

DNA duplication: A mechanism for 'survival of the fittest'

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VIB researchers connected to Ghent University, Belgium, have discovered that DNA duplications have given plants an evolutionary advantage. This mechanism enabled plants -- in contrast to the dinosaurs -- to survive the Cretaceous-Tertiary mass extinction of 65 million years ago. With the aid of the latest bioinformatics technologies, the researchers have been able to closely estimate the timing of known DNA duplications in a number of plant species.

Some 65 million years ago, the earth's most recent 'mass extinction' took place. One or more catastrophic events - such as a comet strike or increased [volcanic activity](#) - produced widespread fires and clouds of dust and smoke that obstructed sunlight for a long period of time. These adverse conditions killed off about 60% of the [plant species](#) and numerous animals, including the [dinosaurs](#). Only the most well-adapted [plants](#) and animals were able to survive this [mass extinction](#) - but what is 'most well-adapted'?

Jeffrey Fawcett, Steven Maere and Yves Van de Peer (VIB-UGent) have been working as bioinformatics specialists to decode various plant genomes - the complete content of a plant's DNA - ranging from small weeds to tomatoes and rice to trees. Time and again, they have been confronted with the fact that, over the course of the history of these plants, their entire DNA was duplicated one or more times. By means of sophisticated research techniques, they have dated these duplications as closely as possible.

Yves Van de Peer's group then noticed that the most recent duplications occurred at approximately the same time in all of the plants. But, in terms of evolution, 'the same time' is relative: the DNA duplications occurred between 40 and 80 million years ago. So, the bioinformaticians worked to refine the dating. Thanks to their expertise in comparative genome studies and their extensive database, they were able to make a very precise dating of the duplications on the basis of standard evolution trees. This indicated that, in all of the plants under study, the most recent genome duplication occurred some 65 million years ago - thus, at the time of the last mass extinction.

From these results, the VIB researchers concluded that plants with a duplicated genome were apparently the 'most well-adapted' for survival in the dramatically changed environment. Normally, in unaltered circumstances, duplications of DNA are disadvantageous. In fact, they cause very pronounced properties that are not desired in an unaltered environment. However, in radically changed circumstances, these very properties can make the organism better adapted to the new climate.

In previous research, Yves Van de Peer had discovered very old genome duplications in early ancestors of vertebrates and fish. At that time, he showed that these duplications were probably crucial for the development of vertebrates and thus of human beings as well. So, genome duplication is probably a universal mechanism that has ensured that the role of our planet's vertebrates and flowering plants has become much greater over time.

Source: VIB (the Flanders Institute for Biotechnology)

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