

techman / March 30, 2013 08:08PM

[\[Gnomic Biology\] Phylogeneticists Reaffirm that the Living Fossil, Ginkgo, and Cycads are Sister Groups in the Evolutionary Tree](#)

[Gnomic Biology] Phylogeneticists Reaffirm that the Living Fossil, Ginkgo, and Cycads are Sister Groups in the Evolutionary Tree ([Chinese Version](#))

Academia Sinica Newsletter (2013/02/27) Ginkgo (*Ginkgo biloba* L.) is the only living representative of a plant lineage that has existed for at least 270 million years. However, the evolutionary relationship of ginkgo to other living seed plants has long been controversial and highly debated. Six different placements have been proposed for ginkgo in relation to other divisions of non-flowering seed plants. Recently, a research team from the Biodiversity Research Center, Academia Sinica, using chloroplast phylogenomic studies and examining the reasons for discrepancies in previous classifications, has once again reported evidence that ginkgo and cycads are sister groups. Their research was published in the journal *Genome Biology and Evolution* on January 12, 2013.

Molecular phylogenetics is the study of evolutionary relationships between groups of organisms based on evidence from molecular sequencing data. Through data analyses, phylogenetic trees are established and organisms are grouped into several "clades". Organisms within a clade come from a common ancestor. There are several possible relationships between clades: nested (a clade within a larger clade), sisters (clades with an immediate common ancestor) or basal (if one clade branches off another before the establishment of the first member of a new clade).

Seed-bearing plants are classified into gymnosperms (or "naked" seed-bearing plants) and angiosperms (flowering plants with seeds inside fruits). Within the living gymnosperms, there are four divisions: cycads (Cycadophyta), ginkgo (Ginkgophyta), gnetophytes (Gnetophyta), and conifers (Pinophyta). Among these, the classification of ginkgo, which unprecedentedly has only one living member -- *G. biloba* -- has long been controversial.

The research team, led by Distinguished Research Fellow Shu-Miaw CHAW used analyses of chloroplast genomes to re-examine the position of ginkgo in the evolutionary tree of life. They constructed and analyzed the largest and most diverse gymnosperm chloroplast genome database to-date, including 25 gymnosperm chloroplast genomes, with 35,994 nucleotides or 11,998 amino acids, and carefully examined the reasons for discrepancies in previous classifications. They found that in the evolutionary trees inferred from the nucleotide sequences, the phylogenetic position of the ginkgo is significantly influenced by five factors: the breadth of the sampled species, evolutionary tree construction methods, codon sites (codon position), the position of gnetophytes, and whether or not gnetophytes are included in the data sets. Their analyses finally reaffirm that the ginkgo and cycads are sister groups.

In 1997 Dr. Shu-Miaw Chaw's group hypothesized that ginkgo and cycads were sister groups. This hypothesis, however, was based only on an analysis of the 18S ribosomal RNA gene sequences and has been questioned. It is hoped that the findings from the current study will help to quell the debate.

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Edited 1 time(s). Last edit at 03/30/2013 08:13PM by techman.
