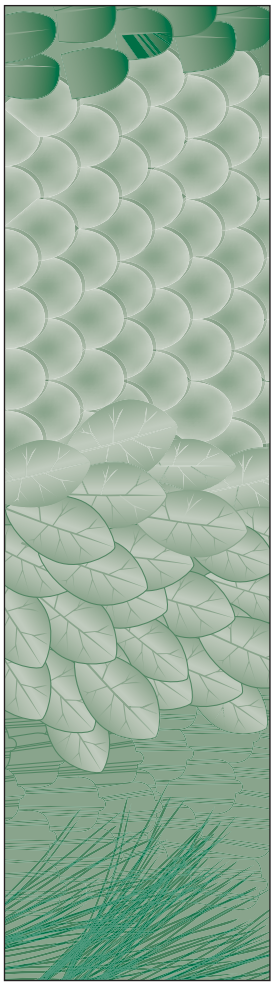
INTRODUCTION

Charting the Evolutionary History of Life

We are part of a tree of life that germinated at the dawn of evolutionary history and encompasses a vast diversity that we are only beginning to understand. Since the advent of molecular techniques for studying phylogenies, there has been active and sometimes acrimonious debate concerning the relative reliability and accuracy of the molecular and fossil records. These debates have involved not only questions of phylogenetic relationships but also the dating of the origins of the major branches of the tree. As more data accumulate from both sources, there are encouraging signs of rapprochement, as discussed by Benton and Ayala (p. 1698).



One of the most elusive nodes of the tree has been the origin of the eukaryotes. Molecular phylogenetic data have largely resolved the systematics of the eukaryotes, but, as Baldauf shows (p. 1703), the latest data are suggesting a radical reinterpretation of the position of the root of the eukaryote branch of the tree. This identity crisis has been further fueled by the recent discovery of ultrasmall eukaryotes.

But the question remains of how best to come up with phylogenies, particularly ones that link vast numbers of organisms. Indeed, just identifying all the species that constitute the twigs of this grand tree of life is a daunting task; even conservative estimates of the number of unknown species approach 4 million. A few enterprising researchers are coming up with ways to simplify and speed up this much-needed assessment of biodiversity. Others have pushed their colleagues into new ways of thinking about creating phylogenies, as they build ever-larger trees on their way to the one grand tree of life (see News story by Pennisi on p. 1692). A sketch of the tree of life itself is shown on p. 1694. Far from a final answer, it illustrates how complex a unified tree of life will be.

This cataloging of life is not an empty exercise, but one that has practical implications. At various points in evolutionary history, the tree of life has lost limbs in major extinction events. As humans wield the ax, Mace *et al*. (p. 1707) consider the consequences and discuss how phylogenies might help us assess the priorities for conservation. The cross-talk between evolution and genomics has been so fruitful for each field that a new field has emerged: "phylogenomics" (Eisen and Fraser, p. 1706), which is providing insights into areas so seemingly removed as the evolution of metabolic pathways (Chothia *et al*., p. 1701).

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