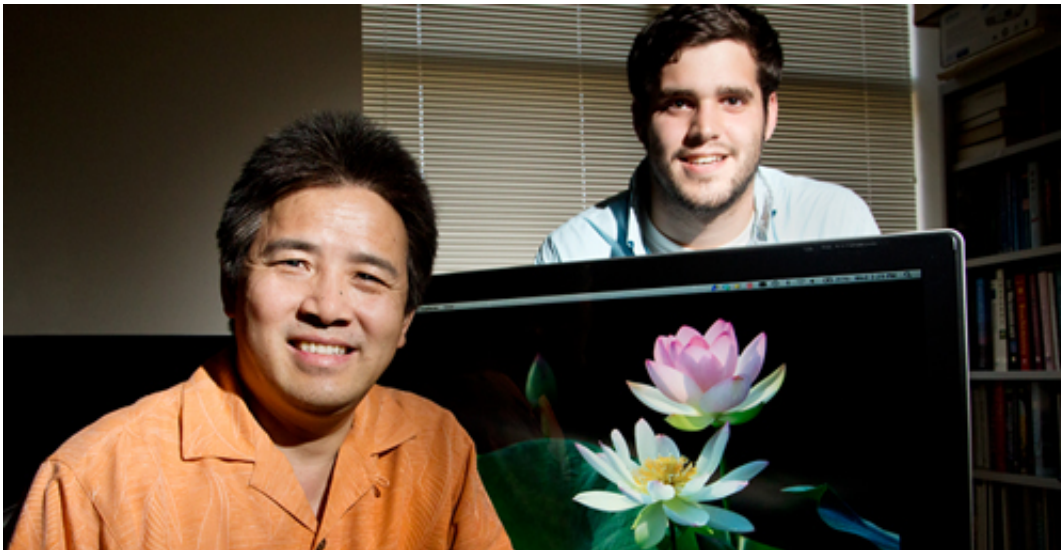


# Sacred lotus genome sequence enlightens scientists

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University of Illinois plant biology professor Ray Ming (left), graduate student Robert VanBuren and their colleagues sequenced the sacred lotus genome.  
Credit: L. Brian Stauffer

The sacred lotus (*Nelumbo nucifera*) is a symbol of spiritual purity and longevity. Its seeds can survive up to 1,300 years, its petals and leaves repel grime and water, and its flowers generate heat to attract pollinators.

Now researchers report in the journal *Genome Biology* that they have sequenced the lotus genome, and the results offer insight into the heart of some of its mysteries. The sequence reveals that of all the [plants](#) sequenced so far – and there are dozens – sacred lotus bears the closest

resemblance to the ancestor of all eudicots, a broad category of [flowering plants](#) that includes apple, cabbage, cactus, coffee, cotton, grape, melon, peanut, poplar, soybean, sunflower, tobacco and tomato.

The plant lineage that includes the sacred lotus forms a separate branch of the eudicot family tree, and so lacks a signature triplication of the genome seen in most other members of this family, said University of Illinois [plant biology](#) and Institute for Genomic Biology professor Ray Ming, who led the analysis with Jane Shen-Miller, a plant and biology professor at the University of California at Los Angeles (who germinated a 1,300-year-old sacred lotus seed); and Shaohua Li, director of the Wuhan Botanical Garden at the [Chinese Academy of Sciences](#).

"Whole-genome duplications – the doubling, tripling (or more) of an organism's entire genetic endowment – are an important events in [plant evolution](#)," Ming said. Some of the duplicated genes retain their original structure and function, and so produce more of a given [gene product](#) – a protein, for example, he said. Some gradually adapt new forms to take on new functions. If those changes are beneficial, the genes persist; if they're harmful, they disappear from the genome.

Many [agricultural crops](#) benefit from genome duplications, including banana, papaya, sugarcane, strawberry, watermelon and wheat, said Robert VanBuren, a graduate student in Ming's lab and collaborator on the study.

Although it lacks the 100 million-year-old triplication of its genome seen in most other eudicots, sacred lotus experienced a separate, whole-genome duplication about 65 million years ago, the researchers found. A large proportion of the duplicated genes (about 40 percent) have been retained, they report.

"A neat thing about the duplication is that we can look at the genes that

were retained and see if they are in specific pathways," VanBuren said. The researchers found evidence that duplicated genes related to wax formation (which allows the plant to repel water and remain clean) and survival in a mineral-starved watery habitat were retained, for example.

By looking at changes in the duplicated genes, the researchers found that lotus has a slow mutation rate relative to other plants, Ming said. These traits make lotus an ideal reference plant for the study of other eudicots, the researchers said.

**More information:** "Genome of the Long-Living Sacred Lotus (Nelumbo nucifera Gaertn.),"  
[genomebiology.com/2013/14/5/R41/abstract](https://genomebiology.com/2013/14/5/R41/abstract)

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