Amborella genome sequenced using material from UCSC Arboretum

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The flowers of Amborella, a plant endemic to the island of New Caledonia, have "primitive" features. Specimens were brought to the UCSC Arboretum in 1975. Credit: S. McCabe

The tropical shrub known as Amborella trichopoda is the duck-billed platypus of the plant world, the only survivor of the earliest branch on the family tree of flowering plants. Scientists have now decoded the complete genome of Amborella, yielding new insights into the evolution of flowering plants. The UCSC Arboretum played an important role in this work, providing plant material from its collections to key researchers working on the Amborella genome project over several

years.

Amborella was added to the collections at the UCSC Arboretum in its early years as part of a small collection of potential "primitive flowering plants." In 1975, under the guidance of founding director Ray Collett, two UCSC students, Virginia and Todd Keeler-Wolf, collected Amborella specimens in New Caledonia and shipped them back to the Arboretum. In the early 1980s, three other UCSC students—Betty O'Donnell, Jenny Wardrip (Keller), and Antje Pawlik—investigated Amborella as a possible link to ancient flowering plants in an undergraduate research project that was perhaps ahead of its time.

Charles Darwin called the sudden appearance of flowering plants in the fossil record an "abominable mystery." There is so little fossil evidence of early flowering plants that scientists were unable to penetrate this mystery until new molecular genetics technology enabled them to find clues in the DNA of living plants. In the late 1990s, researchers from other institutions studied DNA from Amborella and a wide range of other plants and determined that Amborella is the "most primitive" of living flowering plants. At that time, the UCSC Arboretum was the only source of Amborella specimen material in the United States.

More recently, the Amborella Genome Group used plant material from the Arboretum and material from other institutions to sequence the complete genome (all of the plant's genetic code). They found that, in addition to being the sister group to all flowering plants, Amborella has incorporated genetic material from green algae, mosses, and other flowering plants into its mitochondrial DNA. The Arboretum shared plant material with several researchers responsible for this work, including Claude de Pamphilis at Pennsylvania State University and Douglas and Pamela Soltis and Sangtae Kim at the University of Florida.

Since the original research story broke in 1999, Amborella has been

featured in most college biology textbooks along with staff photos of the Arboretum's plants. Part of the NOVA television special "First Flower" was filmed at the Arboretum. Photos of the plants by Arboretum staff have also appeared in planetarium shows about life on Earth at the California Academy of Sciences and the National Botanic Garden, and in a widely reprinted *Science* article on the origin of flowering plants.

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