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PERPETUATION OF THE RECAPITULATION MYTH*

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Recapitulation, or the biogenetic "law" is shown to be held in disrepute by many biologists. Evidences from embryology as well as logical implications of the "law" if it were true are used to show that recapitulation cannot be a valid biological principle. Quotations from several modern textbooks are given to illustrate that some biologists are unwilling to reject ***in toto*** *the views of Haeckel, in spite of evidence to the contrary. In fact, many authors continue to refer to fishlike gill slits in mammalian embryos, thereby perpetuating the myth of recapitulation.*

Introduction

Occasionally a grossly mistaken concept is perpetuated as "evidence" for macro-evolution, especially in popular literature and even in some textbooks and journals. While many individuals may be aware of the situation, little effort is directed toward purging the literature of the misconception. Such seems to be the case with the myth of recapitulation.

Also known as the biogenetic "law,"[1] the theory of recapitulation was promulgated in the late 1800's by the biologist Haeckel. The essence of his concept was that ontogeny recapitulates phylogeny. That is, "each embryo in its development passes through abbreviated stages that more or less resemble some developmental stage of its evolutionary ancestors, both remote and immediate."[2]

Haeckel's views amounted to an adulteration of the concepts proposed by von Baer in 1824. von Baer's first two conclusions indicated that in the development of a vertebrate embryo, there is an early stage at which it could be recognized as a vertebrate, but it was impossible to distinguish what kind of a vertebrate it was (e.g., reptile, bird or mammal).[3] At a later stage it may be recognized supposedly as a bird, for instance, but it cannot be determined what kind of a bird it is. von Baer's last two conclusions express the concept that animals are more similar at early stages of development than when they are fully grown, and these similarities are diminished as the animals mature.[3]

Oppenheimer, a well-known embryologist, stated that the work of Haeckel was the "culmination" of the "extremes of exaggeration" which followed Darwin.[4] She further declared that Haeckel's influence was "damaging to science."[5] Later she continued:

> The investigators [e.g., Haeckel] who have derived their ideas from the philosophical side, and examined their embryos to fit their observations into philosophical patterns already set and rigid . . . were the minds whose philosophical patterns delayed rather than accelerated the course of embryological progress.[6]

A few contemporaries of Haeckel refused to accept the biogenetic "law." von Baer himself warned against comparing "embryos of 'higher' forms to adults of 'lower' forms."[7] Rádl mentioned that "everything important that has ever been cited against the recapitulation theory was known when the theory was first put forward; nevertheless it was widely accepted."[8]

According to Oppenheimer, "Haeckel's doctrines" were blindly and uncritically accepted not only by workers in the many related fields of biology, but aso by "professional embryologists."[9] She then categorized Haeckel as a "fanatic" who never could be considered to have been a "professional embrylogist."[10]

*A condensed version of this paper has appeared eslewhere.

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Fallacies Exposed upon Examination

The recapitulation theory has been examined thoroughly by embryologists and other serious scholars. Weisz declared that "Haeckel's basic thesis is invalid."[11] de Beer flatly concluded that "Recapitulation . . . does not take place."[12] In an excellent review, Rusch showed that "Haeckel resorted to a series of dishonest distortions in making his illustrations" which he used to support his theory.[13] Other authors have dealt in great detail on the many shortcomings and fallacies of the theory.[14, 15, 16, 17]

Probably one of the most widespread of the recapitulation fallacies concerns the fact that at a particular stage of development, the human embryo possesses (as do the embryos of many mammals) structures which superficially resemble the gills of fish. These embryonic features, erroneously referred to as "gill pouches" or "gill slits," are then said to "repeat or recapitulate a fish stage in our evolution."[18]

However, this is most certainly not the case. It is true that a series of five alternating ridges and grooves are present in mammalian embryos in approximately the same region as the gill bars of aquatic vertebrates such as fish. In fish these grooves open into the pharynx, forming the true gill slits through which water passes for respiration. In mammals, birds and reptiles, however, these structures **never** function in respiration, nor are there ever any openings into the pharynx.[19, 20] Moreover, in mammals these pharyngeal bars (as they are more properly termed) begin immediately to undergo further development.

> For example, the first arch and its pouch [i.e., groove] . . . form the upper and lower jaws and inner ear of higher vertebrates. The second, third and fourth arches contribute to the tongue, tonsils, parathyroid gland, and thymus.[21]

None of these structures, it may be noted, are associated with respiration. Thus, the use of the biogenetic "law" to support the fish ancestry of mammals and other non-aquatic vertebrates has no basis in fact.

Additional support for the evolutionary scheme of fish-amphibians-reptiles-mammals is often claimed by comparing the embryonic development of the mammalian heart with the differences between the fully developed hearts of fish, amphibians and mammals. The fish heart consists of a single tube with one atrium and one ventricle; the frog heart is a partially double tube, with two atria and one ventricle; and the mammalian heart is a completely double tube having two atria and two ventricles.[22]

Recapitulation, then, would require the heart of the embryo to begin as a single tube. While the embryonic heart of the mammal does progress from a single tube with two chambers to a double tube with four chambers, it *begins* as a double tube which fuses to form a single tube before it undergoes further changes to become the heart.[23] Once again embryology is shown to be contradictory to the biogenetic "law."

Embryonic Growth Not "Evolutionary"

The fallaciousness of the recapitulation theory can be further illustrated by other examples in which characteristics appear in ontogeny out of order of their supposed evolutionary development. de Beer stated that while teeth are supposed to have evolved before tongues, tongues of mammalian embryos appear before teeth.[24] As also pointed out by de Beer, Pavlov demonstrated that in the fossil cephalopods known as ammonites, the young stages often foreshadow later evolutionary developments, rather than recapitulating past development.[25]

Another instance of reversed order is that the embryonic skeleton in mammals is first cartilaginous, being replaced by bone later.[26] The opposite sequence should be found according to evolutionary speculation. Thus, it can be seen that a reversed order is often exhibited by embryology, rather than the order in which various structures supposedly evolved.

A logical extension of Haeckel's "law" would have to allow for the existence of the caterpillar as a fully developed organism, for which there is no evidence.[27] In 1925, using the same type of reasoning, Gregory made this cutting observation:

> . . . if the biogenetic law were universally valid, it would seem legitimate to infer that the adult common ancestor of man and apes was a peculiar hermaphroditic animal, that it subsisted exclusively upon its mother's milk, and that at an earlier phylogenetic period the adult ancestor was attached to its parent by an umbilical cord.[28]

It is true that the embryos of many vertebrates (e.g., man, fish, bird, pig) are similar in the early stages of development. However, could not most of these similarities be accounted for by the fact that there are also likenesses between the adults of these species? For example, they all have jaws, skull, backbone, four appendages, etc.[29]

Thus, it is evident that undue emphasis is placed on certain similarities between embryos of different species, or on certain unique developmental stages; while differences between embryos, out-of-sequence stages, or embryological structures with no apparent function in ancestral stages are ignored or explained away. Furthermore, the biogenetic "law" cannot be applied to the plant kingdom.[30]

If there is to be any semblance of validity in recapitulation, it is obvious that many stages of "evolution" have been deleted and the "evolutionary" history as revealed by the embryo has been greatly condensed. However, reasons as to why this should be the case are not apparent.

Textbook Authors Commit Errors

As pointed out by Oppenheimer in 1955, "the record of many of our 'modern' textbooks is none too pure with respect to the biogenetic law."[31] Bock has made the following observation:

> . . . the biogenetic law has become so deeply rooted in biological thought that it cannot be weeded out in spite of its having been demonstrated to be wrong by numerous subsequent scholars. Even today both subtle and overt uses of the biogenetic law are frequently encountered in the general biological literature as well as in more specialized evolutionary and systematic studies.[32]

For instance, a little book for youngsters, copyrighted in 1958 and still available, contains the following statement: "Mammals and birds go through stages with gill pouches—first like fish, then like reptiles."[33] A typical spurious illustration is included.

In a recent high school biology textbook by Frazier and Smith, the following passage may be found:

> Although man is essentially a land animal, he still retains some of the features of his developmental history. . . . The human embryo resembles a fish embryo at first, It *has gill slits*, blood vessels passing through the gill bars, a fishlike heart with one atrium and one ventricle, a primitive kidney, and a tail. A little later in development the human embryo comes to resemble a reptilian embryo. The *gill slits become closed* and the blood vessels in the gill region become modified . . . the heart contains three chambers. Still later, the heart contains four chambers.[34] (Emphasis added)

Further evidence of the perpetuation of the gill slit myth is afforded by two additional examples. In a recent letter-to-the-editor in a local newspaper, the writer suggested that the presence of gill slits in the human embryo may be used by some individuals as evidence that the embryo is not yet human, thus justifying abortion.[35] The famous Dr. Benjamin Spock, in one of his books, contributed to the continuance of the recapitulation myth:

> Each child as he develops is retracing the whole history of mankind, physically and spiritually, step by step. A baby starts off in the womb as a single tiny cell, just the way the first living thing appeared in the ocean. Weeks later, as he lies in the amniotic fluid of the womb, *he has gills like a fish.*[36] (Emphasis added)

Baldwin, in his book on comparative biochemistry, makes the following statement:

> The mammals, for instance, had fish-like ancestors, and early in its development the mammalian embryo *actually possesses gill slits like those of a fish.* . . .[37] (Emphasis added)

In view of the evidence presented previously, these quotations from Frazier and Smith, Spock and Baldwin are clearly erroneous and misleading. The perpetuation of such untruth, in the light of modern embryology, is truly incomprehensible.

In most of the more recent college textbooks which I have examined, the authors are careful to avoid a direct adherence to Haeckel's concepts, yet they do not divorce themselves entirely from his basic premise. For instance, Weisz stated that "recapitulation in the Haeckelian sense simply does not occur; the embryonic stages of given animals do not repeat the adult stages of other animals."[38] Yet, he then claimed that since these "similarities . . . are consequences of common ancestors, they may indicate degrees of evolutionary interrelationships among animals."[39]

Hickman and Hickman stated that "we can scarcely believe that mammalian embryos retrace vertebrate evolutionary history. . . ."[40] Yet a few lines earlier they wrote:

> . . . similarities can only be explained as an indication of common vertebrate ancestory. Embryonic development is thus a record, although a considerably modified one, of evolutionary history.[41]

Nason cautioned that "In some instances the sequence of events in the ontogeny of a body part is the reverse of its known phylogenetic history."[42] But on the preceding page we find the following:

> Such evidence [gill pouches] clearly implies that terrestrial vertebrates have evolved from aquatic forms with functional gills. . . . In certain respects, ontogeny during the embryonic state reflects or repeats phylogeny in a modified way.[43]

The differences between what these authors actually accept and what Haeckel taught are not at all clear; but the desired implication (i.e., evolution) remains the same. If any differences do exist, they are so slight as to be insignificant insofar as the influence of these misconceptions on young minds is concerned.

Haeckel's concepts were actually twofold. First, " 'ontogeny recapitulates phylogeny' "; and second, " 'phylogeny causes ontogeny'."[44] While most modern authors have rejected the second concept, the first seems to be too deeply imbedded

in evolutionary thinking to be uprooted. Even the world-famous geneticist Dobzhansky clings tenaciously to this doctrine when he writes:

> This co-called biogenetic law is no longer credited in its original form. And yet embryonic similarities are undeniably impressive and significant. . . . But why should it [human embryo] have *unmistakable gill slits* unless its remote ancestors did respire with the aid of gills?[45] (Emphasis added)

In spite of the fact that no functional gills ever exist in the mammalian embryo (which Dobzhansky[46] and others readily admit) and that these pharyngeal bars develop into structures having nothing to do with respiration, these men continue to refer to these ridges and grooves as "gill slits" or "gill arches." And, while denying that recapitulation occurs, they boldly state that these arches clearly demonstrate man's aquatic origin. In spite of the fact that the sequence of events in embryological development is often the reverse of that assumed for evolution, the authors continue unjustifiably to inject "evolutionary" significance into embryology.

Conclusions

It is my feeling that many of today's scientists are guilty of the same crime as Haeckel; i.e., "fitting the facts to the theory."[47] This error likely results from a "blind acceptance of the evolution-doctrine,"[48] as Oppenheimer accused Haeckel.

It seems that having first assumed evolution to have occurred, the data are interpreted to fit the assumption. By circular reasoning, embryological data are then cited as evidence for evolution. Emphasis is placed on certain selected structures or sequences of development which fit evolutionary dogma; while dissimilarities and reversed sequences are ignored.

I am in agreement with the geneticist Tinkle who succinctly declared, "Science should consider *all* the facts."[49]

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