

POLICY STATEMENTS

On Evolution

A statement by The Society of Vertebrate Paleontology

The fossil record of vertebrates unequivocally supports the hypothesis that vertebrates have evolved through time, from their first records in the early Paleozoic Era about 500 million years ago to the great diversity we see in the world today. The hypothesis has been strengthened by so many independent observations of fossil sequences that it has come to be regarded as a confirmed fact, as certain as the drift of continents through time or the lawful operation of gravity.

Paleontology relies for its evidence on two different but historically related fields, biology and geology. Evolution is the central organizing principle of biology, understood as descent with modification. Evolution is equally basic to geology, because the patterns of rock formations, geomorphology, and fossil distributions in the world make no sense without the underlying process of change through time. Sometimes this change has been gradual, and sometimes it has been characterized by violent upheaval. These processes can be seen on the Earth today in the forms of earthquakes, volcanoes, and other tectonic phenomena. Vertebrates have also evolved at a variety of rates, some apparently gradual, and some apparently rapidly. Although the fossil record is not complete, and our knowledge of evolution will always be less than entire, the evidence for the progressive replacement of fossil forms has been adequate to support the theory of evolution for over 150 years, well before genetic mechanisms of evolutionary change were understood. Paleontologists may dispute, on the basis of the available evidence, the tempo and mode of evolution in a particular group at a particular time, but they do not argue about whether evolution took place: that is a fact.

The fossil record has long been seen as a search for "ancestors" of living forms and of other fossil forms. Some fossil vertebrates appear to have no features that debar them from ancestry to other groups, and so could be seen as potential ancestors. Nevertheless, paleontologists do not focus on a search for direct ancestors, but rather look for sets of evolutionarily derived characters that are shared by fossil taxa that can then be linked as each other's closest known relatives. Proceeding in this way, paleontologists have clarified in recent years a great many mysteries about the origins and interrelationships of major groups of vertebrates, including birds, dinosaurs and their relatives, lizards and snakes, Mesozoic marine reptiles, turtles, mammals and their relatives, amphibians, the first tetrapods, and many groups of fishes. At the same time, techniques of geologic dating, including magnetostratigraphy, radiometric dating of many different isotopes of common elements, lithostratigraphy, and biostratigraphy, have provided independent lines of evidence for determining age relationships of the sediments in which fossils are found. This evidence from the principles and techniques of chemistry and physics support the finds of paleontology based on paleobiological and geological analyses, making the theory of evolution the only robust scientific explanation for the patterns of life on Earth.

Evolution is fundamental to the teaching of good biology and geology, and the vertebrate fossil record is an excellent set of examples of the patterns and processes of evolution through time. We therefore urge the teaching of evolution as the only possible reflection of our science. Any attempt to compromise the patterns and processes of evolution in science education, to treat them as less than robust explanations, or to admit "alternative" explanations not relying upon sound evolutionary observations and theory, misrepresents the state of our science and does a disservice to the public. Textbooks and other instructional materials should not indulge in such misrepresentation, educators should shun such materials for classroom use, and teachers should not be harassed or impeded from teaching vertebrate

evolution as it is understood by its practitioners. The record of vertebrate evolution is exciting, inspirational, instructive, and enjoyable, and it is our view that everyone should have the opportunity and the privilege to understand it as paleontologists do.

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