



Press Release - Science

Ghent - 20 March 2009

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

Ghent - 150 years after Darwin published his theory of evolution, VIB researchers connected to Ghent University 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. The doubling of their DNA made these plants the 'fittest' for surviving the altered climatic conditions, a mechanism that is probably also found in vertebrates.

The end of an era

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'?

A role for DNA duplication?

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.

A universal mechanism

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.



Relevant scientific publications

This research appears in the authoritative journal *PNAS* (Fawcett *et al.*, Plants with double genomes might have had a better chance to survive the Cretaceous-Tertiary extinction event). You can find the publication on <http://www.eurekalert.org/jrnls/pnas/subject.htm>.

Other relevant publications:

Blomme, T., Vandepoele, K., De Bodt, S., Simillion, C., Maere, S., Van de Peer, Y. (2006)

The gain and loss of genes during 600 million years of vertebrate evolution. *Genome Biology* 7, R43.

De Bodt, S., Maere, S., Van de Peer, Y. (2005)

Genome duplication and the origin of angiosperms. *Trends Ecol. Evol.* 20, 591-7.

Van de Peer, Y. (2004)

Tetraodon genome confirms Takifugu findings: most fish are ancient polyploids. *Genome Biology* 5, 250

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Mention both VIB and the university

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VIB is a non-profit research institute in the life sciences. Some 1100 scientists and technicians conduct strategic basic research on the molecular mechanisms that control the functioning of the human body, plants, and micro-organisms. Through a close partnership with four Flemish universities – Ghent University, the Katholieke Universiteit Leuven, the University of Antwerp, and the Vrije Universiteit Brussel – and a solid investment program, VIB unites the forces of 65 research groups in a single institute. Their research aims at fundamentally extending the frontiers of our knowledge. Through its technology transfer activities, VIB strives to convert the research results into products for the benefit of consumers and patients. VIB also develops and distributes a broad range of scientifically substantiated information about all aspects of biotechnology. More info at: www.vib.be.

With over 30,000 students, **Ghent University** (UGent) is one of the largest universities in the Dutch-speaking world. The university's [educational offering](#) encompasses virtually all of the academic fields of study established in Flanders. UGent prides itself on being an open, socially engaged and pluralistic university in an international context. More info at: www.ugent.be.

Note to the Editor

Yves Van de Peer leads the Bioinformatics research group in VIB's Department of Plant Systems Biology, Ghent University, under the direction of **Dirk Inzé**.

(For more info, see:

www.vib.be/Research/EN/Research+Departments/Department+of+Plant+Systems+Biology/Yves+Van+de+Peer)

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