

Evolution coup: Study reveals how plants protect their genes

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Unlike animals and humans, plants can't run and hide when exposed to stressful environmental conditions. So how do plants survive? A new Université de Montréal study, published in the journal *Proceedings of the National Academy of Sciences*, has found a key mechanism that enables plants to keep dangerous gene alterations in check to ensure their continued existence.

"We've discovered a new pathway that plants use to protect their genes against dangerous alterations that could also allow some useful mutations to occur," says Normand Brisson, a Université de Montréal biochemistry professor who made his discovery with graduate students Alexandre Maréchal and Jean-Sébastien Parent.

"Such mutations played an important role in the <u>evolution</u> of plants with high nutritional value, resistance to disease and harsh climate that are so important to modern agriculture," adds Dr. Brisson. "Our results open new research avenues for the study of similar mechanisms of gene repair in humans that might be important for human evolution, our responses to stress and the prevention of devastating diseases."

How do plant genes mutate?

All living things are constantly exposed to stressors that can provoke gene mutations, yet if uncorrected such mutations can have disastrous consequences such as the development of cancers in humans or cell



resistance to cancer-fighting drugs.

Cells have evolved a battery of mechanisms to correct mutations, including recently discovered strategies that can also modify the number of copies of individual genes. These corrective mechanisms have attracted a lot of scientific interest since they could play a key role in species evolution. For example, while chimps and humans have almost identical genes, differences present in the number of copies of individual genes could account for distinctions between these species.

Dr Brisson suspected that a protein family he has studied for years, called the "Whirlies" (because of their peculiar structure similar to a whirligig) might be important to protect against mutations in plant cells - specifically in the chloroplast - the engine of photosynthesis that allows plants to transform carbon dioxide into sugar and expel the oxygen we breathe.

Working with his students and Biochemistry Professor Franz Lang, they showed that Whirlies are key to preventing major rearrangements of genes that could result in the creation of multiple gene copies. The discovery is important, since the number of copies of a gene must be kept scrupulously in balance with other genes so they can function correctly together.

Even though gene multiplication can be thought of as detrimental, such multiplication can be an important adaptation to stressors and so keeping such mutations in check must be balanced against creating <u>mutations</u> that may actually help living things survive in changing conditions.

"As the effects of climate change and industrial pollution cause increasing concern for human health, we might overlook how increases in temperature and pollutants affect the plants we depend on for our survival," stresses Dr. Brisson. "These rapid changes in <u>environmental</u>



<u>conditions</u> all cause great stress on crops, trees and wild <u>plants</u> and could have further unforeseen effects on their <u>genes</u>."

<u>More information</u>: To read the Proceedings of the National Academy of Sciences (USA) article: <u>www.pnas.org/content/106/34/14693.full</u>

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