Nurture has greater effect than nature, says study

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(PhysOrg.com) -- Nurture could have an even greater effect than originally thought, according to a University of Manchester study that is set to shake up the 'nature versus nurture' debate.

It is well known that many traits such as body weight and growth are a result of an organism's genetic make up and the influence of environmental factors. Variation among individuals in these traits is also affected by so-called epigenetic effects such as genomic imprinting where no genetic variation is involved. However, whether epigenetic effects can interact with the environment in a similar way to genotypes remained unexplored.

In a new study, Reinmar Hager and Jason Wolf at the Faculty of Life Sciences together with their collaborator James Cheverud at St Louis have shown how maternal environment can affect how genes are expressed, influencing the body weight and growth of young mice, even if they are not related to the 'mother'.

They have thus revealed an additional route by which the environment may affect how genes are expressed. Focusing on genomic imprinting, the researchers demonstrated that the environment has a strong effect on how imprinting influences body weight and growth in mice.

Dr Hager, whose findings are published in the latest Proceedings of the Royal Society B (27 May 2009), said: "Our results suggest a greater plasticity of genomic imprinting than previously assumed and may have

far-reaching implications for how organisms can flexibly adapt to changing environments. For example, mothers could pass on information to their offspring about the environment in which they will be growing up, such as availability of resources. Thus, young may be better adapted to the environment when they know what to expect."

The team used a cross fostering design in which mouse pups were nursed by either their own or an unrelated mother. They then scanned the entire genome of the pups to find the genes affected by cross-fostering and found ten such loci. Of the ten loci identified, four showed imprinting by cross-fostering interactions where the epigenetic effect of genomic imprinting mostly occurred in the pups nursed by their foster mother. This suggests that the maternal environment influences whether or not genomic imprinting occurs in young, which in turn affected the body weight of the mice.

Dr Hager added: "This study is significant because it shows that not only genes interact with the environment but also epigenetic effects. This interaction adds an extra source of phenotypic variation with important implications for the underlying causes of variation in many traits such body weight and growth, response to stress or resistance to disease."

Yet, the mechanisms behind the interaction require further research. "We don't know yet how the change in environment corresponds with a change in epigenetic effects on the offspring but we believe it is via a change in maternal behaviour and will test this in the next study."

More information: The paper 'Change in maternal environment induced by cross-fostering alters genetic and epigenetic effects on complex traits in mice' can be seen in the *Proceedings of the Royal Society B.*

Provided by University of Manchester (news : web)