



Deep Time: a comprehensive phylogenetic tree of living and fossil angiosperms

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The angiosperms are the largest group of land plants, yet their origin and early diversification have long been enigmatic. However, extensive collaborations among systematists have clarified the major lineages of angiosperms and their relationships, and views of early angiosperm diversity have improved through the recent description of numerous fossils. Integrating these fossils into the tree of living taxa remains essential for understanding both the origin of extant angiosperms and the origins of morphological features. Such attempts at integration have been rare for any group of organism; there has been surprisingly little communication between paleobotanists and systematists. Deep Time seeks to facilitate, coordinate, and stimulate research at the interface of paleobotany, geology, and systematics/phylogenetics. We explore the ways in which angiosperm and other vascular plant fossils can be appropriately integrated into the phylogenetic framework for extant taxa, with the ultimate goal of forming a comprehensive phylogenetic tree of living and fossil angiosperms. We address five components focusing on flowering plants: (1) evaluation and prioritization of the fossil record; (2) critical appraisal of the age of fossils; (3) construction of a morphological data matrix for fossils and extant taxa; (4) integration of fossils into the phylogenetic analyses; and (5) calibration of divergence times. We conduct annual meetings, workshops, student travel awards, student research training awards, and website development. With the rapid developments in both angiosperm phylogenetics and paleobotany, the timing is appropriate for integration of these fields. The theory and methodology developed will be applicable to the integration of paleontology and neontology on a broader scale.