CHANGE IN SPECIES--IS EVOLUTION TRUE?

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There is abundant evidence to show that species change. But how much change is possible? Evolutionists hold that changes have accumulated over time, starting with simple one-celled organisms and eventually producing the variety of organisms seen today. The Bible teaches that God created a diversity of organisms in the beginning, not by changes in previously living organisms, but by His creative power. The Bible briefly mentions that changes would occur, both in plants and in animals (Gen. 3:14, 18), but it does not discuss how much change is possible.

1. Evidences for Change in Species

a. *Variation among individuals of a species.* No two individuals are identical in every detail. Certain characteristics seem particularly variable, such as size, color and relative proportions of appendages. Less obvious traits that often are significantly variable include amino acid sequences of enzymes, chromosomal structure, behavioral patterns, and ecological tolerances. Closely related species often appear to differ primarily by these traits, and it seems clear that such species do share a common ancestry. However, such differences would probably not be used to distinguish different genera of vertebrates. Vertebrate genera are typically distinguished by differences in shape.

b. *Variation under artificial selection.* Numerous breeds of domestic animals and plants have been developed. Many varieties of dogs are known, differing in many characteristics, including shape of the skull. Differences in size and proportion among breeds of dogs are as great as those among some genera of wild canids (Wayne 1986). Thus it seems likely that species different enough to be classified in different genera could have a common ancestry. Numerous other examples of domesticated species with many varieties are known, but none of them show differences significantly greater than those seen among breeds of dogs.

c. *Degenerative change.* Many species of animals in isolated environments have lost some genetic information. Loss of flight is one common example. Many species of flightless rails (marsh hens) are known from remote islands (Diamond 1981), although most rails are able to fly. The flightless cormorant of the Galapagos islands is classified in a separate genus. Other organs may also be subject to degeneration. Blind cave fish from the eastern United States have lost the ability to see. Certain lizards and salamanders have only two virtually useless legs, and some have no legs at all. Examples of degeneration among vertebrates commonly result in their classification in separate species or genera. Many parasites also appear to be degenerate, but analysis of degree of change is difficult when no intermediate forms are known. Spiny-headed worms, for example, are classed in a separate animal phylum. Such examples illustrate that one cannot describe natural limits to change purely by the level of taxonomic category.

d. *Biogeographic distribution.* Patterns of distribution of species on islands and continents suggest that considerable change may have occurred since creation. Certain families of birds, such as the Hawaiian finches and the West Indian todies, are found only on islands. Numerous families, and even some orders of mammals are endemic to regions of the earth remote from Mt. Ararat (see Gibson 1989). Examples include the rodents, monkeys, opossums and edentates of South America, the lemurs of Madagascar, and the monotremes and marsupials of Australia. The edentates represent a distinct order, and the monotremes a separate subclass of mammals. These facts suggest that changes might have occurred sufficient to justify establishment of new families or even higher categories, but no mechanism is known to explain how such changes could have occurred, and the evidence for such changes is only circumstantial.

2. What is Evolution?

The term evolution has been used with several different meanings. This has been the cause of considerable confusion in discussions of evolution. Depending on the mind of the speaker, evolution may mean changes in gene frequencies (without any need for changes in the genes themselves), changes in the genes themselves (whether or not they make any difference to the organism), diversification by morphological modification,

morphological specialization, or development of new organs and systems (Campbell 1987). Because of differences in the validity of these concepts, I will briefly discuss some of the meanings of evolution.

a. *Evolution as change in gene frequencies.* In a simple sense, evolution means change, and any change can be considered to be evolution. One definition of evolution is that evolution is a change in gene frequencies in a population. Since changes in gene frequencies in a population have been observed (e.g., Zimmerman 1988), there can be no doubt that evolution, in this sense, is true. Several factors may cause the frequencies of genes in a population to change, such as a change in environment that favors different gene combinations, a reduction in population size that eliminates certain genes by chance, or the chance failure of some rare genes to be passed on to the next generation.

Evolution as change in gene frequencies can be called microevolution. Microevolution is the kind of evolution seen within a species or population, and is the basis for nearly all quantitative discussions of evolution. However, many biologists believe that the kind of evolution being described is trivial, and does not explain how the present diversity of organisms have come into being (e.g., Miklos and John 1987). Creationists sometimes use microevolution to refer to any kind of change they think has happened, and macroevolution to refer to any kind of change they think has not happened, but these are not good definitions, and contribute to the confusion over the meaning of evolution.

b. *Evolution as diversification by change in body proportions.* The kinds of differences separating species within a genus are typically of the same general sort as seen within a species. But species in different genera typically differ from each other in some morphological way, often involving a difference in shape (Lemen and Freeman 1984). Differences in shape may be due to differences in proportions of certain anatomical parts. The kind of change producing new shapes is morphological evolution. Evidence from artificial selection and other, more circumstantial evidence, suggest that morphological evolution does occur.

The Hawaiian honeycreepers (or finches) provide an example of diversification involving change of body proportions. The honeycreepers are a group of more than 20 species of birds, classified in several genera of a single family. They vary a great deal in the shape and size of the beak, and in color. Some species have long curved beaks, other species have short parrot-like beaks, and many species with beaks of intermediate shapes are known. However, in their internal structure the species are very similar, and it does appear that they share a common ancestry.

Some important points are illustrated by the Hawaiian honeycreepers. First, the differences between the species are primarily external, and relatively minor. It is as though some traits, such as beak shape and plumage color, are quite variable, while other traits, such as the structure and internal arrangement of the organs, are essentially fixed. Another point is that the species seem to be evolutionary dead ends. Many honeycreeper species have already become extinct, and others are nearly extinct. The reason for this may be that the ancestral gene pool was fragmented during the process of speciation (Lester and Bohlin 1984:144). If so, each species may have reduced genetic variability and be less able to adapt to changes in the environment, resulting in habitat specialization. The honeycreepers apparently have been able to survive because competition is low and predators are few.

Differences among species of Hawaiian honeycreepers are greater than those ordinarily seen within a species. However, if one compares the diversity of honeycreepers with the results of artificial selection in dogs, it seems that such changes are possible, even in a relatively short time. Changes of this magnitude might account for the variety of species seen in well-defined families of mammals such as dogs, bears, cats, horses, etc. Diversification by change in proportions would probably be accepted by both creationists and evolutionists. However, evolutionists consider this kind of change to be macroevolution, and creationists hesitate to accept that term.

c. *Evolution as change in body plan.* Species of mammals from different orders are typically distinguished by differences in internal structure or arrangement of parts, although the parts themselves may be anatomically equivalent. Often these differences involve the shape and construction of the skull, the number and types of teeth and their arrangement in the jaws, and the positional relationships of the bones of the feet and legs.
As an example, consider a dog and a rabbit. A dog has long canine teeth and a specialized pair of shearing cheek teeth, while a rabbit has no canines and its molars have broad grinding surfaces. Other differences include

diet, behavior and style of locomotion. There are no fossils linking dogs and rabbits, and it is difficult to see how the differences between dogs and rabbits could be bridged by intermediate forms. This problem becomes much more severe when one considers the differences among such groups as bats, whales and primates.

The internal parts of an organism all interact in a harmonious way to promote survival. A change in one structure will require changes in other structures, which will in turn require changes in other structures. Because of this interrelationship of parts, it is difficult to see how a lineage could survive a significant modification of its body plan. Biologists have not been able to propose any plausible mechanism to explain how such changes could come about. Much of the current debate among evolutionists stems from dissatisfaction of developmental biologists with known genetic mechanisms of change as described by population geneticists. But here we speak largely from ignorance, since we know very little about how morphology is produced.

Evolution by modification of body plan could be called megaevolution. At the present time, the evidence does not provide adequate support for megaevolution, and creationists will tend to reject the possibility of its occurrence. In this, they will be in direct disagreement with evolutionists. However, one should be cautious in this area, pending future discoveries in developmental genetics. Until we better understand the process by which morphology is produced, we will not know how difficult or how easy it may be to modify the positional relationships of organs.

d. *Evolution as an increase in complexity.* The general theory of evolution holds that life started in a simple form, and has diversified and become increasingly complex over time. In order for this theory to be true, evolution must include the development of new organs and systems. It is the requirement for the generation of new organs that makes the evolutionary theory seem so implausible. One can observe variations in populations, and it is plausible they could lead to diversification. Even though evolution by modification of body plan seems unlikely, one might be able to imagine that it could happen. But it is difficult to even imagine how a lineage could increase in complexity.

There are several reasons why it seems totally unreasonable to think that living things could have increased in morphological complexity by evolution. First of all, such a result is contrary to all experience. Nobody has ever observed such an event in any living system. Instead, natural processes tend toward loss of complexity. Evolutionists recognize the tendency toward loss of complexity when they explain that traits tend to be lost unless they are selected for. If life naturally tended toward increasing complexity, selection would not be required to preserve it.

A second reason that increasing complexity in evolution seems impossible is that organs are complex, and have a complex genetic basis, but organs cannot function unless they are complete. How does a species go about evolving a leg? What about a heart, a feather or an eye? The list is virtually endless. Not only must a new organ be complete, it must work in harmony with other organs. What advantage would an eye be if one could see an enemy approaching but there were no nervous connections to produce a response? The chances of favorable mutations producing even one tiny part of a new organ are infinitesimal. To expect a multitude of new parts to arise simultaneously and fit together is to believe in miracles, and explanations requiring miracles are what evolutionists wish to avoid.

Finally, evolutionary increase in complexity is implausible because of the nature of the genetic mechanism. Genetic information is stored in the DNA. Changes in DNA would result in changes in information. But DNA changes are believed to occur randomly. It is not reasonable to believe that random changes could result in an increase in information. One does not increase the information in a textbook by randomly changing or adding letters, or even words or sentences, in the book. The more biologists learn about the mechanisms of genetics, the less believable such a process becomes.

On the issue of evolution by increase in complexity, creationists are in a good position. The scientific evidence is against evolutionary theory on this point. Scientists are becoming increasingly concerned about this problem, and have made several different suggestions in response. One common suggestion is that the process of evolution has been supernaturally directed. The study of supernatural processes is outside the realm of science, and such questions should be answered from the scriptures.

3. Rates of evolution

a. *The process of speciation*. Biological change is believed by many biologists to occur in two stages: reproductive isolation and genetic divergence. Two populations are reproductively isolated if they do not exchange genes under natural conditions. Biological factors that prevent interbreeding are known as reproductive barriers. Examples of reproductive barriers include differences in anatomy, behavior, chromosomes, development and immunology (see Mayr 1970). Geographic isolation is not in itself a biological factor, but it does prevent gene exchange, and it facilitates the formation of reproductive barriers. When two populations become reproductively isolated, speciation has occurred, and a new species has been produced.

After two populations are isolated, the next stage, genetic divergence, can occur. Genetic divergence may be due to differences in selective responses to environmental conditions or to accidental differences in gene frequencies between the two populations. Genetic divergence can occur without the need for new genes, because all populations have considerable unexpressed genetic variation.

b. *Time requirements for speciation*. Speciation is achieved by the formation of reproductive barriers. The amount of time required for speciation depends on the particular situation. Several kinds of reproductive barriers exist, each requiring different conditions and a different time framework for its establishment. However, both experimental evidence (Dobzhansky and Pavlovsky 1973) and observations of natural populations (see below) suggest that speciation does not require extremely long periods of time.

Numerous examples of speciation during or since the Pleistocene have been postulated, especially among fish (e.g., Miller 1950, Myers 1960). Speciation in desert pupfish (Miller 1950) seems to have involved genetic loss, producing differences sufficient to establish different genera. There is no reason to think genetic loss would require many generations, and speciation of desert pupfish could have been accomplished rapidly. Several species of Hawaiian moths appear to have arisen in less than 1000 years (Zimmerman 1960). How much less time is required is not known, but thirty years seems to have been sufficient for speciation producing the Salton Sea copepod (Johnson 1953). Five generations may be enough time for significant phenotypic changes to be brought about by natural selection (Carson 1987).

c. *Conditions that promote speciation*. Speciation seems to be facilitated by certain environmental factors, and the rate of speciation will be influenced by the nature of these factors. The most important of these environmental factors seem to be: small population size, geographic isolation and a changing environment.

Rapid changes are more likely to occur in small populations than in large ones. One reason for this is that a new mutant gene can spread through a small population more rapidly than through a large population. Also, a small population may, by chance, have a combination of genes that was rare in the large population or in the previous generation. Such a population may be genetically different from the parent population in a single generation. Small populations may be formed by chance dispersal, or by a small number of individuals surviving an environmental catastrophe. The more often small populations are formed, the greater the likelihood of rapid change.

Geographic isolation may promote rapid speciation by preventing a small population from interbreeding with other populations of a species. This promotes the possibility of rapid change in small populations as described above. Another way in which geographic isolation may promote rapid change is by reducing competition. Populations are normally composed of individuals that are well adapted for their environment. Aberrant individuals are generally eliminated by competition. If competition is reduced, aberrant individuals may survive. If these aberrant individuals can survive for several generations, a new species may be formed. Rapid genetic changes seem to be promoted by geographic isolation combined with reduced competition.

Another condition that promotes rapid speciation is environmental change. In a stable environment, competition eliminates variant individuals. If the environment changes, the basis for competition will likely also change, and different gene combinations may be favored. Of course if a species cannot change as rapidly as the environment changes, the species will become extinct in that environment. But if the environmental change is less severe, a species may change in a handful of generations.

Oceanic islands provide the three conditions discussed above that seem to promote speciation. Oceanic islands are isolated, and populations that are established on islands will probably be unable to exchange genes with mainland populations. Since islands are generally small, island populations will tend to be small. Island environments often differ from those on the mainland. Islands usually have fewer species, and this often means less competition. These factors may explain why islands often show interesting patterns of speciation. Oceanic islands are not the only kind of isolated habitats. Lakes act like islands as far as fish are concerned, and mountain forests surrounded by desert may act like islands for small mammals.

d. *Speciation and the flood.* It is difficult to imagine a more effective way of providing conditions favorable for rapid speciation than a worldwide flood. Most organisms were destroyed by this catastrophe, leaving small populations of survivors.

Terrestrial vertebrates were saved in the ark in small numbers. After they were released from the ark, they found almost unlimited resources available, making possible rapid increases in population size, together with reduced levels of competition. Environmental conditions would be unstable as geological and climatic processes brought the earth toward a new state of equilibrium. Geological processes such as volcanoes, earthquakes and isostatic changes would affect climate, create and remove barriers to dispersal, and produce many smaller catastrophes that would tend to isolate populations of dispersing species. The earth's climate would be rapidly changing as inland seas dried up, and new patterns of oceanic and atmospheric currents were becoming established.

Those species which were preserved outside the ark would also be subjected to conditions favorable for speciation. Aquatic organisms would be moved about by currents, possibly resulting in dispersal of small groups of survivors to many isolated places with different environmental conditions. The same could happen to terrestrial groups such as insects, earthworms, and other invertebrates. Plants would also be tossed about by the waters and dispersed by currents. These conditions would likely result in rapid speciation within many groups of organisms.

e. *Mechanisms of rapid change in species.* The most likely mechanism for rapid change may be genetic loss. Genes may be lost by chance in small populations, as described previously. If a population with a high degree of genetic variability were subdivided by a catastrophe into many small populations in different environments, many new species might be produced. Each population produced by the catastrophe would have a unique set of gene combinations and a unique set of environmental influences acting in natural selection, and could become a new species.

Another cause of genetic loss might be mildly harmful mutations occurring in populations that are isolated from competition. Competition and natural selection tend to eliminate individuals that have lost genetic information. If predators are absent, potential competitors are rare, and food and space are plentiful, an organism may survive in the face of considerable genetic loss. Thus blind fish may be able to survive in caves, where the loss of sight makes little difference. Small, flightless birds are generally unable to survive except on islands or on remote, isolated lakes.

It appears that genetic variability increases during times of environmental change. Environmental stress seems to increase the rate of recombination (Parsons 1988) as well as the activity of movable elements, causing an increase in mutation rates (Parsons 1987). Both these processes could rapidly increase phenotypic variability, permitting rapid change, especially in a changing environment. Mutation mediated by movable elements would probably not be a truly random process, because the insertion of movable elements into the genome depends on the DNA sequence. Movable elements might also be able to transfer genes between species (Appleby et al. 1983, Ginzburg et al. 1984, Jeppson 1986).

Evolutionists often assert that evolutionary change comes about when new information produced by random mutations is acted on by natural selection. But neither random mutation nor selection is a suitable mechanism for generating new information. The only two genes known which are believed to have arisen new by mutation turned out to be the same, indicating the mutation that caused them was not random (Opadia-Kadima 1987). Mutations are likely to be corrected by genetic repair mechanisms, and those not repaired are likely to result in loss of information.

Natural selection cannot create new information, but can only preserve old information. The inability of natural selection to cause morphological evolution can be seen by the fact that members of a species appear similar, regardless of the environment in which they live, and by the fact that speciation seems to occur most readily in environments where competition is weak, not where it is strong.

4. Summary and Conclusions

a. *Weakness of the evolutionary model.* The term evolution is used with a variety of meanings. There can be little doubt that evolution of gene frequencies and evolution by diversification due to changes in body proportions are valid processes. In these senses, evolution is true, and virtually all examples of evolution presented in the literature are of one of these types. On the other hand, evidence for evolution by change in body plan is unconvincing. It is difficult to envision a process whereby this could be achieved, except possibly by reducing complexity through loss of information.

In its more general sense, evolution requires that complexity has increased with time. This kind of evolution is certainly false. There is no plausible mechanism whereby complexity can increase naturally. Mutation and natural selection can modify information but they cannot create new information. There is no reasonable theoretical basis for the maintenance of partially formed incipient organs. There are no substantiated examples of evolution in this sense. There is sufficient evidence against such a theory that its survival can only be attributed to a refusal to accept alternatives.

b. *Evidence for limits to change.* Conditions needed for rapid changes in species would have occurred at the end of the flood, but it is not clear how much species have actually changed. Species tend to occur in groups of similar species, separated from each other by significant morphological gaps. Especially at the family level or higher, the gaps are not bridged by either living or fossil species. This pattern is not consistent with evolutionary theory, which demands ancestor-descendent relationships, with bridges connecting all living and extinct species in a single phylogenetic tree. However, the pattern is consistent with a creationary origin, with many separate, unrelated lineages, each of which may have produced variations in different geographic regions.

The lack of a satisfactory genetic mechanism for major morphological evolution justifies a conservative approach to the question. The failure of artificial selection to produce new kinds of organisms raises doubts about the possibility of such changes. Even if large changes have occurred, there is no evidence that changes have led to an increase in complexity as maintained by evolutionists. It seems likely that most changes have come about by recombination and by subdividing the genetic variability present in the ancestral species, generally resulting in a loss of vigor and adaptability.

c. *Conclusion.* The possibility of change in species should not surprise creationists. Misunderstanding of the term "after his kind" in Genesis has led some to suppose that animals could not change significantly, but a more careful reading shows that the text is actually stating that God created many kinds of organisms in one day of creation. The term says nothing about whether they can or cannot change. To the contrary, Genesis plainly states that changes would occur (Gen. 3:14, 18), and Paul wrote that the whole creation "groans with pain" (Rom. 8:22 TEV) as the result of sin.

We may not understand everything written about creation in Genesis, but some things are clearly taught. The scriptures state that God spoke and it was done. He did not use long periods of time to change simple animals into more complex ones. The original creation was perfect, and of great variety. The entrance of sin into the world brought about changes that were not in accordance with God's will, but which He was prepared to meet. It is reassuring to realize that God made provision for living organisms to survive despite the changes caused by sin, and that mankind is the object of His greatest care and concern.

Literature cited

Appleby, C. A., J. D. Tjepkema, and M. J. Trinick. 1983. Hemoglobin in a nonleguminous plant, *Parasponia*: a possible genetic origin and function in nitrogen fixation. Science 220:951-953.

Campbell, J. H. 1987. The new gene and its evolution. Pp. 283-310 in (K. S. W. Campbell and M. F. Day, eds.) Rates of evolution. Allen and Unwin. London.

Carson, H. L. 1987. Population genetics, evolutionary rates and Neo-darwinism. Pp. 209-217 in (K. S. W. Campbell and M. F. Day, eds.) Rates of evolution. Allen and Unwin. London.

Diamond, J. M. 1981. Flightlessness and fear of flying in island species. Nature 293:507-508.

Dobzhansky, T. and O. Pavlovsky. 1971. Experimentally created incipient species of *Drosophila*. Nature 230:289-292.

Gibson, L. J. 1989. Patterns of mammalian distribution. Unpublished manuscript.

Ginzburg, L. R., P. M. Bingham, and S. Yoo. 1984. On the theory of speciation induced by transposable elements. Genetics 107:331-341.

Jeppson, L. 1986. A possible mechanism in convergent evolution. Paleobiology 12:80-88.

Johnson, M. W. 1953. The copepod *Cyclops dimorphus* Kiefer from the Salton Sea. American Midland Naturalist 49:188-192.

Lemen, C. A. and P. W. Freeman. 1984. The genus: a macroevolutionary problem. Evolution 38:1219-1237.

Lester, L. P., and R. G. Bohlin. 1984. The natural limits to biological change. Zondervan, Grand Rapids, Mich.

Mayr, E. 1970. Populations, species, and evolution. Belknap Press, Cambridge, Mass.

Miklos, G. L. G. and B. John. 1987. From genome to phenotype. Pp. 263-282 in (K. S. W. Campbell and M. F. Day, eds.) Rates of evolution. Allen and Unwin. London.

Miller, R. R. 1950. Speciation in fishes of the genera *Cyprinodon* and *Empetrichthys*, inhabiting the Death Valley region. Evolution 4:155-163.

Myers, G. S. 1960. The endemic fish fauna of Lake Lanao, and the evolution of higher taxonomic categories. Evolution 14:323-333.

Opadia-Kadima, G. Z. 1987. How the slot machine led biologists astray. Journal of Theoretical Biology 124:127-135.

Parsons, P. A. 1987. Evolutionary rates under environmental stress. Evolutionary Biology 21:311-347.

Parsons, P. A. 1988. Evolutionary rates: effects of stress upon recombination. Biological Journal of the Linnaean Society 35:49-68.

Wayne, R. K. 1986. Cranial morphology of domestic and wild canids: the influence of development on morphological change. Evolution 40:243-261.

Zimmerman, E. C. 1960. Possible evidence of rapid evolution in Hawaiian moths. Evolution 14:137-138.

Zimmerman, E. G. 1988. Temporal genetic variation in a population of the pocket gopher, *Geomys bursarius*. Genetica 76:153-159.

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