Enzyme necessary for DNA synthesis can also erase DNA

June 8 2009

In this week's edition of *Proceedings of the National Academy of Sciences,* PNAS, Uppsala University scientists describe a new mechanism behind an important process that causes a rapid reduction of DNA in the chromosomes of bacteria. The findings advance our knowledge of how DNA content has been reduced, which is something that has occurred in bacteria that live as parasites inside the cells of other organisms.

The amount of DNA in the chromosomes of bacteria can change rapidly, either by increasing, so-called gene amplification, or by decreasing, so-called gene deletion. These processes are evolutionarily very important, and the discovery of a new mechanism that is involved when DNA disappears is of fundamental importance to our understanding what influences the stability of chromosomes and why the amount of DNA can decrease in certain types of bacteria. "How rapidly and by what mechanisms DNA can disappear from the chromosome is a central genetic and evolutionary question," says Professor Dan I Andersson, the lead author of the study.

Previously these types of large gene deletions, have mostly been studied in artificial model systems with two long identical and neighboring DNA sequences. Normal spontaneous deletions, on the other hand, are often remote from each other and lack sequence identity.

In the current study, the PhD student Sanna Koskiniemi has carried out comprehensive genetic analyses of Salmonella mutants and her results

show that a

special type of DNA-synthesizing enzymes are necessary if spontaneous deletions are to be formed in the bacteria. This new function has never before been described in these enzymes. By genetically inactivating or overproducing these enzymes, the researchers were able to show that the deletion rates decreased or increased by up to 30 times.

These findings can explain how and why the DNA content of different organisms varies and what genetic mechanisms govern this, says Professor Dan Andersson, who suggests that bacteria that live either as parasites inside cells or in symbiosis with other organisms are of special interest with regard to this new mechanism.

These bacteria often have small chromosomes because DNA has disappeared during evolution. With these new findings we can better understand and predict how DNA is eliminated from chromosomes.

Source: Uppsala University (news : web)