Battle of sex in genes and the brain

July 14 2008

Sex is good for a lot of things. One of the most important is the way in which sex leads to a shuffling of the genetic cards in every individual. Scientists in Cardiff are beginning to build up a picture of what certain genes are doing in the brain and how they affect behaviour. The results, delegates were told in Geneva today, could help researchers find the causes for conditions such as autism.

Professor Lawrence Wilkinson from Cardiff University, UK, said, "With sex, mum and dad can provide their offspring with a new combination of genetic cards – genes - ready to meet the challenges of a changing environment. Another good thing about the way genes are passed down the generations is that they are usually in pairs with one copy provided by mum and one by dad." This arrangement serves as a form of survival insurance since in many situations when one copy does not work properly, or is missing, the other copy can do the job. The large majority of genes in the mammalian genome obey this rather sensible rule.

However the genes that Professor Wilkinson and his team are most interested in are 'imprinted genes' in the brain. These are odd in that they effectively give up the protection by turning off the activation of one of the gene copies, depending on whether the copy came from the mother (maternal imprinting) or father (paternal imprinting).

Scientists have known about the existence of this idiosyncratic group of genes for about 20 years. They have raised a number of questions about their function, and intense debate over the evolutionary reasons for their

existence. The most popular hypothesis put forward to date is that imprinted genes are the consequence of a form of 'internal genomic' conflict that arises from the differing interests of the mother's or father's genes, and this conflict affects the characteristics of the body and behaviour inherited by the offspring. These arise, in turn, from differences of relatedness between the offspring and the parents. "For example, the female can be sure of the extent to which she is related to her child but the male cannot," said Professor Wilkinson.

It seems that imprinted genes can influence a range of behaviour, from the baby's ability to suckle all the way through to the complexities of how we think and behave in adulthood. It is likely that imprinted genes exert many of their effects on the developing brain, both in the womb and after the baby has been born, especially in the critical early phases of infancy.

Consistent with this idea there is good evidence for the involvement of imprinted genes in a number of developmental brain disorders. Some, such as Prader-Willi syndrome and Angelman syndrome, are quite rare, but imprinted genes have also been implicated as important players in autism spectrum disorders.

With the increasing use of genetic screening methods that take 'parent-of-origin' into account it is very likely that more examples of the effects of genomic imprinting on the risk of abnormal psychological traits and behaviour will emerge in the future. "The work on brain's imprinted genes is at an early stage and there are many challenges ahead, not least testing the idea that aspects of normal and abnormal brain function can be influenced by a battle of the sexes that is being waged at the level of our genes," he said.

Provided by Swiss Society for Neuroscience