

Novel Structure In South Pacific Plant May Be 'Missing Link' In Evolution Of Flowering Plants

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The Amborella plant. (Photo by Tom Lemieux)

A new University of Colorado at Boulder study involving a "living fossil plant" that has survived on Earth for 130 million years suggests its novel reproductive structure may be a "missing link" between flowering plants and their ancestors.

The Amborella plant, found in the rain forests of New Caledonia in the

South Pacific, has a unique way of forming eggs that may represent a critical link between the remarkably diverse flowering plants, known as angiosperms, and their yet-to-be-identified extinct ancestors, said CU-Boulder Professor William "Ned" Friedman. Angiosperms are thought to have diverged from gymnosperms -- the dominant land plants when dinosaurs reigned in the Cretaceous and Jurassic periods -- roughly 130 million years ago and have become the dominant plants on Earth today.

"One of the biggest challenges for evolutionary biologists is understanding how these flowering plants arose on Earth," said Friedman, a professor in CU-Boulder's ecology and evolutionary biology department, whose study appears in the May 18 issue of *Nature*. "The study shows that the structure that houses the egg in *Amborella* is different from every other flowering plant known, and may be the potential missing link between flowering plants and their progenitors."

In basic terms, *Amborella* has one extra sterile cell that accompanies the egg cell in the female part of its reproductive apparatus known as the embryo sac, according to the study. The discovery of the unique configuration of the egg apparatus, which is thought to be a relic of intense evolutionary activity in early angiosperm history, "is akin to finding a fossil amphibian with an extra leg," according to a May 18 *Nature* perspective piece accompanying Friedman's article.

The novel embryo sac described in *Nature* is the first new type of egg-bearing apparatus to be discovered in flowering plants in more than 50 years, according to Friedman. "The unique four-celled egg apparatus in *Amborella* could represent a critical link between angiosperms and gymnosperms," he wrote in *Nature*.

The study was funded by the National Science Foundation.

The origin and evolution of flowering plants has long confounded

scientists, he said. Nearly 130 years ago, Charles Darwin, known for developing the theory of natural selection, called the appearance of flowering plants "an abominable mystery."

The surprising new finding suggests flowering plants may have arisen on Earth during a time when plant evolution was "particularly flexible," Friedman said.

The peculiar egg-forming structure seen in *Amborella* may eventually link the odd South Pacific shrub to gymnosperms such as conifers, said Friedman. "We associate this structure with a relatively primitive reproductive process," he said.

Amborella is a small shrub with tiny greenish-yellow flowers and red fruit that grows only in the understory of New Caledonia rain forests. *Amborella* plants are unisexual, meaning they will produce either all male or all female flowers. Cross-pollination between plants is required for fruit production.

Plants used in the study were from both New Caledonia and from specimens cultivated in a CU-Boulder greenhouse. Friedman used a combination of laser, fluorescence and electron microscope techniques during the study.

"My research and teaching go hand in hand, and this is the kind of science that goes directly into the classroom," said Friedman, who oversees the work of six CU-Boulder undergraduates and graduate students. "The kinds of discoveries we make in the lab have a profound effect on the material taught in my courses."

Source: University of Colorado at Boulder

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