MedicalXpress

Mobile DNA elements can disrupt gene expression and cause biological variation, study shows

February 23 2012

The many short pieces of mobile DNA that exist in the genome can contribute to significant biological differences between lineages of mice, according to a new study led by researchers at the Ohio State University Comprehensive Cancer Center – Arthur G. James Cancer Hospital and Richard J. Solove Research Institute (OSUCCC – James).

The movable pieces of DNA are called transposons or "jumping genes" because they can move from one chromosomal location to another. Unlike viruses, they are not infectious and do not move from cell to cell. They have accumulated over time in the genomes of both mice and humans and now make up about half of genomic DNA in both.

For this study, researchers mapped the genomic locations of certain transposons called endogenous retroviruses (ERVs) in diverse mouse strains. They compared the different strains to learn how ERVs might influence gene expression. They found that ERVs can significantly disrupt gene expression by prematurely halting gene transcription, even when the ERV is located more than 12 thousand base pairs away in the same chromosome. They also found that the disruptive influence is affected by the gender of the parent that supplied the ERV.

The study is published online in the journal Genome *Research*.

"These findings add an interesting new angle to our understanding of

fundamental mechanisms of natural variation and human biology, and possibly cancer and other diseases," says principal investigator Dr. David E. Symer, assistant professor of molecular virology, immunology and medical genetics and a member of the Human Cancer Genetics Program at the OSUCCC – James.

"We showed that gene expression can be influenced very strongly by a transposon located quite a distance from the premature stop site – up to many thousands of base pairs away in the genomic DNA. We also found that gene expression is influenced by whether the ERV was inherited from the father or the mother," he says.

A mouse gene containing an ERV inherited from the father often produced only an incomplete, truncated form of messenger RNA (mRNA); if the ERV came from the mother, not only the truncated transcript but also nearly normal levels of the full-length mRNA were produced from the gene.

"We believe this is an unusual, interesting example of a well-known phenomenon called DNA imprinting," Symer says. "We are now conducting experiments to understand how premature termination of gene expression can be triggered by the transposons, and also how the parent-of-origin effect occurs."

By comparing patterns of gene expression near the ERVs that were present or absent in the different strains, the researchers found about 100 genes whose expression appears to be disrupted when an ERV is present nearby.

"We observed very, very strong disruption of certain mouse genes by ERVs acting at a long genomic distance, and the resulting expression differences – up to almost 50-fold changes – can have major biological consequences that distinguish between the strains," Symer says.

Provided by The Ohio State University