Shrub genome reveals secrets of flower power

***Amborella* sequence might help to explain why flowering plants conquered Earth.**

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A shrub with cream-coloured flowers that is the closest living descendant of Earth's first flowering plants has had its genome decoded. The sequence of *Amborella trichopoda* hints at the genetic adaptations that helped flowers to emerge and conquer the world some 160 million years ago — an evolutionary explosion described by Charles Darwin as an "abominable mystery".

Nearly everything about *Amborella* is fodder for a botanist's pub quiz. It grows natively in 18 known spots on the New Caledonian island of Grande Terre in the South Pacific, and nowhere else on Earth. The plant's reproductive structures are encased in tepals — a hybrid between petals and leaf-like support structures called sepals.

Amborella is the only species in its genus, family and order. "Phylogenetically, it's really the equivalent of the duck-billed platypus and monotremes," says Claude dePamphilis, a plant evolutionary biologist at Pennsylvania State University in University Park, who co-led researchers on the *Amborella* Genome Project. The fruits of their labour are published in three papers in *Science* today[1–3].

Just as the platypus genome yielded insights into the emergence of mammals, *Amborella*'s gives a glimpse at changes that helped flowering plants, or angiosperms, to diversify from a common ancestor with gymnosperms — another major plant lineage, which includes conifer trees such as spruces.

Sangtee Kim

The plant *Amborella* is found natively only in New Caledonia.

Double trouble

Comparisons of the genomes of *Amborella* and those of other plants suggest that an early ancestor of flowering plants gained a duplicate copy of its genome, a feature known as polyploidy. Many angiosperms are known to be polyploid — potatoes, for instance, have between two and six copies of each chromosome. But the duplication in *Amborella* predates all the other polyploids, says dePamphilis, who led a team in 2011 that inferred this ancient duplication from more limited genetic data[4].

The duplication may have spurred the diversification and expansion of flowering plants by providing an extra copy of each gene for evolution to play around with to yield new functions, dePamphilis suggests.

The origin of flowers — the defining features of angiosperms — might be explained by a collection of genes that appeared when angiosperms split from gymnosperms, analysis of the *Amborella* genome reveals. About one-quarter of the genes involved in flowering lack obvious counterparts in the genomes of gymnosperms, whereas the other three-quarters existed in the common ancestor of both plant lineages. His team's analysis also provides insight into the evolution of complex seeds, floral scents and other features of flowering plants.

Keith Adams, a plant molecular geneticist at the University of British Columbia in Vancouver, Canada, thinks the idea that a genome duplication helped flowering plants to diversify is "an intriguing hypothesis — although it's impossible to prove". Botanists studying other plants should find the *Amborella* genome useful as a reference point to identify and study families of genes in other plants, including crops, he says.

DePamphilis' team also surveyed the genetic diversity of *Amborella*, identifying four distinct populations on Grande Terre. The plant may have once been distributed more extensively across New Caledonia and beyond, and conservation efforts should focus on maintaining the diversity that remains, says DePamphilis. "It's a very special plant."

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References

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