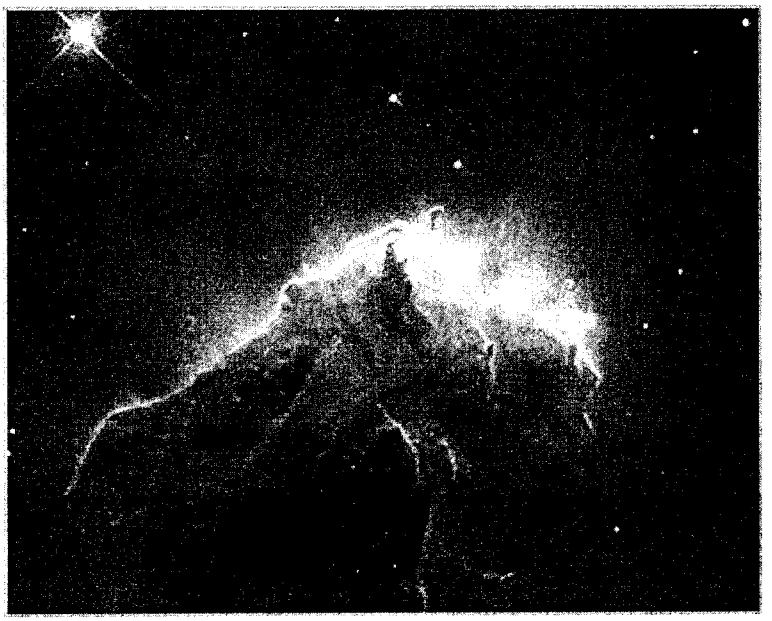
APPENDIX IV

TAB Z

Introduction

Science is a particular way of knowing about the world. In science, explanations are limited to those based on observations and experiments that can be substantiated by other scientists. Explanations that cannot be based on empirical evidence are not a part of science.



In the quest for understanding, science involves a great deal of careful observation that eventually produces an elaborate written description of the natural world. Scientists communicate their findings and conclusions to other scientists through publications, talks at conferences, hallway conversations, and many other means. Other scientists then test those ideas and build on preexisting work. In this way, the accuracy and sophistication of descriptions of the natural world tend to increase with time, as subsequent generations of scientists correct and extend the work done by their predecessors.

Progress in science consists of the development of better explanations for the causes of natural phenomena. Scientists never can be sure that a given explanation is complete and final. Some of the hypotheses advanced by scientists turn out to be incorrect when tested by further observations or experiments. Yet many scientific explanations have been so thoroughly tested and confirmed that they are held with great confidence.

The theory of evolution is one of these well-established explanations. An enormous amount of scientific investigation since the mid-19th century has converted early ideas about evolution proposed by Darwin and others into a strong and well-supported theory. Today, evolution is an extremely active field of research, with an abundance of new discoveries that are continually increasing our understanding of how evolution occurs.

This booklet considers the science that supports the theory of evolution, focusing on three categories of scientific evidence:

- Evidence for the origins of the universe, Earth, and life
- Evidence for biological evolution, including findings from paleontology, comparative anatomy, biogeography, embryology, and molecular biology
- Evidence for human evolution

At the end of each of these sections, the positions held by advocates of "creation science" are briefly presented and analyzed as well.

The theory of evolution has become the central unifying concept of biology and is a critical component of many related scientific disciplines. In contrast, the claims of creation science lack empirical support and cannot be meaningfully tested. These observations lead to two fundamental conclusions: the teaching of evolution should be an integral part of science instruction, and creation science is in fact not science and should not be presented as such in science classes.

Terms Used in Describing the Nature of Science*

Fact: In science, an observation that has been repeatedly confirmed and for all practical purposes is accepted as "true." Truth in science, however, is never final, and what is accepted as a fact today may be modified or even discarded tomorrow.

Hypothesis: A tentative statement about the natural world leading to deductions that can be tested. If the deductions are verified, the hypothesis is provisionally corroborated. If the deductions are incorrect, the original hypothesis is proved false and must be abandoned or modified. Hypotheses can be used to build more complex inferences and explanations.

Law: A descriptive generalization about how some aspect of the natural world behaves under stated circumstances.

Theory: In science, a well-substantiated explanation of some aspect of the natural world that can incorporate facts, laws, inferences, and tested hypotheses.

The contention that evolution should be taught as a "theory, not as a fact" confuses the common use of these words with the scientific use. In science, theories do not turn into facts through the accumulation of evidence. Rather, theories are the end points of science. They are understandings that develop from extensive observation, experimentation, and creative reflection. They incorporate a large body of scientific facts, laws, tested hypotheses, and logical inferences. In this sense, evolution is one of the strongest and most useful scientific theories we have.

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*Adapted from *Teaching About Evolution and the Nature of Science* by the National Academy of

Sciences (Washington, D.C.:
National Academy Press, 1998).