted that God created various "kinds" of animals and man as mature, or full-blown. But the Bible does not tell us that the maturely created animals and man bore the evidences of all the stages of growth, development, and aging characteristic of their subsequent progeny. There is no basis whatever in the Bible for such assertions.

To create as mature or full-blown, is not at all deceptive, since God tells us that He has done this very thing. however, to posit the conception that God formed the geologic strata with fossils manifesting every evidence of birth, growth, development, struggle for existence, and violent death, to appear precisely as they would have appeared if they had been formed by natural processes requiring vast periods of time, would not only seem to raise questions of an ethical nature, but would also be positing such a conception upon ignorance! For if God does not reveal that He has done such a thing, and if such a conception can not be based upon the record of the rocks then on what basis can such an idea be posited? It must therefore be viewed as pure speculation! And to employ a mere possibility device raising ethical questions and basing itself on pure speculations, would seem to be a desperate attempt to uphold a weak view.

Flood Geology -- This is an attempt to offer a reasonable explanation for the data of geology and paleontology, one which upholds the supernaturalism and Special Creationist viewpoint of the Bible while attempting to refute the uniformitarian, completely naturalistic, and evolutionary implications of the present interpretation of those data, as generally held by the overwhelming majority of scientists in those areas. As such, the attempt is commendable.

Flood Geology attempts to explain all of the geologic strata and their fossils in terms of the effects of the Genesis Flood. In The Genesis Flood Morris and Whitcomb state:

> It may of course be granted that the principles of stratigraphic correlation by means of fossils, in terms of the accepted sequence, is supported by much evidence. Any theory that could have obtained almost universal acceptance by geologists is obviously not founded solely upon wishful thinking.
>
> On the other hand, it is possible that some other theory may explain the same evidence more effectively . . . And in spite of the general validity of the standard and accepted geologic stratigraphic succession, there are many exceptions and contradictions to it, which have been very unsatisfactorily explained in terms of the accepted theory.

The authors propose that the Noachian Flood explains the evidence quite effectively:

> Any deposits formed before the Flood would almost certainly have been profoundly altered by the great complex of hydrodynamic and tectonic forces unleashed during the Deluge period. The fundamental principle

> of historical geology, that of uniformitarianism, however valid it may be for the study of deposits formed *since* the Deluge, can therefore not legitimately be applied before that time.
>
> Never since the world was formed could there ever have been such extensive erosion of soil and rock beds, on a global scale, as during the Genesis Flood. And the materials that were eroded must eventually have been deposited somewhere, and necessarily in stratified layers, such as we find everywhere around the world today in the great sedimentary rock systems.
>
> -- Henry H. Morris and John C. Whitcomb, Jr., *The Genesis Flood* (Grand Rapids, Michigan: Baker Book Mouse, 1961), pp. 123-124, 170.

Flood Geology holds that the first period of the Flood destroyed the old earth, the waters rising to carry in suspension both earth and the remains of living things. The last period of the Flood found the waters receding and in a constant state of flux and reflux, thus effecting the deposition of the matter floating upon or suspended in them, and thus forming the strata of the new earth.

One of the most important features of the Deluge theory is that of the assorting power of water to sort the sediments which they carry, both inorganic and organic; the inorganic according to their relative weights, the organic according to their weight and size. Thus as tidal waves carrying differing sediments traveled over various areas of the earth, they deposited their load, the heavier objects and sediments falling first, the lighter later. Strata were therefore being laid in different places at different times. It is even probable, says the flood geologist, that while one part of the world was being severely subjected to tidal actions, another far away was not even covered with water, for while the Scripture says that all the high places of the earth were covered, it does not say they were all covered at the same time.

Thus one flood geology proponent explains the data in the following fashion:

> It is, of course, to be granted that, in general, the remains of the simpler forms of organic life are found buried today in the lower strata of the earth's stratified surface, and that, in general, the more complex forms of organic life are found in the upper strata. The lower strata of the earth, on the whole, contain the remains of shell-creatures and other simply constructed marine forms, while the upper strata, on the whole, contain the remains of four-footed animals and other complexly constructed land forms. This situation is, seemingly, in accordance with the modern evolutionary theory of geology. But is it

> not also in exact accordance with the Flood theory? If the Flood buried the fossils, where would simple marine forms (shells, corals, and so on) naturally be buried? Being heavy, they would naturally be buried in the lowest strata. Where would fish be buried? Naturally, in strata higher than shells. Where would land animals be buried? Naturally, in the very topmost strata. Hence, while the situation as it exists is in accordance with the evolutionary theory, it is also exactly in accordance with the Flood.
>
> -- Byron C. Nelson, *The Deluge Story in Stone* (Minneapolis: Augsburg Publishing House, 1931), pp. 146, 147.

In spite of the attempts of George McCready Price, Byron C. Nelson, Alfred Rehwinkel, and Morris and Whitcomb to make Flood Geology the prevailing viewpoint of the Christian position on geology and paleontology, the evidence continues to run counter to that viewpoint. Stratigraphy and isotopic Geochronology (radioactive dating) simply refuse to be so simply explained away

All of the theories which hold that the geological strata are relatively young suffer from the same defect: they fail to take seriously the results of modern-day physics and astronomy. The universe, our galaxy, our solar system, and our planet, are obviously much, much older than we had dreamed. And the rock strata of the surface of the earth have a much greater time perspective than we had previously believed.

Of the theories which hold that the geological strata are relatively old, the Gap or Restitutionary Theory, by pushing the fossils back into a pre-Adamic world, falls into two important problems: (1) putting fossil men into a pre-Adamic world runs counter to Paul's statements about Adam's being the first man; and (2) the record of fossil man shows a sequence, without interruption, to the present. If at the time of the flint age, a great cataclysm had destroyed man, and God had recreated man, would we expect the recreated man to take up the very flint culture previously destroyed? And if such a cataclysm had occurred, would there not be some record of it in the rocks?

With respect to the mythical or symbolical theories, we hasten to affirm the necessity of taking the Genesis narrative as inspired of God, and therefore trustworthy and accurate. We also note that Christ took Genesis as a historical account, not as a myth or allegory; and that other Scripture writers do the same.

Perhaps Thomas Aquinas' comment on the first chapter of Genesis is in order:

> . . . in questions of this sort there are two things to be observed. First, that the truth of Scripture be inviolably maintained. Secondly, since Scripture doth admit of diverse interpretations, that no one cling to any particular exposition

> with such pertinacity that, if what he supposed to be the teaching of Scripture, should afterwards turn out to be clearly false, he should nevertheless still presume to put it forward, lest thereby the Sacred Scripture should be exposed to the derision of unbelievers, and the way of salvation should be closed to them.

9. Evaluation of the Evidence for Human Evolution

a. Scientific Considerations

(1) The antiquity of man

Any scientific discussion of man's antiquity must attempt to answer two questions: (a) What counts as "man"? (b) How far back can the history of man be traced?

(a) What counts as "man"?

> Taxonomically, the family Hominidae is part of the infraorder Catarrhini (Old World forms), which is part of the suborder Anthropoidea (which includes monkeys, apes, and men), which is part of the order Primates. The family Hominidae includes two species: *Australopithecus* and *Homo*. Are both these species to be viewed as "man"? Donald C. Johanson does not think so. In *Lucy The Beginnings of Mankind* Johanson distinguishes between the Hominidae and Homo. We writes:
>
> > . . . it is safe to say that a hominid is an erect-walking primate. . All human beings are hominids, but not all hominids are human beings. . . the handiest way of separating the newer types from their ape ancestors is to lump together all those that stood up on their hind legs. That group of men and near-men is called hominids . . . .Homo sapiens, Neanderthal Man. . . Homo erectus. . . Homo habilis. . . Lucy. . . All of the above are hominids. They are all erect walkers. Some were human. . . Others were not human. Lucy was not.
>
> -- Donald C. Johanson and Maitland A. Edey, *Lucy: The Beginnings of Mankind* (New York: Warner Books, Inc., 1981), pp. 18-20.

However, even if the australopithecines are classified as non-human, what about *Homo habilis*, *Homo erectus*, and fossil forms of *Homo sapiens*? Are all these to be included in the history of man? Do they all count as "man"? The status of *Homo habilis* is still uncertain. In spite of the size (775 cc.) of skull 1470 (discovered by Richard Leakey in 1972) and its general characteristics

(thinness of cranial vault, lack of prominent brow ridges); and in spite of its owner's bipedalism; Alan Walker and Richard Leakey in an article ("The Hominids of East Turkana") published in *Scientific American* (August 1978), state that "We ourselves cannot agree on a generic assignment for KNM-ER 1470. One of us (Leakey) prefers to place the species in the genus Homo the other (Walker) in Australopithecus.

What about *Homo erectus*? Was this creature a human being? Although his average cranial capacity was smaller than that of *Homo sapiens* (930 cc, as compared with 1361 cc for modern man), his ability to make and use tools is undoubted. *Homo erectus* made a variety of stone tools, hunted large animals, cooked his food, and made clothing. *Homo erectus* and *Homo sapiens* are both human.

However, this raises another question: Why two species of *Homo*: *erectus* and *sapiens*? Are they, to use Ernst Mayr's definition of a species ("a group of inter-breeding natural populations that are reproductively isolated from other such groups") so reproductively isolated from each other as to warrant specific distinction?

Donald C. Johanson observes that "It would be interesting to know if a modern man and a million-year-old Homo erectus woman could together produce a fertile child. The strong hunch is that they could; such evolution as has taken place is probably not of the kind that would prevent a successful mating. But that does not flaw the validity of the species definition given above, because the two cannot mate. They are reproductively isolated by time." (Lucy p. 144)

But by the same logic a twentieth-century man would be reproductively isolated from a first-century woman (or a sixteenth or even nineteenth)! Mere isolation by time is a poor basis on which to set up species distinctions!

it would seem that the distinction between Homo erectus and Homo sapiens is a relative one. Both are bipedal; both are thinking creatures; both make and use tools, cook food, make and use clothing, etc. Certain physical Characteristics (such as height, average cranial capacity, size of Jaw, etc.) differ somewhat, and levels of cultural complexity differ somewhat, but these are relative, not absolute differences.

What, then, counts as "man"? *Australopithecus* does not count as man. Only *Homo* counts as man. *Homo habilis* may be an australopithecine; at least there is no evidence clearly identifying him as man. *Homo erectus* and *Homo sapiens* both count as man, and probably do not warrant specific distinction.

(b) How far back can the history of man be traced?

Modern man (*Homo sapiens sapiens*) is viewed as first making his appearance about 50,000 years ago. if the skull found in 1965 in Vertesszöllös, Hungary continues to withstand the scrutiny of paleontologists, then

Homo sapiens is found as early as 500,000 B.P.

What about Homo erectus The fossils found in China and Java are dated back to 700,000 and 710,000 B.P. respectively. And the fossils from East Africa (East Turkana) are dated back to 1.5 million B.P.!

(2) The unity of man

The general consensus is that pre-human ancestors of man made the transition to being fully human in various places at various times. Although some paleontologists think of southern Asia or Europe as the place where the transition was first made, the majority feel that Africa is the most probable "cradle of mankind." in any case, groups made this transition, not individuals; and certainly not a single pair!

(3) Man's relationship to the animals

(a) Anatomy

Scientifically, man is classified as a member of the kingdom animalia the phylum chordata the subphylum vertebrata the class mammalia the order primates the family hominidae and the genus Homo. On each level, he shares anatomical similarities with other members of the group.

Of course, if man's uniqueness as a personal, rational, moral, and spiritual being is preserved, then with respect to his physical aspect only man could be described anatomically as a well-organized, multicellular living being, incapable of photosynthesis (an animal), as a living being possessing a well-developed nervous system and a body supported by a bony chord or spinal column (a chordate), as a backboned living being that reproduces on land, possesses hair, and nurses its young (a mammal), as a member of the first order of mammals (a primate), and as a member of the family of man (a hominid).

Although both Australopithecus and Homo are included in the *hominidae*, man differs anatomically from the australopithecines in both average brain size and average (estimated) body weight. According to Ralph W. Holloway, in an article in the July 1974 *Scientific American* ("The Casts of Fossil Hominid Brains"), Australopithecus had an average brain size of 450 cc. and an estimated average body weight of 50 pounds; whereas Homo erectus had an average brain size of 930 cc. and an estimated average body weight of 114 pounds, and Homo sapiens has an average brain size of 1361 cc. and an average body weight of 150 pounds.

(b) Use and manufacture of tools

In the August 1963 issue of *National Geographic* Jane Goodall, a zoologist who lived among and studied chimpanzees for many months in the Gombe Stream Game Reserve in Tanganyika, reported the following:

For a long time there has been heated discussion in scientific circles as to whether any primates in the wild ever modify natural objects to make tools. My chimpanzees have settled the argument once and for all: The answer is that at least some chimpanzees do.

Termites form a major part of the chimpanzee diet for a two-month period. The termite season starts at the beginning of the rains, when the fertile insects grow wings and are ready to leave the nest. At this time the passages are extended to the surface of the termite heap and then sealed lightly over while the insects await good flying weather. The chimpanzee is not alone in his taste for termites -- the baboon in particular has a fondness for the juicy insects, but he must wait until they fly and then take his turn, together with the birds, at grabbing the termites as they leave the nest.

The chimpanzee forestalls them all. He comes along, peers at the surface of the termite heap and, where he spies one of the sealed-off entrances, scrapes away the thin layer of soil. Then he picks a straw or dried stem of grass and pokes this carefully down the hole. The termites, like miniature bulldogs, bite the straw and hang on grimly as it is gently withdrawn.

I have watched chimpanzees fish this way for two hours at a time, picking dainty morsels from the straw and munching them with delight. When they don't have much luck with one hole, they open another and try again.

As the straw becomes bent at the end, the chimpanzee breaks off the bent pieces until the tool is too short for further use. Then it is discarded and a new one picked. Sometimes a leafy twig is selected, and before this can be used the chimpanzee has to strip off the leaves.

In so doing -- in modifying a natural object to make it suitable for a specific purpose -- the chimpanzee has reached the first crude beginnings of tool making.

In this respect, the chimpanzees do not always await the discovery of a termite nest before seeking a tool. I have seen them break off a twig and carry it for as far as half a mile, going from one termite hill to another, though none at the time was suitable for feeding.

-- Jane Goodall, "My Life Among Wild Chimpanzees," in *National Geographic* August 1963, pp.307-308.

Following another article by Jane Goodall (by now Baroness Jane Van Lawick-Goodall) in the December 1965 *National Geographic* ("New Discoveries Among Afrlca's Chimpanzees"), in which she reported seeing chimpanzees make leafy sponges to soak up water from hollows in trees for drinking, the following article appeared in the January 6, 1967 issue of *Time*

ZOOLOGY

Birds that Throw Stones

Time was when only five species of vertebrates were known to use tools. There was man, of course. Chimpanzees used rocks to break open hard-shelled food, sticks to feed on termites and ants, and leaves for wiping their bodies and drinking. A gorilla had been seen pulling fruit to within its grasp by means of a crooked branch. The sea otter used rocks for opening shellfish. And Galapagos woodpecker finches probed insects from holes with short twigs. Come now the Egyptian vulture.

Traveling in Tanzania on a National Geographic Society photographic expedition, Zoologist Jane Goodall and her photographer husband Hugo Van Lawick came upon an abandoned ostrich nest. Two ostrich eggs left in the nest were under attack by a variety of vultures, which were trying vainly to peck through the tough shells. While the Van Lawicks watched and photographed, they reported last week in Nature two Egyptian vultures took a novel approach to their problem.

Picking up small stones in their beaks, they raised their heads high, then whipped the stones in the direction of the eggs with forceful movements of their heads and necks. Throwing, you might call it. After several hits -- and many misses -- they successfully broke open the shells and feasted.

To verify that the behavior of the two Egyptian vultures was no fluke, the Van Lawicks set out two ostrich eggs at a site 60 miles away and sat back to see who would cast the first stone. Sure enough, the eggs were promptly attacked by two mature, stone-hurling Egyptian vultures, which aimed wildly, often pausing to threaten each other. After the pair finally had cracked and eaten the eggs, an Egyptian vulture that was lower in the social pecking order approached one of the empty shells and peppered it with 30 rocks, perhaps practicing for the day when he, too, would be lucky enough to have ostrich egg for lunch.

Of course there is a great gap between the use and slight modification of naturally-occurring objects and the simplest tool and weapon kit of the most primitive man. Even the stripping off of leaves from a branch so that it can be used to fish for termites is a far cry from the manufacture of stone or bone cutters, borers, scrapers, or other simple tools, or from the production of stone or bone axes, spear heads, arrow heads, or other simple weapons.

(c) Intelligence

Various animals have been singled out for their "smartness," including dogs, horses, dolphins, etc. Some animals have been trained to do rather remarkable things. But what are we to make of the following, quoted from *Sports Illustrated*

Psychologists at Holloman Air Force Base in New Mexico, training 80 chimpanzees in symbol recognition for space research, are teaching their pupils games involving shapes, colors and numbers. A chimp named Big Mean fleeces all corners, including a visiting Air Force general, at a game of squares and triangles. Zsa Zsa is fantastically accurate with numbers -- when surrounded by admiring kibitzers. if an audience walks away, her score nosedives.

Food pellets and mild shocks were originally used to train the chimps, but the psychologists have since discovered that competition is a strong motivating factor. Big Mean and Pale Face (a pallid chimp who, equipped with green eyeshade, would cause no comment at Las Vegas) were put in adjoining glass booths to play an electronic version of ticktacktoe. The chimps learned that they were competing almost as soon as they learned to get three across. If one lost too often, he would stamp and scream and pound the window facing his opponent.

When Pale Face began to win every game, Big Mean no longer wanted to play. Pale Face stopped smirking and threw a few games to keep Big Mean interested. For those who may find the data useful, a recording tape shows that Pale Face discovered one win in every five was enough to keep the sucker in the game.

Just how human is he, wondered the psychologists. Will a chimp champ like Pale Face play the game for its own sake? They disconnected the reward circuit. The game went on, lights flashed, the loser scowled, the 'reward' signal went on, but no banana pellet tumbled out of the slot.

Pale Face pounded the machine. He played again. He decided the machine had stopped paying off. He quit.

The kid had turned pro.

Aside from the clever way in which this piece was written, it should be noted that a fair amount of training and conditioning was involved in this experiment, as is apparent from the mention of food pellets and mild shocks. In addition, it should be noted that if one subtracts the rhetoric which attributes human characteristics to chimpanzees, the results can be interpreted to mean that when chimpanzees conditioned by the use of food pellets to behave in certain ways no longer receive food pellets, the desired behavior is diminished or extinguished.

(d) Use of fire

Although much evidence has been uncovered as to man's use of fire to keep himself warm or for cooking purposes, there is no evidence that any creature other than man has ever made use of fire.

(e) Building of structures

Although some invertebrates (bees, ants, termites, spiders, etc.), some birds, and a number of burrowing mammals build rather elaborate hives, hills, traps, nests, tunnels and chambers, dams, etc., yet it is man and man alone who uses both natural and artificial materials to build various types of structures to meet varied needs. Animals appear to do what they do instinctively: they appear to construct the forms they are programmed to construct. Man creates Structures of almost infinite variety.

(f) Use of language

In Julian Huxley's book, *Animal Language How Animals Communicate* the author points out the fact that many kinds of animals communicate by means of various types of sound, some quite elaborate. Then he states:

> But between even the most elaborate animal language and the simplest human language there is a great gulf. However varied animal language may be, it can never be called speech. The fundamental distinction is that all human languages but no animal languages have words for things -- common nouns, as the grammar would say . . . . Another important feature about true words is that, not only can they denote objects, but that they are arbitrary, and their use has to be learnt; while the sounds used by even the highest animals to express emotional states are (though they may be modified as the result of experience) innate, given automatically in response to the appropriate situation . . . .As a moment's thought will show, the use of words for objects and not merely for feelings implies a new step in the quality of thinking. it implies what the psychologists call conceptual thought, in which general ideas are involved . . . It is true that higher animals are quite capable of distinguishing between different kinds or classes of objects -- between bananas, for instance, and carrots. But this degree of generalization is. It seems,

> wholly unconscious, and lacks any mechanism for focusing it and keeping it together. Common nouns provide just such a mechanism. With the aid of a word, you can handle a general concept, manipulate it in its wholeness, carry it about with you, remind yourself about it when none of the particular objects that compose it are present . . . . Human beings have thus reached a new stage in the development of language. We may call it the stage of speech, and define speech as the use of arbitrary symbols to convey information, including words for things. Man has been defined as the tool-making animal; but in a very real sense the most important tools that he possesses are words.
>
> -- Julian Huxley and Ludwig Koch, *Animal Language: How Animals Communicate* (New York: Grosset & Dunlap, 1964), pp. 24-25.

But what about the developments in communication with apes which were reported from 1967 on through the 1970's? What about the work of Allen and Beatrice Gardner of the University of Nevada, who taught the chimpanzee Washoe to use 132 signs in American Sign Language? What about the work of Ann and David Premack of the University of California at Santa Barbara, who taught the chimpanzee Sarah to use plastic symbols of different shapes and colors to represent words, and claimed that Sarah had learned 130 words and even mastered some phrases? What about the work of Duane and Susan Rumbaugh at the Yerkes Regional Primate Research Center in Atlanta, who, using a language of their own invention, Yerkish, claimed that they got two chimpansees to communicate with each other in this language by pressing appropriately marked keys on a console? And what about the work of Francine Patterson at Stanford, who claimed she had taught a female gorilla named Koko more than 400 signs; and that Koko had proceeded to use word combinations to insult her trainers (You nut) to compose rhymes (bear hair, squash wash), and to invent metaphors (eye hat for mask, finger bracelet for ring)?

In the March 10, 1980 issue of Time an article appeared entitled "Are Those Apes Really Talking?" The article states:

> Though a few experts expressed skepticism, these claims of the apes' linguistic ability were widely accepted during the 1970s. But now many scientists are beginning to have second thoughts. They suggest that much of what the animals are doing is merely mimicking their teachers and that they have no comprehension of syntax. What is more, they say, the primate experimenters are probably so eager to prove their case that they often provide inadvertent cues to the animals, who quickly realize which 'right' answer will bring them some

goody. In short, the skeptics raise the possibility that the apes have been making monkeys out of their human mentors.

No one has done more to stir doubts than Columbia University Psychologist Herbert Terrace in his work with little Nim (full name: Nim Chimpsky, a play on the name of Linguist Noam Chomsky of the Massachusetts Institute of Technology, a staunch proponent of the idea that language ability is biologically unique to humans). The object of Terrace's experiment was to prove Chomsky wrong -- to show that creatures other than man could, indeed, conquer syntax and link words into sentences, however simple.

Toward that goal, Terrace, with Laura Petitto, a student assistant, and other trainers, put Nm through 44 months of intensive sign-language drill, while treating him much as they would a child. In some ways the chimp was an apt student, learning, for example, to 'sign' dirty when he wanted to use the potty or drink when he spotted someone sipping from a Thermos. Nevertheless, Him never mastered even the rudiments of grammar or sentence construction. His speech, unlike that of children, did not grow in complexity. Nor did it show much spontaneity; 88% of the time he 'talked' only in response to specific questions from the teacher.

Armed with his new insights, Terrace began reviewing the reports and video tapes of other experimenters. Careful study of the record showed the same pattern with other apes that Terrace had noted in the work with Him. There were rarely any 'spontaneous' utterances, and what had seemed at first glance to be original sentences now emerged as responses to questions, imitations of signs made by the teacher, or as rote-like repetitions of memorized combinations.

An equally serious criticism has been made by Linguist Thomas Sebeok and his wife, Anthropologist Donna Jean Umiker-Sebeok, both at Indiana University. . . they maintain that much of what passes for language skill in apes can be explained by the 'Clever Hans effect' -- a phenomenon named for a turn-of-the-century German circus horse that astounded audiences by tapping out with his hoofs correct answers to complex mathematical and verbal problems. In fact, as a German psychologist finally discerned, Clever Hans was picking up unintentional cues -- changes in facial expression, breathing patterns and even eye-pupil size -- from his questioner telling him when and how many times to stomp (or, more precisely, when to stop stomping).

> Part of the talking-ape lore may come from the subjectivity of researchers. The Sebeoks note that when Koko is led to give the sign for drink and makes the proper gesture but touches her ear instead of her mouth, Psychologist Patterson assumes not that the gorilla has made a mistake but that it is joking. If koko smiles when asked to frown, she is displaying a 'grasp of opposites.' Say the Sebeoks: 'Real breakthroughs in man-ape communication are the stuff of fiction.'
>
> Such words touched off angry responses. . . .
>
> As for the man in whose honor Nim was named, he has no doubts. Says Noam Chomsky: 'it's about as likely that an ape will prove to have a language ability as that there is an island somewhere with a species of flightless birds waiting for human beings to teach them to fly.'

(g) Morality and Religion

Only man is considered to be a moral being, capable of actions which have moral and ethical value. Animals may be vicious, treacherous, ruthless; they may kill, commit adultery, steal; but they are not considered criminals.

And only man is a religious being. All men have same form of religion, even atheists and agnostics. All men manifest commitment or devotion to some system of beliefs which they hold to with ardor and devotion, which system of beliefs pertain to matters which they hold to be of ultimate importance. No culture in the history of man has been without some form of religion. There is no evidence whatever of religion among the animals.

b. Scriptural Considerations

(1) The antiquity of man

William Henry Green, Professor of Oriental and Old Testament Literature in Princeton Theological Seminary from 1859 until 1900, published a historic article in *Bibliotheca Sacra* in 1890 entitled 'Primeval Chronology." (The article has been reprinted most recently in Appendix II in *Genesis One and the Origin of the Earth*, by Robert C. Newman and Herman J. Eckelmann, Jr.). A few excerpts from this article follow.

The question of the possible reconciliation of the results of scientific inquiry respecting the antiquity of man and the age of the world with the Scripture chronology has been long and earnestly debated. On the one hand, scientists, deeming them irreconcilable, have been led to distrust the divine authority of the Scriptures; and, on the other hind, believers in the divine word have been led to look upon the investigations of science with an unfriendly eye, as though they were antagonistic to religious faith. In my reply to Bishop Colenso in 1863, I had occasion to examine the method and structure of the biblical genealogies, and incidentally ventured the remark that herein lay the solution of the whole matter. I said, 'there is an element of uncertainty in a computation of time which rests upon genealogies, as the sacred chronology so largely does. Who is to certify us that the antediluvian and ante-Abrahamic genealogies have not been condensed in the same manner as the post-Abrahamic? . . . . Our current chronology is based upon the prima facie impression of these genealogies . . . But if these recently discovered indications of the antiquity of man, over which scientific circles are now so excited, shall, when carefully inspected and thoroughly weighed, demonstrate all that any have imaged they might demonstrate, what then? They will simply show that the popular chronology is based upon a wrong interpretation, and that a select and partial register of ante-Abrahamic names has been mistaken for a complete one.' Further reflection has confirmed me in the correctness of the opinion then expressed.

. . . the genealogies in Genesis, chapters v, and xi, were not intended to be used, and cannot properly be used, for the construction of a chronology.

It can scarcely be necessary to adduce proof to one who has even a superficial acquaintance with the genealogies of the Bible, that these are frequently abbreviated by the omission of unimportant names. In fact, abridgement is the general rule. . .

The omissions in the genealogy of our Lord as given in Matt.1 are familiar to all. Thus in verse 8 three names are dropped between Joram and Ozias (Uzziah), viz., Ahaziah (2 Kings 8:25), Joash (2 Kings 12:1), and Amaziah (2 Kings 14:1), and in verse 11 Jehoiakim is omitted after Josiah (2 Kings 23:34; I Chron. 3:16); and in verse 1 the entire genealogy is summed up in two steps, 'Jesus Christ, the son of David, the son of Abraham.'. . .

The genealogy of Ezra is recorded in the book which bears his name; but we learn from another passage, in which the same line of descent is given, that it has been abridged by the omission of six consecutive names. . . .

Still further, Ezra relates (8:1,2):- 'These are now the chief of their fathers, and this is the genealogy of them that went up with me from Babylon, in the reign of Artaxerxes the king. Of the sons of Phinehas, Gershom. Of the sons of Ithamar, Daniel. Of the sons of David, Hattush.'

Here, if no abridgement of the genealogy is allowed, we should have a great-grandson and a grandson of Aaron, and a son of David coming up with Ezra from Babylon after the captivity.

Another proof equally convincing is to be found in the fact that Levi's son Kohath was born before the descent into Egypt (Gen. 46:11); and the abode of the children of Israel in Egypt continued 430 years (Ex. 12:42,41). Now as Moses was eighty years old at the Exodus (Ex. 7:7) he must have been born more than 350 years alter Kohath, who consequently could not have been his own grandfather.

This genealogy, whose abbreviated character is so clearly established, is of special importance for the immediate purpose of this paper . . . . The names which are found without deviation in all the genealogies are Jacob, Levi, Kohath, Amram, Moses (Ex. 6:16-20; Nun. 3:17-19; 26:57-59; I Chron. 6:1-3; 16-18; 23:6,12,13). Now unquestionably Levi was Jacob's own son. So likewise Kohath was the son of Levi (Gen. 46:11) and born before the descent into Egypt. Amram also was the immediate descendant of Kohath.

This subject may be relieved from all perplexity, however, by observing that Amram and Jochebed were not the immediate parents, but the ancestors of Aaron and Moses. How many generations may have intervened we cannot tell. It is indeed said (Ex. 6:20; Nun 26:59), that Jochebed bare them to Amram. But in the language of the genealogies this simply means that they were descended from her and from Amram. In like manner, according to Matt. 1:11, Josias begat his grandson Jechonias, and ver. 8, Joram begat his great-great-grandson Ozias. And in Gen. 10:15-18 Canaan, the grandson of Noah, is said to have begotten several whole nations, the Jebusite the Amorite, the Girgasite, the Hivite, etc. Nothing can be plainer, therefore, than that, in the usage of the Bible, 'to bear' and 'to beget' are used in a wide sense to indicate descent, without restriction to the immediate offspring.

After these preliminary observations, . I come to the more immediate design of the present paper, by proceeding to inquire, whether the genealogies of Gen. 5 and 11 are necessarily to be considered as complete, and embracing all the links in the line of descent from Adam to Noah and from Shorn to Abraham. And upon this I remark --

1. That the analogy of the Scripture genealogies is decidedly against such a supposition. In numerous other instances there is incontrovertible evidence of more or less abridgement . . . . The result of our investigations thus far is sufficient to show that it is precarious to assume that any biblical genealogy is designed to be strictly continuous, unless it can be subjected to some external tests which prove it to be so. And it is to be observed that the Scriptures furnish no collateral information whatever respecting the period covered by the genealogies now I question. The creation, the Flood, the call of Abraham, are great facts, which stand out distinctly in primeval sacred history. A few incidents respecting our first parents and their sons Cain and Abel are recorded. Then there is an almost total blank until the Flood, with nothing whatever to fill the gap, and nothing to suggest the length of time intervening but what is found in the genealogy stretching between these two points. And the case is substantially the same from the Flood to Abraham. So far as the biblical records go, we are left not only without adequate data, but without any data whatever, which can be brought into comparison with these genealogies for the sake of testing their continuity and completeness.

The structure of the genealogies in Gen. 5 and 11 also favors the belief that they do not register all the names in these respective lines of descent. Their regularity seems to indicate intentional arrangements. Each genealogy includes ten names, Noah being the tenth from Adam, and Terah the tenth from Noah. And each ends with a father having three sons. . . Now as the adjustment of the genealogy in Matt. 1 into three periods of fourteen generations each is brought about by dropping the requisite number of names, it seems in the highest degree probable that the Symmetry of these primitive genealogies is artificial rather than natural.

it may further be added that if the genealogy in chap. 11 is complete, Peleg, who marks the entrance of a new period, died while all his ancestors from Noah onward were still living. indeed Sham, Arphaxad, Selah, and Eber must all have outlived not only Peleg, but all the generations following as far as and including Terah. The whole impression of the narrative in Abraham's days is that the Flood was an event long since past, and that the actors in it had passed away ages before. And yet if a chronology is to be constructed out of this genealogy Noah was for fifty-eight years the contemporary of Abraham, and Sham actually survived him thirty-five years, provided 11:26 is to be taken in its natural sense, that Abraham was born in Terah's seventieth year. This conclusion is well-nigh incredible. The calculation which leads to such a result, must proceed upon a wrong assumption.

On these various grounds we conclude that the Scriptures furnish no data for a chronological computation prior to the life of Abraham; and that the Mosaic records do not fix and were not intended to fix the precise date either of the Flood or of the creation of the world.

-- William Henry Green, "Primeval Chronology," in *Bibliotheca Sacra* 147 (1890), pp. 285-303.

Oswald 1. Allis, in Appendix II ("The Antiquity of Man") of *The Five Books of Moses* treats the genealogies of Genesis 5 and 11. A few excerpts from this article follow.

> With regard to the genealogies in Genesis v. and xi. there are a number of important points to be noted.
>
> 1. it is significant that neither chapter v. nor xi. ends with a total for the period covered and that the data supplied by these chapters are never used elsewhere in Scripture as the basis for chronological calculations. Several long dates are given (e.g., Gen. xv.13, Ex. xii.40, I Kgs. vi.1), cf. Acts vii.6, xiii.20); and a statement as to the length of time between the Creation and the Flood, and between the Flood and the Call of Abraham would be very interesting. But such statements occur nowhere in the Bible, though found for example in Josephus.
>
> 2. These genealogies have a symmetrical form which suggests that links may have been omitted. . . .
>
> 3. The statement in Gen. xi.26, 'and Terah lived seventy years and begat Abram, Nahor, and Haran' does not accord with the theory that we are dealing with an exact chronology.
>
> 4. That many of the genealogies in the Old Testament are abridged is a well-known fact. . . .
>
> 5. The only objection which can be raised against the view that, as in many other instances so in the genealogies of Gen. v. and xi., links may be omitted, is the fact that the age of each patriarch on attaining fatherhood is expressly stated. This is thought to Justify or require the conclusion that the total for the entire period can be ascertained (in round numbers) by adding up the total ages of these worthies when they became fathers. But this argument is not convincing . . . . If the formula 'x begat y' can, in the statement 'Joram begat Ozias,' mean 'Joram begat (the ancestor of) Ozias,' there is no reason why adding the statement of age 'Joram lived ____ years and begat Ozias' could not mean exactly the same thing.
>
> 6. The view that these tables are not intended to give a strict chronology is favored by certain phenomena which appear in them. . . .

> Since archaeology indicates so convincingly that man has been on the earth much more than 6,000 years, the defender of the trustworthiness of the Genesis record should be thankful that a careful study of the Biblical data does not lead to the conclusion that the Ussher chronology must be accepted as taught in Scripture; and he should therefore recognize that to insist on the acceptance of that chronology is to place a stumblingblock in the way of those who sincerely desire to accept the Book of Genesis as historically reliable.
>
> -- Oswald T. Allis, *The Five Books of Moses*, Second Edition (Philadelphia: The Presbyterian and Reformed Publishing Company, 1949), pp. 295-298.

Benjamin B. Warfield, in his article "On the Antiquity and the Unity of the Human Race," published in *The Princeton Theological Review* in 1911, writes the following:

> The question of the antiquity of man has of itself no theological significance. it is to theology, as such a matter of entire indifference how long man has existed on earth. It is only because of the contrast which has been drawn between the short period which seems to be allotted to human history. In the Biblical narrative, and the tremendously long period which certain schools of scientific speculation have assigned to the duration of human life on earth, that theology has become interested in the topic at all. There was thus created the appearance of a conflict between the Biblical statements and the findings of scientific investigators, and it became the duty of theologians to investigate the matter. The asserted conflict proves, however, to be entirely fictitious. The Bible does not assign a brief span to human history; this is done only by a particular mode of interpreting the Biblical data, which is found on examination to rest on no solid basis. It must be confessed, indeed, that the impression is readily taken from a prima facie view of the Biblical record of the course of human history, that the human race is of comparatively recent origin. it has been the usual supposition of simple Bible readers, therefore, that the Biblical data allow for the duration of the life of the human race on earth only a paltry six thousand years or so: and this supposition has become fixed in formal chronological schemes which have become traditional and have even been given a place in the margins of our Bibles to supply the chronological framework of the Scriptural narrative . . . . On a more careful scrutiny of the data on which these calculations rest, however, they are found not to supply a satisfactory basis for the constitution of a definite chronological scheme. These data consist largely, and at the crucial points solely,

of genealogical tables; and nothing can be clearer than that it is precarious in the highest degree to draw chronological inferences from genealogical tables. . . .

These genealogies must be esteemed trustworthy for the purposes for which they are recorded, but they cannot safely be pressed into use for other purposes for which they were not intended, and for which they are not adapted. In particular, it is clear that the genea1ogical purposes for which the genealogies were given, did not require a complete record of all the generations through which the descent of the persons to whom they are assigned runs; but only an adequate indication of the particular line through which the descent in question comes. Accordingly it is found on examination that the genealogies of Scripture are freely compressed for all sorts of purposes; and that it can seldom be confidently affirmed that they contain a complete record of the whole series of generations, while it is often obvious that a very large number are omitted. There is no reason inherent in the nature of the Scriptural genealogies why a genealogy of ten recorded links, as each of those in Genesis v. and xi. is, may not represent an actual descent of a hundred or a thousand or ten thousand links. The point established by the table is not that these are all the links which intervened between the beginning and the closing names, but that this is the line of descent through which one traces back to or down to the other.

A sufficient illustration of the freedom with which the links in the genealogies are dealt with in the Biblical usage is afforded by the two genealogies of our Lord which are given in the first chapter of the Gospel of Matthew. For it is to be noted that there are two genealogies of Jesus given in this chapter, differing greatly from one another in fullness of record, no doubt, but in no respect either in trustworthiness or in principle of record. The one is found in the first verse, and traces Jesus back to Abraham. The other is found in verses 2-17, and expands this same genealogy into forty-two links, divided for purposes of symmetrical record and easy memorizing into a three-fold scheme of fourteen generations each. And not even is this longer record a complete one. A comparison with the parallel records in the Old Testament will quickly reveal the fact that the three kings, Ahaziah, Joash, and Amaziah are passed over and Joram is said to have begotten Uzziah his great-great-grandson. The other genealogies of Scripture present similar phenomena; and as they are carefully scrutinized, it becomes ever clearer that as they do not pretend to give complete lists of generations, they cannot be intended to supply a basis for chronological calculation, and it is illegitimate and misleading to attempt to use them for that purpose. The reduction for extraneous reasons

of the genealogy of Christ in the first chapter of Matthew into three tables of fourteen generations each, may warn us that the reduction of the patriarchal genealogies in Genesis v. and xi. into two tables of ten generations each may equally be due to extraneous considerations; and that there may be represented by each of these ten generations -- adequately for the purposes for which the genealogy is recorded -- a very much longer actual series of links.

It is quite true that, when brought together in sequence, name after name. these notes assume the appearance of a concentrated chronological scheme. But this is pure illusion, due wholly to the nature of the parenthetical insertions which are made . . . . The circumstances that the actual items chosen for parenthetical notice are such that when the names are arranged one after the other they produce the illusion of a chronological scheme is a mere accident, arising from the nature of the items chosen, and must not blind us to the fact that we have before us here nothing but ordinary genealogies, accompanied by parenthetical notes which are inserted for other than chronological purposes; and that therefore these genealogies must be treated like other genealogies, and interpreted on the same principles. But if this be so, then these genealogies too not only may be, but probably are, much compressed, and merely record the line of descent of Noah from Adam and of Abraham from Noah. Their symmetrical arrangement in groups of ten is indicative of their compression; and for all that we know instead of twenty generations and some two thousand years measuring the interval between the creation and the birth of Abraham, two hundred generations, and something like twenty thousand years, or even two thousand generations and something like two hundred thousand years may have intervened. In a word, the Scriptural data leave us wholly without guidance in estimating the time which elapsed between the creation of the world and the deluge and between the deluge and the call of Abraham. So far as the Scripture assertions are concerned, we may suppose any length of time to have intervened between these events which may otherwise appear reasonable.

The question of the antiquity of man is accordingly a purely scientific one. . . .

-- Benjamin B. Warfield, "On the Antiquity and the Unity of the Hunan Race," In *The Princeton Theological Review* ix. (1911), pp. 1-25; reprinted in *Biblical and Theological Studies* edited by Samuel C. Craig (Philadelphia: The Presbyterian and Reformed Publishing Company, 1952), pp. 238-261.

According to these proposals by Green, Allis, and Warfield, the Genesis 5 account should be read in some such fashion as follows:

> "This is the written account of Adam's line. When God created man, he made him in the likeness of God. He created them male and female, at the time they were created, he blessed them and called 'man.'
>
> When Adam had lived 130 years, he had a son in his own likeness, in his own image; and he named him Seth. After Seth was born, Adam lived 800 years and had other sons and daughters. Altogether, Adam lived 930 years, and then he died.
>
> When Seth had lived 105 years, he became the ancestor of Enosh. And after he became the ancestor of Enosh, Seth lived 807 years and had other sons and daughters. Altogether, Seth lived 912 years, and then he died.
>
> When Enosh had lived 90 years, he became the ancestor of Kenan. And after he became the ancestor of Kenan, Enosh lived 815 years and had other sons and daughters. Altogether, Enosh lived 905 years, and then he died. (underlining mine)"

These genealogies in Genesis 5 and 11, then, are not lists of successive generations, framed in a chronological scheme, but rather records of lines of descent, with no indication of the length of time between individuals in the line of descent. There could have been one thousand years between named individuals, or ten thousand years, or one hundred thousand years. And thus man could be 50,000 years old, or 700,000 years old, or 2,000,000 years old. As Warfield pointed out, the question of the antiquity of man is a scientific one.

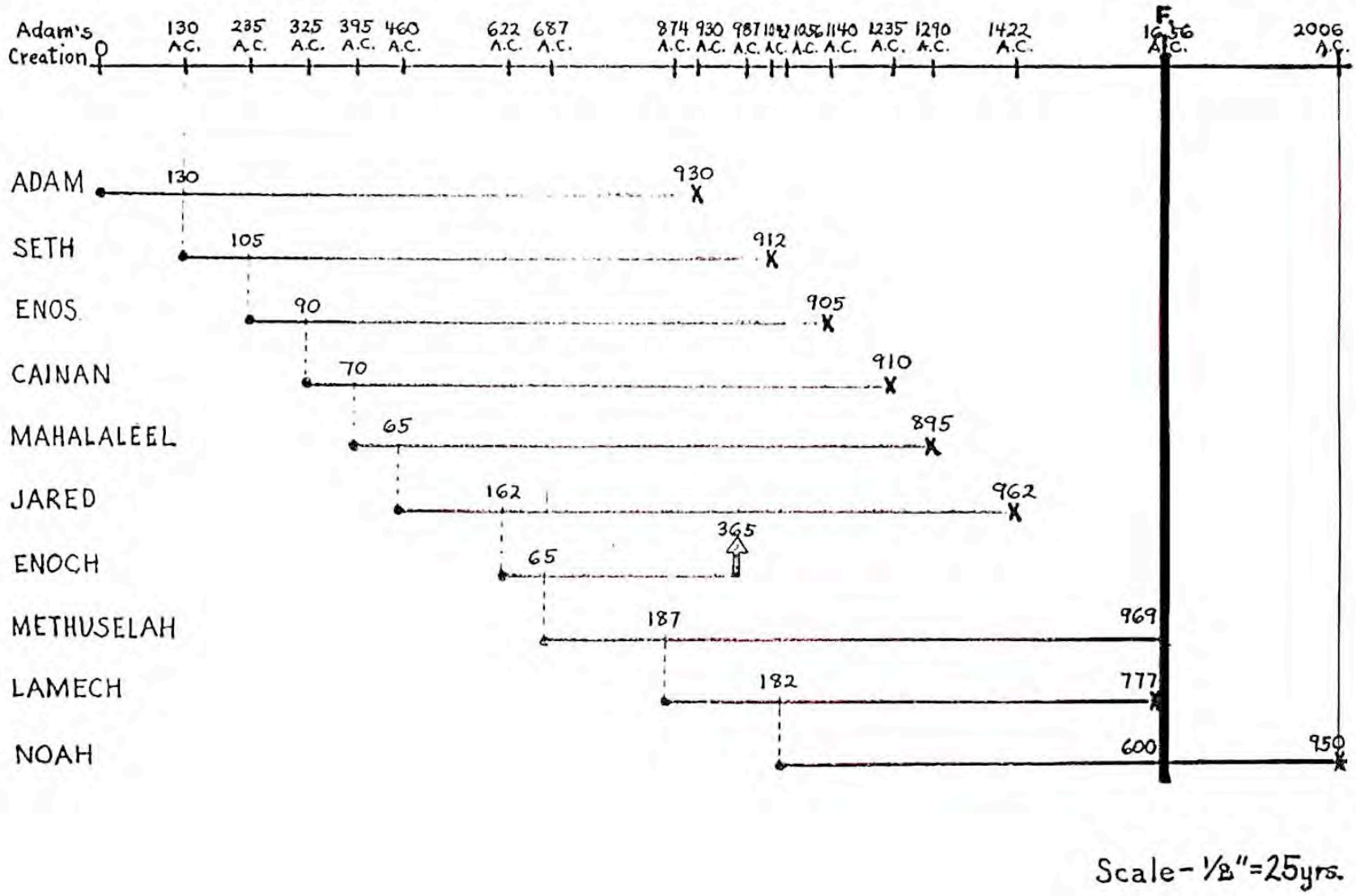
(2) The unity of mankind

The Bible everywhere represents Adam and Eve as the progenitors of all mankind.

Acts 17:26 relates all nations of mankind to one man, Adam. Luke writes: "and He made from one every nation of mankind to live on all the face of the earth, having determined their appointed times, and the boundaries of their habitation." "Every nation of mankind" includes all races, including Mongoloids, Caucasoids, Congoids, Capoids, and Australoids.

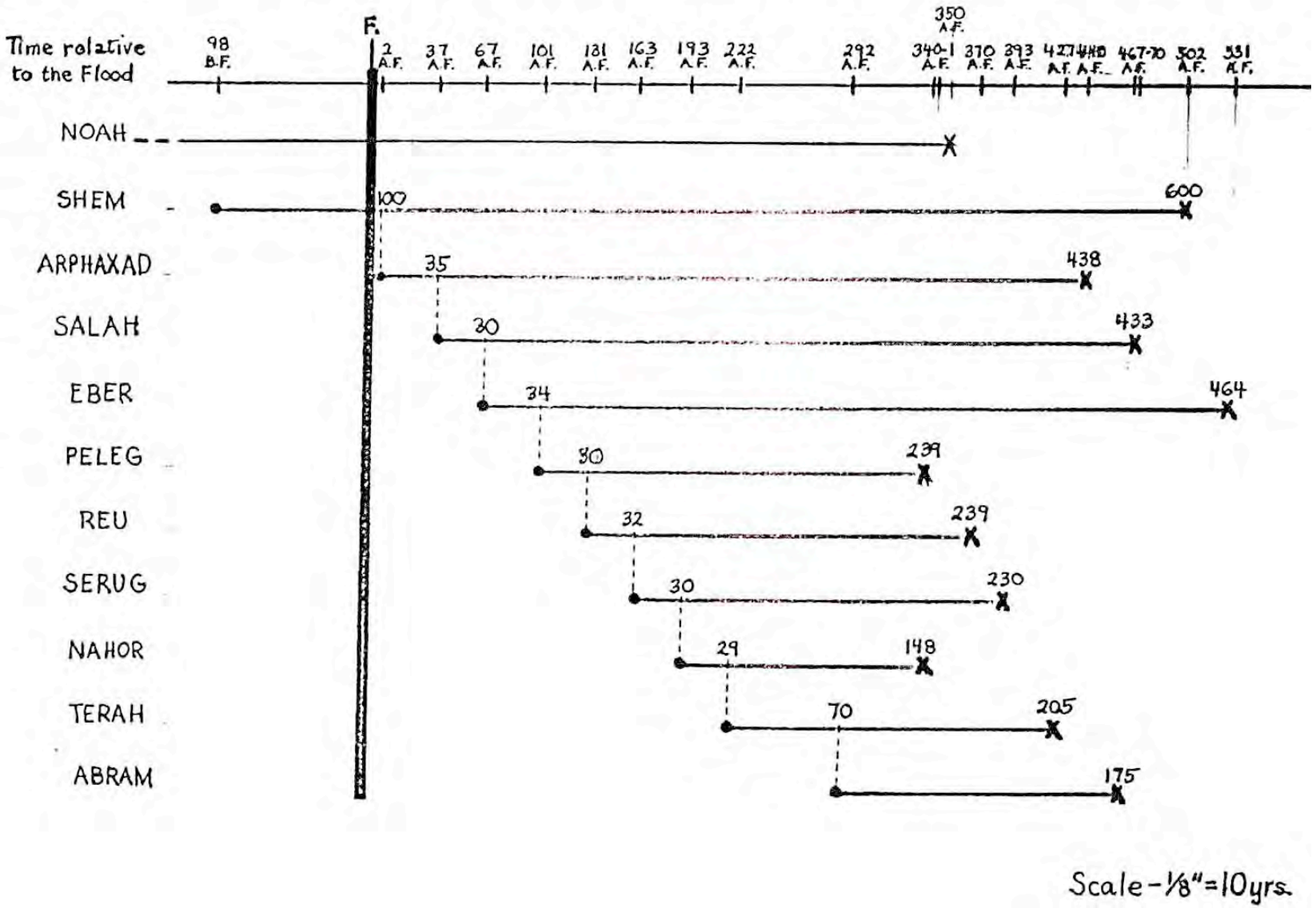
I Corinthians 15:45 states -- "And so it is written, the first man Adam was made a living soul; the last Adam was made a quickening spirit."

Non-Gap Chronology of the Genesis 5 Genealogy — Adam to Noah.



Scale - 1/8" = 25yrs.

Non-Gap Chronology of the Genesis 11 Genealogy — Shem to Abram



GENESIS 5 GENEALOGY AND THE POSSIBILITY OF GAPS

No. in List	Name of Ancestor	Yrs. before becoming Ancestor	Terms expressing Relationship	Yrs. after becoming Ancestor	Total Age	Name of Descendent	Is a Gap Possible?
1	Adam	130	"he became the father of a child"	800	930	Seth	No "he called his name Seth"
2	Seth	105	"he became the father of Enosh"	807	912	Enosh	Yes
3	Enosh	90	"he became the father of Kenan"	815	905	Kenan	Yes
4	Kenan	70	"he became the father of Mahalalel"	840	910	Mahalalel	Yes
5	Mahalalel	65	"he became the father of Jared"	830	895	Jared	Yes
6	Jared	162	"he became the father of Enoch"	800	962	Enoch	Yes
7	Enoch	65	"he became the father of Methuselah"	300	365	Methuselah	Yes
8	Methuselah	187	"he became the father of Lamech"	782	969	Lamech	Yes
9	Lamech	182	"he became the father of a son"	595	777	Noah	No "he called his name Noah"
10	Noah	500	"Noah became the father of Shem, Ham, and Japheth"	450	950	Shem, Ham, Japheth	No Gen. 7:13-"Shem and Ham and Japheth the sons of Noah . . . entered the ark

Romans 5:12-19 clearly connects Adam with all mankind in a solidarity of sin, guilt, condemnation, and death:

> . . . by one man sin entered into the world, and death . . . through the offense of one many be dead. . . by one man's offense death reigned. . . by the offense of one Judgment came upon all men. . . for as by one man's disobedience many were made sinners, . . .

And I Corinthians 15:21-22 connects all natural men with Adam in death:

> For since by man came death, by man came also the resurrection of the dead. For as in Adam all die, even so in Christ shall all be made alive.

Thus we are pressed to the conclusion that all human beings have descended from Adam and Eve. This includes all creatures that can properly be called man, including *Homo erectus* and *Homo sapiens*. This includes representatives of *Homo erectus* from Africa, Java, China, and Europe; and representatives of *Homo sapiens* from various parts of the earth, including Vertesszollos Man, Steinheim Man, Swanscombe Man, Neanderthal Man, Solo Man, Rhodesian Man, and Cro-Magnon Man, as well as many others, both ancient and modern.

(3) Man's relationship to the animals

(a) Anatomy

A study of the biblical materials in the first few chapters of Genesis reveals some striking similarities between man and the animals in terms of the derivation of their bodily materials and the origin of their biological life, as well as a crucial distinction. This study is presented on a separate sheet, under the heading "Man's Relationship to the Animals."

In the first 11 chapters of Genesis there is no indication of the anatomical features or the appearance of human beings from Adam to Noah, or from Noah to Abraham. The only exceptions to this statement are found in Genesis 6:2, where the "daughters of men" (the descendants of Cain) are said to have been beautiful; and in Genesis 6:4, where the Nephilim (giants) are mentioned as being present among mankind even before the Flood. However, as to whether early human beings were four, five, six, or seven feet tall, whether they were slender and lithe or broad and powerful, whether their skin coloring was light or medium or dark, whether they were hairy or smooth-skinned, whether their hair was blond or red or brown or black, whether they had a cranial capacity of 800 cc or 1000 cc or 1400 cc

or 2000 cc whether they had smooth foreheads or prominent brow ridges, whether they had small jaws and teeth or large ones, or whether some of the women were beautiful in the modern sense of that word, we simply do not learn from the scriptural account.

We do know, however, that when Adam had been created, there was found no animal that was suitable to be a companion, a helper, or a mate to him (Genesis 2:18-20). Apes were not suitable, and neither were australopithecines. Only another member of the genus Homo was suitable, and God created her and brought her to Adam.

The only other reference in the Bible that could have some bearing on the question of man's physical distinction from the animals is found in I Corinthians 15, where Paul is teaching about the nature of the resurrection body of the believer. In verses 35-49 he develops the line of thought that just as earthly bodies differ in degree of splendor from each other, and heavenly bodies differ in degree of splendor from each other; and just as the splendor of earthly bodies differs in kind from the splendor of heavenly bodies; so also the present earthly bodies of believers differ in kind from their future heavenly (resurrection) bodies. In the context of this development Paul, in verse 39, writes: "All flesh is not the same: Men have one kind of flesh, animals have another, birds another, and fish another." Paul does not specify the precise manner in which the fleshy bodies of earthly living creatures differ from each other in degree of splendor; he simply states the fact that they do. How much, therefore, can be built upon this distinction is a question that remains an open one.

(b) Use and manufacture of tools -

In Genesis 3:7 we are told that Adam and Eve sewed together some fig leaves and made coverings for their nakedness. Did they make and use some simple tools to facilitate this purpose? We are not told.

In Genesis 4:21 we are told that Jubal was the prototype of those who play the harp and the flute. How long after Cain did Jubal appear on earth? 0f course, if Genesis 4:18-22 is understood in the same fashion as the genealogies in Genesis 5 and 11, then Jubal could have been born a long, long time after Cain. In such a case we would read verses 18-22 as follows:

"To Enoch (Cain's immediate son) was born Irad, and Irad was the ancestor of Mehujael, and Mehujael was the ancestor of Methushael, and Methushael was the ancestor of Lamech. Lamech married two women, one named Adah and

the other Zillah. Adah gave birth to Jabal; he was the progenitor (or father) of those who live in tents and raise livestock. His brother's name was Jubal; he was the progenitor of all who play the harp and flute."

In Genesis 4:22 we are also told that another son of Lamech, Tubal-Cain, forged all kinds of tools out of bronze and iron. Tubal-Cain could also have been born a long, long time after Cain.

And in Genesis 6:14-16 Noah was told to build an ark, which was to be 450 feet long, 75 feet wide, and 45 feet high, which was to have lower, middle, and upper decks, and which was to have a roof and a door and rooms. It was to be made of cypress wood and to be coated with pitch inside and out. Presumably it took a number of tools to cut, transport, shape, hoist, fasten, and pitch the timbers needed for such a large vessel.

There is no indication anywhere in Scripture of animals' ability to use or manufacture tools.

(c) intelligence

In Genesis 1-11 we are not given any direct information as to early man's level of intelligence. Of course, since Adam and Eve were created without sin, and since their minds before the Fall were unaffected by depravity, and if they used a larger proportion of the capacity of their brains than human beings use today, then perhaps our original parents were more intelligent than modern man. After the Fall, when human beings were depraved, and when they were cursed with the noetic effects of sin, perhaps they came to use less of the capacity of their brains.

However, it remains true that between the simplest expressions of normal human intelligence and the most "clever" of animal behaviors there is a sizable gap that cannot be bridged. Perhaps this assertion can indirectly be supported by the implications of the command that the Lord gave Adam and Eve to "Rule over the fish of the sea and the birds of the air and over every living creature that moves on the ground." (Gen. 1:28). A higher level of intelligence on the part of man would appear to be required for the exercise of such dominion.

Once we are past Genesis 1-11, there are a few references in Scripture which bear directly on the question.

in Psalm 73:22, Asaph speaks of a time when he became envious of the prosperity and seeming impunity of the wicked. However, when he came to understand their final destiny, he realized how foolish and wicked he had been, and he wrote: "I was senseless and ignorant; I was a brute beast before you."

in Daniel 4:16, Daniel tells Nebuchadnezzar of the judgment which God, speaking through an angelic messenger in a dream, has pronounced upon the king: "Let his mind be changed from that of a man and let him be given the mind of an animal, till seven times pass by for him."

In II Peter 2:12, Peter, speaking of the false teachers who will come among the believers, says, "But these men blaspheme in matters they do not understand. They are like brute beasts, creatures of instinct, born only to be caught and destroyed, and like beasts they too will perish."

And in Jude 10, Jude, speaking of the godless men who have crept in among believers, who "pollute their own bodies (with sexual immorality and perversion), reject authority and slander celestial beings," says: "Yet these men speak abusively against whatever they do not understand; and what things they do understand by instinct, like unreasoning animals -- these are the very things that destroy them."

Human intelligence is usually seen to be evidenced by the development of culture. Actually, the history of culture does not bear witness to a straight-line development. Human history tells us that various people have risen to high levels of knowledge and cultural sophistication in such fields as art, mathematics, astronomy, etc., only to fail back into decline, decay, and loss of such knowledge. The Egyptian, Babylonian, Greek, Chinese, Roman, Mayan, and Incan civilizations all show such rises and falls. Of course, the technological developments of the 19th and 20th centuries have encouraged some human beings to believe themselves to be much more intelligent than any human beings in the past. But whether mankind as a whole is more intelligent today than those who lived before the Flood, or during the golden ages of Egypt or Greece or Rome, is arguable. It is true that some modern human beings know a great deal more than those who lived thousands or even hundreds of years ago. But it is also true that, with the advent of the knowledge explosion, human beings are able, relatively speaking, to know more and more about less and less. Besides, the acquisition of a great deal of knowledge does not in itself demonstrate a high level of intelligence, especially if the knowledge cannot be integrated with previously-acquired knowledge, or cannot be used to solve new problems. In fact, if intelligence is defined as "the capacity to apprehend facts and propositions and their relations and to reason about them" (Webster's Seventh New Collegiate Dictionary), one can at least wonder whether modern man's intelligence is significantly higher than that of his ancestors. On the other hand, man's intelligence can at least be

measured (or mis-measured via cultural conditioning or bias, as the case may be); there is no meaningful way to measure the capacity of animals to apprehend facts and propositions and their relations and to reason about them.

(d) Use of fire

The Bible provides little information about early man's use of fire. In Genesis 4:22 Tubal-Cain is reported to have forged tools. This would require the use of fire. However, if Tubal-Cain was born a long, long time after Cain (as was suggested above, under the discussion about the use and manufacture of tools), then this does not help us.

in Genesis 8:20 we are told that Noah sacrificed burnt offerings following the Flood. This definitely involves the use of fire. However, the question of how extensive was man's use of fire for warmth and for cooking during the period from Adam to Noah is not answered for us.

On the other hand, Scripture gives not the slightest hint about the use of fire by any animal in any period of history.

(e) Building of structures

In Genesis 4:17 we read that Cain, Adam's immediate son, built a city. According to the *Theological Wordbook of the Old Testament* edited by R. laird Harris, Gleason L. Archer, Jr., and Bruce K. Waltke, the Hebrew word iyr` (עִיר) refers to a permanent settlement without reference to size or claims, generally surrounded by a wall. It is difficult to know how large Cain's settlement was, since Cain was Adam's immediate son, and there were not yet many people on the earth. However, if Cain experienced the same order of longevity that Adam and Seth experienced, then there would have been enough people among his own family to make up a settlement.

But what kind of structures made up this settlement? Did Cain and his people live in caves? lean-to's? huts made of branches and thatch? mud houses? stone buildings? We do not know.

In Genesis 4:20 we read of Jubal, who was the prototype of those who live in tents and raise livestock. Of course, if Jubal was born a long, long time after Cain, this does not tell us about early man. In fact, a good many people today live a nomadic type of life, living in tents and raising livestock which must frequently be moved to find new grazing areas.

In Genesis 6:14-16, 22, we read that Noah built a huge, fairly elaborate structure, the ark, according to God's command and basic design. Did God instruct Noah as to how to go about implementing this basic design? We are not told.

Nevertheless, it seems safe to assume that God supplied whatever Noah did not know or could not figure out in the task of saving alive those human beings and animals who were to people the post-diluvian earth.

In Genesis 11:3, we read that, shortly after the Flood, men began to build a city and a high tower of baked bricks and tar in the plain of Shinar, but that God stopped them and scattered them. This represents a fairly advanced level of building.

Although certain animals construct various structures for shelter, for protection, for storage, or to trap other animals, they do not appear to do so as an expression of their own forethought, design, and purpose, but instinctively, as an expression of God's forethought, design, and purpose. As such, these structures display God's wisdom, not that of the animals And in this too, man is distinct from the animals, in that man is a subcreator of structures.

(f) Use of language

In Genesis 1:16 we read that God communicated with Adam.

In Genesis 1:19-20 we read that Adam gave names to the beasts of the field and to the birds.

In Genesis 11:1 we discover that shortly after the Flood the whole inhabited earth had one language. We do not know what that language was.

in Genesis 11:6-9 we read that the Lord scattered human beings from the plain of Shinar, and thus one language became many languages.

Other than the serpent in Genesis 3 and Balaam's donkey in Numbers 22 there is no scriptural evidence in favor of the use of language by animals. Of course, if the serpent was not a snake but Satan (cf. Rev. 12:9); and if Balaam's donkey "spoke" in the sense that God rebuked Balaam by speaking through the donkey, then there is no evidence at all.

(g) Morality and Religion

The Bible nowhere treats animals as though they were moral beings, subject to the Law of God, and capable of moral notions or motions. Although animals are often used in religious worship as sacrifices, they are not to be worshipped, nor are they considered worshippers of God in any religious sense (i.e., religion defined as the outward expression or exercise of faith). Animals are not considered sinners, are not under the wrath of God, and do not experience salvation or damnation. They are not moral or spiritual beings.

On the other hand, man was created in the image of God (Gen. 1:26-27). Because God is a personal being, man was created a person. Because God is holy and righteous man was created holy and righteous. Because of this image, man's life is sacred (Gen. 9:6), and man has an essential dignity (James 3:9). In addition, the Law of God was written into man's nature at creation; and God's moral judge, the conscience, was made a part of man's being (Romans 2:14-15). All men (except for Adam before the Fall, and Jesus Christ) are considered sinners, are under the wrath of God, and experience either salvation or damnation (Romans 3:23, Ephesians 2:3; John 3:18, 36).

MAN'S RELATIONSHIP TO THE ANIMALS

Biblical Similarities Between Man and the Animals

A. Derivation of Bodily Material

I. Animals

Genesis 2.19 -- "And out of the ground the Lord God formed every beast of the field and every bird of the sky, . . ."

. . . וַיִּצֶר אֲדָמָה אֱלֹהִים יְהוָהמִן־ה

2. Man

Genesis 2:7 -- "Then he Lord Cod formed man of dust from the ground, . ."

. . . וַיִּיצֶר יְהוָה אֶת אֱלֹהִים-מִן עָפָר הָאָדָם-הָאֲדָמָה

B. Origin of Biological Life

1. Animals

Genesis 6:17 -- "And behold, I even I am bringing the flood of water upon the earth, to destroy all flesh in which Is the breath of life, . . ."

Genesis 7.13-15 -- "On the very same day Noah and Shem and Ham and Japheth, the sons of Noah, and Noah's wife and the three wives of his sons with them, entered the ark, they and every beast after its kind, and all the cattle after their kind, and every creeping thing that creeps on the earth after its kind, and every bird after its kind, all sorts of birds. So they went into the ark to Noah, by twos of all flesh In which was the breath of life."

מְכָּל-אֲשֶׁר הַבָּשָׂר-רוּחַ בּוֹ חַיִּים:

Genesis 7.21-22 -- "And all flesh that moved on the earth perished, birds and cattle and beasts and every swarming thing that swarms upon the earth, and all mankind; of all that was on the dry land, all in whose nostrils was the breath of the spirit of life, died."

2. Man

Genesis 2.7 -- "Then the Lord God . . . breathed Into his nostrils the breath of life. . . .

. . . חַיִּים נִשְׁמַת בְּאַפָּיו וַיִּפַּח

C. Resultant Creation as a Living Being

1. Animals

Genesis 1:20 -- "Then God said, 'Let the waters teem with swarms of living creatures, . . . "

Genesis 1:21 -- "And God created the great sea monsters, and every living creature that moves, with which the waters swarmed after their kind, . ."

. . . כָּל הַחַיָּה נֶפֶשׁ

Genesis 1:24 -- "Then God said, 'Let the earth bring forth living creatures after their kinds cattle and creeping things and beasts of the earth after their kind'; . . ."

. . . תְּהָאָרֶץ תּוֹצֵא חַיָּה נֶפֶשׁ

2. Man

Genesis 2:7 -- " . . . and man became a living being."

וַיְהִי הָאָדָם לְנֶפֶשׁ חַיָּה:

The Uniqueness of Man Among the Animals

Genesis 1:26 -- "Then God said, 'Let us make man In our Image, according to our likeness; and let them rule over the fish of the sea and over the birds of the sky and over the cattle and over all the earth, . . . "

F. Paleontology end the Bible: A Creationist Synthesis

1. Definition of the term "Creation"

First of all, "Creation" means the bringing into being of that which did not (either in its substance or its form) previously exist. An example of this meaning would be the creation of the original matter-energy complex of the physical universe. This usage we shall call EX NIHILO CREATION (i.e., "creation from nothing").

Secondly, "Creation" means the bringing into being of that which did not (in its form) previously exist, employing previously-existing substance. An example of this meaning would be the creation of Adam's body from the dust of the ground. This usage we shall call IMMEDIATE CREATION (i.e., creation by direct action of God, using previously existing substance).

Thirdly, "Creation" means the bringing into being of that which did not (in its form) previously exist, employing both previously-existing substance and secondary causes. An example of this meaning is the creation by God, through human parents, of each child born into the world. This usage we shall call MEDIATE CREATION.

in each of these three usages -- Ex Nihilo Creation, immediate Creation, and Mediate Creation -- it is important to remember and to recognize that in the context of this discussion it is God who is the Creator. But it is also important to remember that when we speak of God's activity in Creation, we must from time to time clarify the statement, "God created such-and-such," by specifying whether God created ex nihilo or immediately, or mediately. This also means that when we read a statement in Scripture concerning God's creative activity, we must occasionally ask ourselves the question, "Which meaning of 'Creation' is intended in this usage?"

2. An outline survey of the creative events of Genesis 1-2

EVENT #1 (included in Genesis 1:1) -- God's Ex Nihilo Creation of all the matter-energy and the space of the universe, together with their properties, several billion years ago.

Although Genesis 1:1 does not specifically mention the creation of primal matter, yet it includes that creation. Since matter is not eternal, it must be created; and it is here that we learn of this creative event. In point of fact, this creation refers to God's bringing into being, from nothing, of all of the basic units of matter and energy found in the physical universe -- neutrons, protons, electrons, and various other atomic and sub-atomic particles.

It has been estimated that the entire observed universe, contains 10^{80} particles (i.e., 10 followed by 79 zeros). For most of us, this is an

inconceivable number! And yet God has created them from nothing, by the Word of His power. Incidentally, by way of comparison the entire earth contains 10^{50} atoms (10 followed by 49 zeros), and a single cup of water contains 10^{25} atoms (10 followed by 24 zeros, or 10 trillion trillion atoms).

With respect to the age of the universe (and thus the age of primal matter), a number of astrophysicists, computing back from the present rate of expansion of the universe to the beginning of the expansion, have arrived at a figure of 10^{13} billion years. In addition, astronomical evidence indicates that the energy emitted by certain galaxies (whether in the form of light waves or radio waves) left those galaxies several billion years ago.

EVENT #2 (included in Genesis 1:1) -- God's Mediate Creation of the basic structure of the universe, a process which began after the creation of primal matter-energy, and continued for a vast period of time of indefinite duration.

This process, which proceeded during the long phase of the universal expansion of the universe, refers to the formation, out of the original gaseous agglomerate of energy and matter, of the various elements; and to the condensation of enormous amounts of galactic gas into the large groupings of galaxies and stars which form the essential structure of the physical universe.

EVENT #3 (included in Genesis 1:1) -- God's Mediate Creation of our own galaxy (the Milky Way Galaxy), a process which occupied a long period of indefinite duration.

The Milky Way Galaxy, as it presently appears to us, is a vast aggregate of Star clusters, stars, interstellar gas, and interstellar dust, arranged in the shape of an enormous disk somewhat bulged in the middle (viewing it edge-on) or in the shape of a pinwheel, containing spiral arms winding outward from a central nucleus (viewing it from the top). The size of our galaxy is almost beyond comprehension. The distance from one edge of the disk to the opposite edge is roughly 100,000 light years; i.e., the distance light travels in 100,000 years. Since light travels at 186,000 miles per second the distance covered by a star's light travelling from one edge of our galaxy to the opposite edge would be 587 quadrillion miles (587 followed by 15 zeros), and it would take that light 100,000 years just to cross our galaxy! When we stop to consider the fact that there are at least 100 billion galaxies in the observed universe, our minds reel and stagger at the very thought of such vastness, and we cannot help recalling the Psalmist's words: "When I consider thy heavens, the work of thy fingers, the moon and the stars, which thou hast ordained, what is man, that thou art mindful of him? And the son of man, that thou visitest him? .... 0 Lord, our Lord, how excellent is thy name in all the earth!"

EVENT #4 (recorded In Genesis 1:2-5) -- Gods Mediate Creation of our solar system, comprising a system of planets orbiting the sun and rotating about their own axes, a configuration which not only produced light to shine upon the planet earth, but also provided for a division between day and night upon the earth.

Here I should like to mention a particular scientific theory of the origin of the solar system: the Fowler-Greenstein-Hoyle theory. Now in order for any scientific theory of the origin of the solar system to be called a good theory, it should be able to explain at least five sets of facts:

(I) The fact that the sun has most of the mass of the solar system (750:1), whereas the planets have most of the angular momentum (200:1).
(2) The fact that the orbital planes of most of the planets are within five degrees of the mean plane of the system.
(3) The fact that the planets and their satellites (with only a few exceptions) both orbit and rotate in the same direction as the sun rotates.
(4) The fact that the planetary orbits are nearly circular.
(5) The fact that the inner planets are less volatile (i.e., do not vaporize as easily) and more dense than the outer planets.

The Fowler-Greenstein-Hoyle theory of the origin of the solar system proposes that the whole solar system was at first a dark, tenuous nebula which, as it revolved, contracted into a slowly spinning disk. When contraction was well advanced, this disk began to glow. The center of the disk, contracting still further, became the hot sun. The gaseous outer portion of the disk, magnetically connected to the spinning sun, moved outward and condensed to form the orbiting planets.

There are three reasons why I mention this particular scientific theory:

(1) Most of the contemporary theories of the origin of the solar system are similar to the Fowler-Greenstein-Hoyle theory.
(2) This theory is not in conflict with the biblical facts, but fits them rather well. The dark, tenuous, disk-shaped-nebula concept fits rather well with the biblical statement, "And the earth was without form (or unformed), and empty; and darkness was upon the face of the deep."
(3) This theory fits the scientific data quite well.

This fourth event, the creation of our solar system, provided for both light and for day and night, since it is the earth's rotating motion in relation to the sun that gives us the alternating periods of daylight and darkness which we know as day and night. This is in perfect accord with the scriptural account in which we read, "And God

said, Let there be light: and there was light. And God saw the light, that it was good: and God divided the light from the darkness. And God called the light Day, and the darkness He called Night." (Genesis 1:3-5).

EVENT #5 (recorded in Genesis 1:6-8) -- God's Mediate Creation of the earth's atmosphere, and the subsequent separation of water above the surface of the earth from water covering the surface of the earth.

The word translated "firmament" in Genesis 1:6,7,8 -- raqiya`(רָקִיעַ) -- means "that which is stretched out, an expanse" Our proposal is that this expanse was the atmosphere, or what we call the sky (in the near sense of that word). In verse 8 of Genesis I, God calls this expanse "heaven."

Our present atmosphere is a rather thin blanket covering the surface of earth to a height of about 100 miles above sea level. It is comprised of nitrogen (78%), oxygen (20.9%), water vapor, and small amounts of argon, carbon dioxide, neon, helium, methane, and other gases. It should be noted that nitrogen and oxygen comprise 98.9% of the total volume of atmospheric gases.

Professor Russell W. Maatman, a member of the department of chemistry at Dordt College, asserts in his book *The Bible, Natural Science and Evolution* that there is considerable mineralogical evidence that the early atmosphere of the earth was largely carbon dioxide, and that it was almost totally devoid of oxygen (in contrast to our present atmosphere which, as we have mentioned, contains 20.9% oxygen). Such an atmosphere would have been capable of holding a great deal of water, in the form of thick clouds. Thus the initial atmosphere, or "Firmament," would have provided a means of dividing between water above the surface of the earth, and water covering the surface of the earth.

EVENT #6 (recorded in Genesis 1:9-10) -- God's Mediate Creation of dry land, by the structuring of earth's surface into land and seas.

At the present time, of the total surface area of the earth (197,000,000 square miles), 29% (or 57,000,000 square miles) is dry land, and 71% (or 140,000,000 square miles) is covered with water. In primeval times, as we learn from these verses, the entire surface area of the earth was covered with water.

The separation of dry land from water would of necessity involve the uplifting of enormous land masses, with the concomitant creation of deep ocean basins. It is instructive to note that, at present, the average depth of the oceans is much greater than the average elevation of the land. The average depth of the oceans is about 2½ miles, while the average elevation of the land is about ½ mile. Thus if the continents were entirely eroded away, and the material composing them placed in the oceans, the earth would be covered by a universal sea approximately 1.8 miles deep.

Whether one holds the theory that the continents are presently where they always have been, or the theory that whole land masses have drifted to form our present continents is not crucial to the essential interpretation of the Genesis account. However, it is interesting to note that twice in these verses (verses 9 and 10) we read of the gathering together of the waters into one place. Is this significant?

This form of expression could be thought to suggest the idea that only one land mass existed in the distant past; and that later the single land mass broke up to form our present continents. This is called the Theory of Continental Drift, a theory which has practically swept the field of geology in the last few years. This is a possible interpretation of verses 9 and 10. Of course, these statements could also mean simply that God gathered the waters into their own places ('place" taken collectively), so that the dry land could appear in its own places.

EVENT #7 (recorded in Genesis 1:11-13) -- The beginning of God's immediate Creation of various "kinds" of land plants.

Here in these verses we have the first mention of the creation of living things. It is instructive to note that Moses makes no mention of Monerans and Protistans -- two whole kingdoms of very simple microscopic living creatures. Nor does he mention the thousands and thousands of species of marine plants. He speaks only of plants which grew on the land. Of course, it should be pointed out that if Moses, by means of a Special Revelation, had spoken in the inspired Scriptures of these microscopic creatures, no one reading his words at any time during the next 3000 years would have had the slightest notion of what he meant.

in verses 11-12 three general categories of plants are mentioned: "vegetation," "herbs which produce seeds," and "fruit trees which produce seed-containing fruit." The word "vegetation" and the word "herb" are quite general terms, and would appear to have a considerably wide range of applicability.

It is fascinating to note the fact that the creation of plants is mentioned before the creation of animals. Is this a mistake on Moses' part? Or is it merely a coincidence?

in reply to these questions, we must point out that they are capable of manufacturing their own food, by means of photosynthesis. Green plants, which contain chlorophyll, take carbon dioxide and water and, using the energy from sunlight, break down those substances and synthesize their constituent elements into energy-rich sugar and oxygen and water. Some animals eat these energy-rich plants, and thus obtain the energy needed to carry on life functions. Some animals eat other animals, which in turn have eaten energy-rich plants. And man eats both energy-rich plants, and animals which (either directly or indirectly) have eaten energy-rich plants. Thus we discover that, as far as utilizable energy for the carrying on of life functions is concerned, animals and men are dependent upon plants. It is therefore no mistake nor coincidence that Moses mentions plants as having been created before animals and man.

One further word about the fact that only three general categories are mentioned is in order. Botanical taxonomists classify all known plants into more than 350,000 species. One may with propriety ask whether 350,000 species of plants were intended to be included within this simple three-point classification. I should like to suggest that the list in Genesis was not intended to be exhaustive, but only representative of all plants. Yet, as a representative list, in which part is given for the whole (as in the figure of speech called synecdoche), its implications are clear: God is the Creator of all plant-life.

EVENT #8 (recorded in Genesis 1:14-19) -- God's Mediate Creation of the appearance of the sun, the moon, and the stars (as viewed from earth's surface).

We have already spoken of God's creation of the firmament or expanse; and have proposed the idea that the expanse is earth's atmosphere. We have also mentioned the mineralogical evidence that the atmosphere during earth's early history was largely composed of carbon dioxide. And we have suggested that, with a carbon dioxide blanket (which would cause a slight increase in atmospheric temperature), much of the water on the earth's surface would be in the form of water vapor, and the weather would be continually cloudy.

As soon as the created plants began to grow, they commenced, by means of the process of photosynthesis, to consume the carbon dioxide in the atmosphere and to produce free oxygen. Of course, through the process of cellular respiration, they also took in oxygen and released carbon dioxide. However, since the rate of photosynthesis slightly exceeded the rate of respiration, the atmosphere, over a long period of time, was gradually converted from one containing a very large percentage of carbon dioxide and almost no oxygen, to one containing very little carbon dioxide (thirty-three thousandths of one percent, to be exact!), and a sizable amount of oxygen (almost twenty-one percent).

As the carbon dioxide percentage decreased, the temperature decreased also. Gradually the water vapor condensed, and the thick clouds began to dissipate. Then at some point in the process, the cloud cover broke up and the sun, moon, and stars became visible from the surface of the earth. And thus the now-visible sun, moon, and stars became light-bearers, to clearly distinguish day from night, to give light upon the earth, to signify God's Creatorship and Providential Rulership, and to mark off periods of time, including days, seasons and years.

EVENT #9 (recorded in Genesis 1:20-23) -- The Beginning of God's immediate Creation of various "kinds" of aquatic animals and various "kinds" of birds.

The animals mentioned in these verses are classified according to the environment in which they move. The environment of the various "kinds" of "living creature that moves" is in this case the water. This category also includes the "great sea monsters," and probably the amphibians, as well as all fish and marine invertebrates. The environment of the various "kinds" of birds and other flying creatures is twofold: the firmament of heaven (i.e., the air above the ground), and the ground.

In addition, we are told that God blessed the aquatic animals and the celestial animals with the blessing of fruitfulness, that they might multiply and fill their ecological niches. throughout the earth, both in the seas and on he land.

EVENT #10 (recorded in Genesis l:21-25) -- The beginning of God's immediate Creation of various "kinds" of terrestrial animals.

Three basic categories of land animals are mentioned here: "cattle," "creeping animals," and "living animals of the earth." The principle of division upon which this classification is based could very well be the method of locomotion. Thus these three categories could be viewed as including animals that move by walking upon the ground, animals that move by creeping on the ground, and animals that move in the ground itself (presumably by digging or burrowing).

in any case, it would appear necessary to break down these three categories into various "kinds" of each category, and we are told that God called these "kinds" of terrestrial animals into existence.

EVENT #11 (recorded in Genesis 2:8) -- God's immediate Creation of the Garden of Eden.

There may be a question a to whether this creative event should be placed before the creation of Adam, or between Adam's creation and Eve's creation, since God placed Adam in the garden (2:15) and put him to sleep there (2:21) in order to create Eve.

Since both male and female are spoken of in the general creation account of Genesis 1:27, it would appear to make very little difference whether one places the creation of the garden before Adam's creation or after it. However, I prefer to view the creation of the garden as coming before Adam's creation, so that the newly-created man would be located in the Garden of Eden from the very beginning of his existence. Thus I prefer the pluperfect translation of Genesis 2:8 -- "And the Lord God had planted a garden eastward in Eden; and there he put the man whom he had formed."

Where was this beautiful paradise located? Weil, beyond the fact that it was somewhere in the Middle East, we know next to nothing about its precise location. Perhaps like the mythical lost continent of Atlantis, that beautiful garden was destroyed, wiped out, and completely obliterated from the face of the earth. Perhaps when we are in glory we

shall learn of its location and its end. In the meanwhile, we are urged, not to fix mournful and longing eyes upon paradise lost, but rather to look forward to a better Paradise, one regained for us by Christ and prepared for those who love Him.

EVENT #12 (recorded in Genesis 1:26-31 and 2:7) -- God's Ex Nihilo Creation of Man's Soul, and His immediate Creation of Man's Body.

The Scriptures tell us that God created man in His own image and likeness. This likeness is stamped upon man's soul. As God is a Spirit (i.e., a Person), so man is a spirit (i.e., a person). As God's nature has the attributes of wisdom, power, holiness, justice, goodness, and truth, so man's nature, as created in God's image, had the attributes of wisdom, power, holiness, justice, goodness, and truth. However, whereas God possesses these attributes in an infinite, eternal, and unchangeable way, unfallen man possessed them in a finite, temporal, and changeable way. Thus there is both likeness and unlikeness in God's creation of man in His own image: likeness, because God created man in His image; unlikeness, because God created man in His image.

The creation of man's body, as recorded in Genesis 2:7, is an immediate creation by God, using pre-existing substance (in this instance, "dust from the ground"), but not secondary causality. The substance from which Adam was formed was not living substance before God communicated life to it at this point.

In connection with this assertion, the translation in the Authorized Version is unfortunate, since it obscures a very important truth, and also makes the verse teach something that simply is not there. Genesis 2:7 should be translated, "And the Lord God formed man of dust from the ground, and breathed into his nostrils breath of life, and man became a living being (or "living creature"). The Hebrew simply says that man became *nephesh chaya'* (חַיָּה נֶפֶשׁ).

Looking back to Genesis 1:20-21, we notice that God created aquatic life. This life s called חַיָּה נֶפֶשׁ. In Genesis l:24-25, God created terrestrial life. This life is also called חַיָּה נֶפֶשׁ. And then in Genesis 2:7, as a result of the divine inbreathing of life into the body which God had created for him, Adam became a נֶפֶשׁ חַיָּה. The facts are clear: Adam was not a living creature before Genesis 2:7; the animals were living creatures before the time of Genesis 2:7; therefore Adam could not have, descended from the animals, since in that case Adam would have been a living creature before he became a living creature, which is plainly absurd. And further, since Genesis 2:7 is speaking of the creation of Adam's body and of the bringing of that body to life, neither Adam as a whole nor Adam's body descended from animals.

EVENT #13 (recorded in Genesis 1:27 and 2:19-23) -- God's Ex Nihilo Creation of Woman's Soul, and His immediate Creation of Woman's Body.

It should be emphasized that God also created woman in His own image and likeness. Again, this likeness, as in man, refers to woman's soul. As to her body, however, she was created from Adam's flesh and bone,

not from dust from the ground. Nevertheless, since Adam's flesh and bones were formed from the dust, Eva also (indirectly) was from the dust; and as a result of the Fall, was destined, by the sentence of death, to return with Adam to the dust. Thus the curse in Genesis 3:19 falls upon both Adam and Eve, and upon all of their posterity.

EVENT #14 (recorded in Genesis 2:1-3) -- The Cessation of God's immediate Creation; the continuation of God's Mediate Creation.

By "cessation of God's immediate Creation" is meant the completion of God's purposed activity of bringing the universe and its constituent elements into being. This expression is not intended to deny the reality of miracle, or to deny the immediate character of God's redemptive acts.

I do not believe that the words, "He rested on the seventh day from all His work which He had made," mean that God was tired out from all that creating and therefore needed to rest up for a day before He took up the Job of keeping everything running. Rather, I believe that this "resting from work" is better understood as a cessation, a stopping of God's creative activity in the *Ex Nihilo* and immediate senses. Of course, His Mediate creative activity continued, continues, and shall continue until the end of time.

The chronological meaning of the term "day" in Genesis 1-2

What is the chronological meaning of the term "day" in the Genesis record of the seven creation "days"? This question places before us the task of determining true Scriptural meaning, according to usage, of the Hebrew word *YOM* (יוֹם).

The Authorized or King James Version translates the Hebrew word *YOM* in the following ways: 1167 times *YOM* is translated "day," 65 times it is translated "time", 30 times it is translated "today" (in these cases the Hebrew has the definite article); 29 times it is translated "daily" (in these cases *YOM* is associated with various prepositions and adjectives): and 18 tines it is translated "for ever"!

Quite apparently the King James translators viewed *YOM* as comprising a fairly broad range of meaning!

Upon examination of a large number of usages in context, the possibilities of meaning of the Hebrew word *YOM* appear to contract to essentially four:

(1) A period during which there is light upon a part of earth's surface, relative to a particular location on earth; or simply a period of light.

Thus in Genesis 1:5 we read, "And God called the light *YOM* ": and in Genesis 1:16 we read that God made "the greater light to rule the *YOM*."

(2) A period during which the earth makes one full rotation upon its axis; or a 24-hour day.

in Exodus 20:8-10 we have an instance of this usage. There we read: "Remember the *YOM* of rest, to keep it holy. Six *YAMIM* (יָמִים -- plural of *YOM*) shall you labor and do all your work. But the seventh *YOM* is the rest of the Lord your God."

(3) A relatively determinate period (i.e., a period with fairly well-determined boundaries) during which some event or series of events takes place. This period could be short or long.

In Genesis 41:1 we read: "And it cane to pass at the end of two full *YAMIM* (plural of *YOM*), that Pharaoh dreamed." This is translated "years" in the Authorized Version, and I believe that the translation is correct. If so, then we take note of the fact that this Scripture is speaking of the two full years during which Joseph was in prison, and yet it uses the plural of the word *YOM*.

in Exodus 13:10 Moses commanded the children of Israel, "Thou shalt therefore keep this ordinance in its season from *YAMIM* to *YAMIM*." This is translated "from year to year."

And in Proverbs 25:13 we read the words, "As the cold of snow in the *YOM* of harvest, so is faithful messenger to them that send him." Here *YOM* means the time of harvest, the season of harvest.

(4) A fourth possibility of meaning is that of a relatively indeterminate period (i.e., a period without well-defined boundaries) during which some event or series of events takes place. This could be a brief indeterminate period or a lengthy indeterminate period.

in Genesis 35:3 Jacob said to his household, "Let us arise, and go up to Bethel; and I will make there an altar unto God, who answered me in the *YOM* of my distress, and was with me in the way which I went." in this usage *YOM* simply means time.

in Genesis 40:3 we read of what Pharaoh did to his chief butler and his chief baker: "And he put them in prison." in verse 4 we are told "and they continued a *YOM* in prison." Here *YOM* simply means a period of time, a season of time of indefinite length.

In Proverbs 31:25 we read of the virtuous woman that "Strength and honor are her clothing, and she shall rejoice in *YOM* to come." Here all is indefinite, without boundaries in time. *YOM* simply means time.

But now we are faced with the question: Which of these four possibilities of meaning was intended in Genesis 1-2? In which sense shall we understand the seven Creation *YOM*s? Are they periods of light, 24-hour periods, relatively determinate periods, or relatively indeterminate periods of time?

There are at least five important considerations which bear upon the question of how we are to understand the time value of the seven Creation *YOM*s:

(1) The light-darkness separation, and the calling of light "Day" and of darkness 'Night";

(2) The evening-morning pattern ("and it was evening, and it was morning") which is associated with *YOM*s 1-6;

(3) The appointment of the sun to rule over the "Day" and of the moon and stars to rule over the "Night";

(4) The time-period occupied by each *YOM*. This could be:

(a) the period during which God spoke His creative command
(b) the period during which God's creative activity was exercised
(c) the period during which God's creative command began to achieve fulfillment
(d) the period during which God spoke His creative command, and saw it completely fullfilled.

(5) The question of the time consumed in the fulfillment of God's creative commands. How shall we interpret the biblical record? Were the creative commands of God fulfilled in a moment, or in a twelve-hour period, or in a twenty-four-hour period, or in a relatively short period of time, or during a moderately long period of time, or throughout a vast period of time? Could some of these commands have been fulfilled in an instantaneous event, and others by a long process? Notice: there is no question here of whether God could have created all things instantaneously, if He had so chosen. The question here is simply, How did He create all things?

With these five considerations in mind, and attempting to keep the biblical data in view, I should like to propose a chronological-aspect meaning of the seven *YOM*s of Genesis 1-2. This proposal has two parts:

First, as to the time-period indicated by each *YOM*, I propose the meaning, "the period during which God's creative command began to achieve fulfillment." Thus the seven *YOM*s would fall into seven periods of time, the first six of which would be creative-aspect periods (i.e., periods during which some aspect of God's creative activity would be accomplished). Further, these creative-aspect periods would be marked by three distinct stages: the beginning stage, the stage of essential fulfillment, and the completion stage. The beginning stage of each creative-aspect period would be marked by God's creative command, "Let there be!" These commands are recorded in Genesis 1:3, 1:6, 1:9, 1:11, 1:14-15, 1:20, 1:24, and 1:26. The stage of essential fulfillment, in which God's creative command began to achieve fulfillment, would be marked by the recognition, by God, that His handiwork was good. These appraisals of the value of God's handiwork toward the accomplishment of His eternal Plan and Purpose are recorded in

Genesis 1:4, 1:10, 1:12, 1:18, 1:21, 1:25 and 1:31. I propose that the first six *YOM*s coincide with six stages of essential fulfillment in six distinct creative-aspect periods The completion stages of the creative-aspect periods are not generally marked, in Scripture, by a special notation. The reason for this may become apparent in facts which we have yet to consider.

To summarize my proposal, then, I propose that the first six *YOM*s fail within six creative-aspect periods of indefinite length, and that they coincide, not with the beginning stage or the completion stage, but with the stage of essential fulfillment in each creative-aspect period.

Second, as to the duration of each *YOM*, I propose that the light-darkness separation factor, the day-night oscillation factor, and the evening-morning pattern factor all combine to point to a literal day; i.e., a period during which the earth makes one full rotation upon its axis.

Combining the two parts of this proposal concerning the *YOM*s of Genesis 1-2, we thus far define a *YOM* as a literal day which marks the stage of essential fulfillment in each of six creative-aspect periods of indefinite length. In this scheme, these Creation *YOM*s are separated from one another by indefinite, sometimes vast periods of time.

4. The chronological relationship of the Creative events of Genesis 1-2 to the geological and paleontological records

The conceptual structure which I have proposed is that of a series of creative-aspect periods, some of which partially overlap in time, and all of which are marked by a beginning stage, a stage of essential fulfillment, and a completion stage. In all of these creative-aspect periods (except the first), the stage of essential fulfillment falls upon a particular literal day, which is numbered. In the total configuration, the seven Days of Genesis 1-2 are arranged in numerical order 1, 2, 3, 4, 5, 6, 7.

The arrangement of the fourteen creative events enumerated earlier is as follows. The Ex Nihilo Creation of primal matter, the Mediate Creation of the structured universe, and the Mediate Creation of our Milky Way Galaxy all fail into a Pre-Day I creative-aspect period. The Mediate Creation of our solar system falls into a second creative-aspect period, which culminates in Day 1. The Mediate Creation of the atmosphere falls within a third creative-aspect period, which culminates in Day II. The Mediate Creation of dry land and the immediate Creation of land plants fail into a fourth creative-aspect period, which reaches its stage of essential fulfillment in Day III, and continues through Day VI. The Mediate Creation of the appearance, from the earth, of sun, moon, and stars falls into the fifth creative-aspect period, which culminates in Day IV. The immediate Creation of aquatic animals and of birds falls into the sixth creative-aspect period, which attains its stage of essential fulfillment in Day V, and continues through Day VI.

THE UNIFIED CREATIONIST VIEW

Part One Three Meanings of the term "Creation

EX NIHILO CREATION -- The bringing Into being of that which did not (either in its substance or its form) previously exist.
IMMEDIATE CREATION -- The bringing into being of that which did not (in its form) previously exist, employing previously-existing substance but not secondary causes.
MEDIATE CREATION -- The bringing into being of that which did not (in its form) previously exist, employing both previously-existing substance and secondary causes.

Part Two: A Proposed Structuring of the Creative Events of Genesis 1-2

Creative Period	Creation Day	Creative Event	Reference
1st	Pre-I	(1) EX NIHILO CREATION of primal matter-energy	1:1
		(2) MEDIATE CREATION of the structured universe	1:1
		(3) MEDIATE CREATION of our Milky Way Galaxy	1:1
2nd	Day I	(4) MEDIATE CREATION of our solar system (thus light, and thus day and night)	1:2-5
3rd	Day II	(5) MEDIATE CREATION of earth's atmosphere, and the subsequent separation of water above the surface of earth from water covering earth's surface	1:6-8
4th	Day III	(6) MEDIATE CREATION of dry land, by the structuring of earth's surface into lands and seas	1:9-10
		(7) IMMEDIATE CREATION of land plants begins	1:11-13
5th	Day IV	(8) MEDIATE CREATION of the appearance of sun, moon, and stars in the sky (as viewed from earth)	1:14-19
6th	Day V	(9) IMMEDIATE CREATION of aquatic animals and of birds begins	1:20-23
7th	Day VI	(10) IMMEDIATE CREATION of terrestrial animals begins	1:24-25
		(11) IMMEDIATE CREATION of the Garden of Eden	2:8
		(12) EX NIHILO CREATION of Man's soul,	1:26-27
		IMMEDIATE CREATION of Man's body	2:7
		(13) EX NIHILO CREATION of Woman's soul,	1:27
		IMMEDIATE CREATION of Woman's body	2:19-23
---	Day VII	(14) Cessation of IMMEDIATE CREATION; MEDIATE CREATION continues to the present	2:1-3

The immediate Creation of terrestrial animals, the immediate Creation of the Garden of Eden, and the *Ex Nihilo* Creations of Adam and Eve's souls together with the immediate Creations of their bodies all fall within the seventh creative-aspect period, which culminates in Day VII. Day VII then initiates the period of the cessation of *Ex Nihilo* and immediate Creation.

But how does this conceptual structure correlate with the combined records of astrophysics, geology, and paleontology? First of all, on the basis of astrophysics, we postulate a pre-earth period of time which stretches back to the Ex Nihilo Creation of primal matter. This pre-earth period would correlate with our Pre-Day I creative-aspect period. Day I would then fall near the beginning of the Precambrian, and Day II farther on in the early Precambrian. Day III would fall in the later Precambrian, and Day IV near the close of the Precambrian. The sixth creative-aspect period would then begin with the palenontologic record in the Cambrian, and Day V would correlate with the Jurassic Period of the Mesozoic Era. The seventh creative-aspect period would begin in the Silurian Period of the Paleozoic, and Day VI would fall in the Quaternary Period of the Cenozoic Era. Day VII would then begin after the appearance of man upon the earth, during the Pleistocene Epoch of the Quaternary Period. This conceptual structure can no doubt be grasped with greater ease if seen in the Diagram of One Possible Structuring of the Creation Days and the Creative Events of Genesis 1 & 2, noting especially the correlation with geology and paleontology.

5. A proposed synthesis of the record of the rocks and the record of Scripture

The record of the rocks provides us with the relevant data of General Revelation; the record of Scripture provides us with the relevant data of Special Revelation.

What does the record of the rocks tell us? For a competent and unbiased (unbiased, i.e., in favor of Creationism!) summary of that record, let us note the words of the "Dean of American Paleontologists," George Gaylord Simpson. In his book, *The Major Features of Evolution* Simpson writes:

> The record already acquired is amazingly good. It provides us with many detailed examples of a great variety of evolutionary phenomena on lower and intermediate levels and with rather abundant data that can be used either by controlled extrapolation or on a statistical sampling basis for inferences as to phenomena on all levels up to the highest. Among the examples are many in which, beyond the slightest doubt, a species or a genus has been gradually transformed into another. Such gradual transformation is also fairly well exemplified for subfamilies and occasionally for

DIAGRAM OF ONE POSSIBLE STRUCTURING OF THE CREATION DAYS AND THE CREATIVE EVENTS OF GENESIS 1 & 2

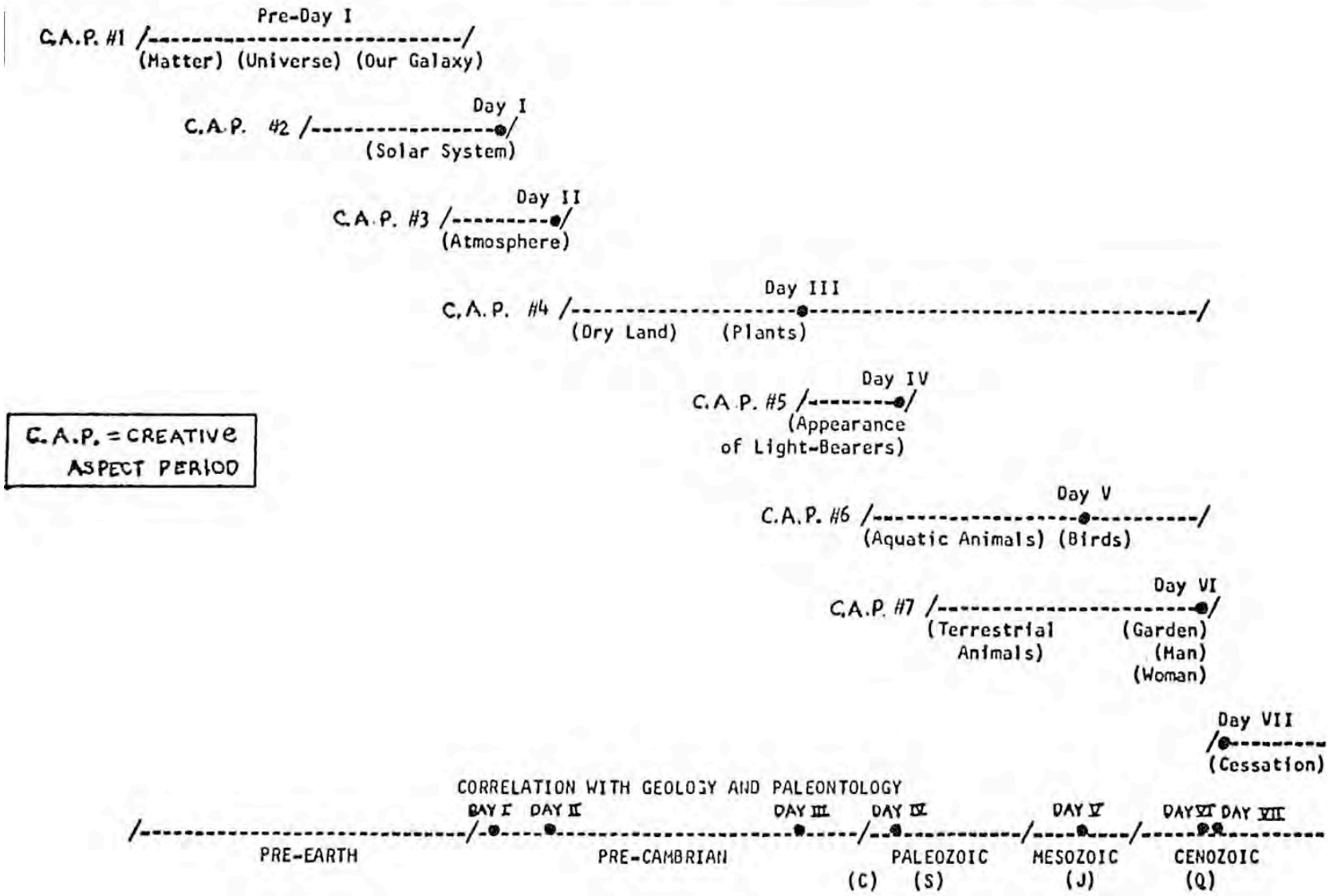
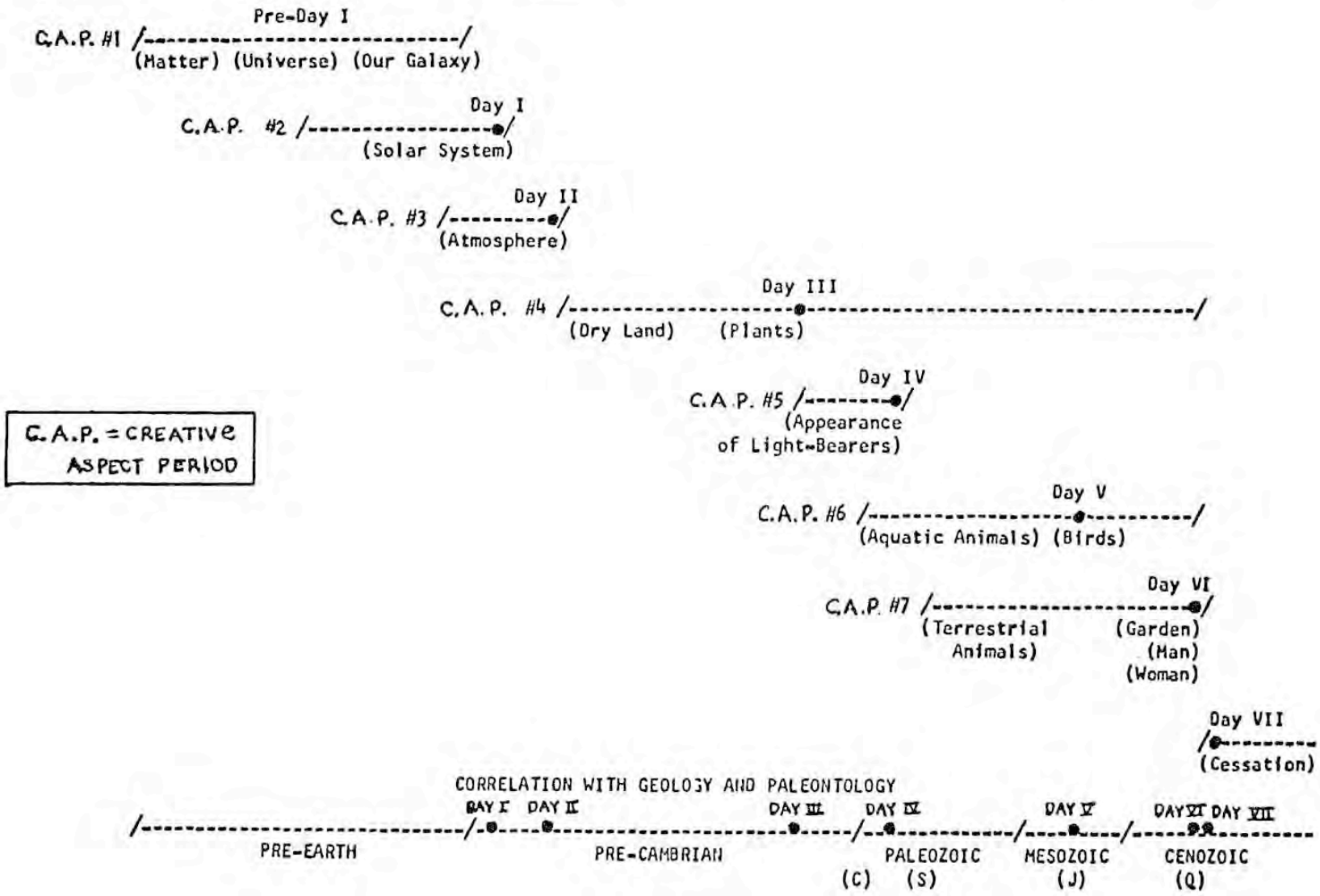


DIAGRAM OF ONE POSSIBLE STRUCTURING OF THE CREATION DAYS AND THE CREATIVE EVENTS OF GENESIS 1 & 2



> families, as the groups are commonly ranked . . . In spite of these examples, it remains true, as every paleontologist knows, that most new species, genera, and families and that nearly all new categories above the level of families appear in the record suddenly and are not led up to by known gradual, completely continuous transitional sequences.
>
> George Gaylord Simpson, *The Major Features of Evolution* (New York: Columbia University Press, 1961), pp. 359-360.

It is important to realize What Simpson is saying. Gradual transformations leading to new species, new genera, some new subfamilies, and occasionally new families are witnessed to by the record of the rocks. However, most new species, genera, and families appear quite suddenly; i.e., the record of the rocks is absent of ancestors from whom they could have descended. Moreover, practically all new orders, classes, and phyla appear quite suddenly; i.e., without ancestors. How are these systematic deficiencies, these discontinuities, these gaps in the fossil record to be overcome? Simpson says that this can be done by extrapolation and inference from what we are able to see on lower levels to what we are not able to find on higher levels. To say that such an explanation of the systematic gaps in the record of the rocks, especially on the higher levels, is quite unsatisfactory, is to utter a gross understatement! But how then can these gaps be explained?

I would propose that the record of the rocks is a natural record of God's creative activity. I would further propose that the reason that most new species, genera, and families, and practically all new orders, classes and phyla appear quite suddenly in the fossil record is that these appearances represent separate creative acts of God in the bringing into existence of new "kinds" of plants and animals. I would still further propose that these distinct creations of new "kinds" of plants and animals be synthesized with the chronological framework previously presented.

The chronological framework for the correlation of the creative events and the Creation Days of Genesis 1-2 consisted of seven creative-aspect periods, some of which overlapped in time, and all of which were marked by a beginning stage, a stage of essential fulfillment, and a completion stage. In each of the creative-aspect periods from the second to the seventh the stage of essential fulfillment coincided with a specific literal day. These were the six Creation Days of Genesis I.

in synthesizing the concept of distinct creations of new "kinds" of plants and animals with this chronological framework, as well as with geologic and paleontologic history, I would propose the following:

(1) That the Immediate Creation of various "kinds" of plants be placed at various intervals In the fourth creative-aspect period, beginning in the later Precambrian and continuing through the Tertiary Period of the Cenozoic Era.

(2) That the Immediate Creation of various "kinds" of aquatic animals be placed at intervals in the sixth creative-aspect period, beginning near or at the inception of the Cambrian Period of the Paleozoic Era and continuing through the Tertiary Period of the Cenozoic Era.

(3) That the Immediate Creation of various "kinds" of birds be placed at intervals in the sixth creative-aspect period, beginning in the Jurassic Period of the Mesozoic Era and continuing through the Tertiary Period of the Cenozoic Era.

(4) That the immediate Creation of various "kinds" of terrestrial animals be placed at varying intervals during the seventh creative-aspect period, beginning in the Silurian Period of the Paleozoic Era and continuing through the Tertiary Period of the Cenozoic Era.

(5) That the *Ex Nihilo* Creation of man's soul and the Immediate Creation of man's body be placed at the close of the seventh creative-aspect period somewhere in the Quaternary Period of the Cenozoic Era.

Thus, by combining the conceptual structure of our proposed chronological framework for the events of Genesis 1-2 with the conception of creation at varying intervals of all the various "kinds' of plants, animals, and man in the world, we arrive at a synthesis of the relevant biblical and scientific data.

THE END