

Mass copying of genes speeds up evolution

In the latest issue of PNAS, *Proceedings of the National Academy of Sciences*, a Swedish-American team of researchers show how selective gene amplification--mass copying of a specific gene--can increase the speed with which organisms adapt to their environment.

All organisms can amplify parts of their DNA under certain conditions, and the variants that have an increased amount of one special gene can gain survival advantages when they are exposed to various types of external conditions, such as stress in the form of antibiotics (bacteria), chemotherapy (humans), or insecticides (insects).

In this study the researchers show that the bacteria *Salmonella typhimurium* uses several different mechanisms to increase the number of copies of a gene that helps the cell use the sugar lactose as a source of nourishment.

“When the bacterium’s gene for making use of lactose is inefficient, that is, when the bacterium has an ineffective enzyme for breaking down lactose, mutant bacteria are favored instead, with up to a hundred-fold rise in the number of copies of the gene,” says Professor Dan Andersson, one of those behind the study.

This has two consequences: on the one hand, the bacterium manages to grow on lactose because the amount of the inefficient enzyme increases and, on the other hand, the chances increase that the bacterium will develop a mutation in one of these 100 identical genes leading to an improvement in the enzyme function. The scientists also show that amplification proceeds stepwise: first, a large region is duplicated and then smaller regions within that region are amplified to high numbers of copies. According to Dan Andersson, it is probably much more common than was previously thought, which is extremely exciting.

“And they are important, since this means that evolutionary changes can take place at a considerably higher speed. One reason the extent of this has been underestimated is their inherent instability, which makes them difficult to study in laboratory experiments.”

Source: Uppsala Universitet

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