Researchers cast into doubt a tenet of the dominant evolutionary biology model

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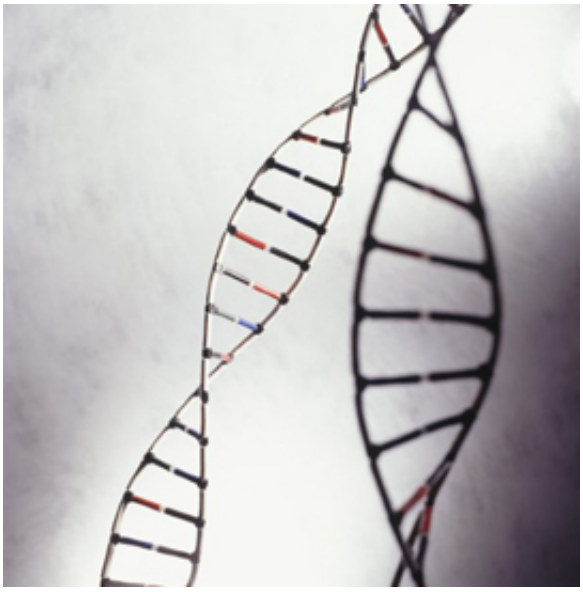

Credit: NIH

A team of Université Laval researchers has cast into doubt a tenet of evolutionary biology according to which organisms with more than one copy of the same gene in their genome are more resilient to genetic perturbations. In an article to be published tomorrow in *Science*, the researchers show that this genetic redundancy can also make the genome more fragile, leaving organisms more vulnerable to the effects of harmful mutations.

To reach this finding, Professor Christian Landry and his team at the

Faculty of Science and Engineering studied 56 pairs of paralogous genes—copies of a same gene—found in bread yeast. They began by characterizing the normal interactions between the proteins produced by these genes and the other protein complexes found in the yeast. They then repeated this exercise using variants whose genomes had been slightly modified.

In the course of the approximately 5,700 tests conducted by the researchers, they found that for 22 of the 56 gene pairs studies, the paralogous gene took over in the absence of its counterpart. "Gene function is maintained by the paralogous gene still present in the cell, which supports the hypothesis that genetic duplication ensures genome resilience," said Christian Landry. However, for 22 other pairs, the absence of one of the two paralogous genes interfered with cellular function. "The presence of both paralogous genes from the pair is sometimes essential to maintain cellular function," he explained. In these cases, the spontaneous mutation of one of the paralogous genes would be sufficient to create a situation where gene function is no longer assured. Duplication of the gene therefore made the genome more fragile."0}

Genetic duplication can affect part of a gene, an entire gene, a chromosome, or an entire genome. "This phenomenon is common in nature and is considered a driving force of evolution," noted Professor Landry. In humans, we are most familiar with its negative effects, such as trisomy 21 and certain cancers. "But genetic duplication also has many lesser known positive effects," he explained. "For example, our ability to distinguish colors and odors is a result of gene duplication."

Although the team's research does not have any immediate medical benefits, it helps us better understand contradictory findings suggesting that the presence of paralogous genes can either attenuate certain mutations or be linked to mutations responsible for certain diseases. "Our study helps clarify the rules we can use to predict how genetic

variations can impact the way the human body functions. Understanding the genotype-phenotype link is one of the leading challenges in human genomics today," the researcher concluded.

More information: "Gene duplication can impart fragility, not robustness, in the yeast protein interaction network," *Science*, science.sciencemag.org/cgi/doi … 1126/science.aai7685

Provided by Laval University