Marsupials and humans shared same genetic imprinting 150 million years ago

July 15 2008

Research published in *Nature Genetics* by a team of international scientists including the department of zoology at the University of Melbourne, Australia, has established an identical mechanism of genetic imprinting, a process involved in marsupial and human fetal development, which evolved 150 million years ago.

"This paper shows that we share a common genetic imprinting mechanism which has been active for about 150 million years despite the differences in reproductive strategies between marsupials and humans," said Professor Geoffrey Shaw of the Department of Zoology at the University of Melbourne, a coauthor on the paper.

Professor Marilyn Renfree who lead the University of Melbourne research team says marsupials give birth to very small young that develop mainly within the pouch while humans have more developed young at birth that undergo a large period of growth in the uterus.

"Our team provided vital samples and genetic resources from marsupials to enable this study and contributed our world-leading expertise on marsupial biology and genomics to the interpretation of the results," Professor Renfree said.

Genomic imprinting is a mechanism that regulates gene expression in the developing fetus and plays a major role in regulating its growth.

"We all carry two copies of every gene in our DNA, one inherited from

our mother and one from our father. So for each gene we have a 'back-up'. Normally, both copies of the gene are used for development, but in some special cases the gene from either our mother or father is switched off, so we only have one active copy. This phenomenon is known as genomic imprinting," explained Dr Andrew Pask also from the Department of Zoology.

"Because there is no back up copy, when errors occur in this process, it results in many human genetic diseases mainly affecting growth and brain function."

Pask explains that a key gene regulating fetal growth is the Insulin-like-growth-factor-2 or IGF2 which is an imprinted gene.

"We inherit a single working copy of this gene from our fathers, while the copy we inherit from our mothers is switched off. The switch for this gene is controlled by another gene known as H19. The H19 gene is unusual gene that makes a microRNA and not a protein."

"MicroRNA genes have been sought in marsupials for years, and now for the first time one has been discovered," Dr Pask said.

Pask explains that the microRNA structure is virtually identical to that of mice and humans, but there was no evidence of this gene or a similar microRNA in the more distantly related platypus.

The study was a large team effort involving researchers in the UK, from the Babraham Institute, the University of Manchester, the Sanger Institute and the University of Cambridge, in Australia, from the University of Melbourne, and the USA, from the University of Texas at San Antonio (all part of the Sequence Analysis of Vertebrate Orthologous Imprinted Regions 'SAVOIR' consortium).

"Understanding how genetic imprinting evolved is important," said Dr Shaw, "It helps us to determine how the mechanism works and what we can do to avoid the development of a number of human diseases."

Source: University of Melbourne