

# ANNOTATIONS FROM THE LITERATURE

## EVOLUTION

Nilsson D-E, Pelger S. 1994. A pessimistic estimate of the time required for an eye to evolve. *Proceedings of the Royal Society of London B* 256:53-58.

*Summary.* The origin of the vertebrate eye has been a conundrum for evolutionary biologists ever since Darwin. Nilsson and Pelger tackled the problem with a computer simulation in which the starting point is a flat patch of light-sensitive, pigmented epithelium. They then proceeded to cause the shape of the patch to vary by “mutations” of 1%, followed by “selection” of the most functional shape. Each step in the process was called a “generation.” They counted the number of “generations” required for the flat patch on the computer screen to change to the shape of the vertebrate eye. Along the way, they introduced a variation in refractive index, which eventually “developed” into a “lens.” The number of “generations” required to effect the change from a flat patch of photosensitive cells to a vertebrate eye with functional lens was calculated as about 364,000.

*Comment.* This report was received approvingly by Richard Dawkins (*Nature* 368:690-691). Various types of eyes are present in at least 40 independent “lineages,” which Dawkins believes shows that evolution of the eye cannot be terribly difficult. Nevertheless, both Dawkins and the authors of the report note that the model does not take certain features into consideration, such as the origins of the photosensitive patch of cells, the variable iris, or variable focusing. Perhaps analysis of these features will be forthcoming.

What is one to make of all this? First, comparing the evolution of the eye to shape changes on a computer screen seems rather far-fetched. The entire project seems closer to an exercise in geometry than in biology. Second, the exercise assumes a functional starting point. Thus it has nothing to do with the origin of the biochemical systems of vision or the requisite neural network. Third, Nilsson and Pelger’s computer exercise operates as if each 1% change in morphology can be accounted for by a single gene mutation. They do

not consider the effects of pleiotropy, genetic background, or developmental processes. Fourth, an important part of the model relies on the special circumstance of a layer of clear cells covering the “retina.” This layer somehow assumes the proper shape of a lens. Fifth, as noted by the authors, several features of the eye remain unaccounted for, such as the iris. Basically, the only result achieved was to show that two light-sensitive surfaces that differ in shape by 1% will have different efficiencies in photoreception, and that an uninterrupted series of 1% improvements is possible. The failure of scientists to produce new structures in selection experiments illustrates the implausibility of Nilsson and Pelger’s “just so” story.

Patterson C, Williams DM, Humphries CJ. 1993. Congruence between molecular and morphological phylogenies. *Annual Review of Ecology and Systematics* 24:153-188.

**Summary.** In 1987, Colin Patterson edited a book entitled “Molecules and morphology in evolution: conflict or compromise?” The general sense of the book was that evolutionary phylogenies based on molecular sequence were often different from those based on morphology. The present paper is a reassessment of the situation. Patterson et al. consider studies from the period 1987-1992, including both plants and animals, but not unicellular organisms, which lack sufficient morphological characters for a useful comparison.

**Comment.** Most of the discussion focuses on higher taxonomic categories, above the level of family. The degree of congruence between molecular and morphological phylogenies seems no better than reported previously in the 1987 book. Few taxonomic groups give completely consistent phylogenies when different methods are used. Disagreement seems to increase as more taxa are added, more characters are considered, and at higher taxonomic levels. Molecular phylogenies are as likely to disagree with each other as are morphological phylogenies. Typically, when all trees within 1% of the shortest tree are combined into a consensus tree, there is little structure left. The authors’ concluding statement suggests pessimism that evolutionists will ever be able to produce a single acceptable tree of relationships for all living organisms.

## GENETICS

Nowak R. 1994. Mining treasures from 'junk DNA.' *Science* 263:608-610.

**Summary.** The function of DNA has generally been seen as the production of proteins. Yet it appears that only a small proportion, thought to be perhaps 3%, of the DNA actually codes for proteins. What is the function of the rest of the DNA? Clearly, some DNA is involved in gene regulation, yet the function of a large proportion of the genome is still unknown. The apparent excess of DNA has been called "junk DNA."

Several explanations have been offered for the existence of "junk DNA": 1) it is largely parasite-like "selfish DNA"; 2) it is composed of "vestigial DNA" remaining from past evolutionary history; 3) it represents the evolutionary future, a kind of "lottery DNA" from which new genes may someday be produced.

**Comment.** Several types of "junk DNA" sequences have been described. Among these are introns, satellites, 3' untranslated regions, short and long interspersed elements, and pseudogenes. As knowledge of the genome has progressed, the proportion of "junk DNA" has decreased. For example, many introns appear to code for "small nucleolar RNAs," which might play a part in ribosome assembly. Satellite DNA might play a role in holding the chromosome together, especially at its ends and at the centromere. Defects in minisatellite and microsatellite DNA have been associated with cancer. Long and short interspersed DNA might also be associated with disease. Although no function is known for most pseudogenes, some of them have been found to be functional.

The functioning of the genetic system is turning out to be much more complex than previously realized. The chromosomes are no longer regarded as a series of genes like beads on a string. Instead, each chromosome is more like a complex "information organelle," with a structural organization that is only beginning to be understood, and with a complex, dynamic system of feedback and control of gene expression.

## PALEONTOLOGY

Fortelius M, Kappelman J. 1993. The largest land mammal ever imagined. *Zoological Journal of the Linnean Society* 107:85-101.

**Summary.** It has been said that the largest mammal that ever lived was an extinct giant rhinoceros-like animal named *Indricotherium* (or “*Baluchitherium*”). Estimates of its weight have ranged as high as 30 tons. This estimate has been revised down to an average of 11 tons, with a maximum of less than 20 tons. Although *Indricotherium* is truly a giant, it is little or no larger than the largest known fossil elephants.

## SCIENCE AND RELIGION

Yang S-H. 1993. Radiocarbon dating and American evangelical Christians. *Perspectives on Science and Christian Faith* 45:229-240.

**Summary.** The development of radiocarbon dating presented young-earth creationists with a challenge to their understanding of the age of Earth. Yang outlines the reactions of four different creationist groups: Seventh-day Adventists (SDAs), the American Scientific Affiliation (ASA), the Creation Research Society (CRS), and the Institute for Creation Research (ICR). All four groups publish journals that discuss issues in creation and evolution.

**Comment.** In 1958 SDAs established the Geoscience Research Institute (GRI) for the purpose of studying issues raised by science. Some SDA scholars challenged the church’s position of a recent creation, but the issue was too fundamental to the church’s doctrinal structure to permit the church to accommodate such a change. The GRI maintains a position that includes a recent creation and a worldwide flood. The ASA became more sympathetic to the concept of an old earth, members variously adopting such explanations as the “gap theory” (pre-Adamic creation and destruction) and the “day-age” theory (each creation day represents an indefinite period of time). Dissident members of the ASA formed their own groups, the CRS in 1963 and the ICR in 1972. The ICR has established its own radiocarbon laboratory in an effort to test the assumptions of the carbon-14 dating method. Yang mentions specific individuals and describes their respective positions, but does not attempt to evaluate the positions taken by the various organizations.