EU-funded study: gut bacteria key for brain development

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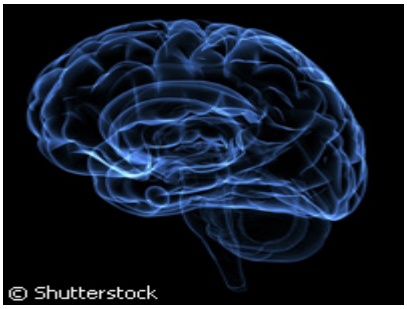

Bacteria living in the gut appear to influence brain development and adult behaviour, according to new EU-funded research published in the journal the Proceedings of the National Academy of Sciences (PNAS). The findings suggest that the colonisation of our guts by microbes in early life may be key to healthy brain development. The research may also have implications for our understanding of psychiatric disorders.

EU support for the work comes from the TORNADO ('Molecular targets open for regulation by the gut flora - new avenues for improved diet to optimize European health') project, which has been allocated EUR 5.9 million under the 'Food, agriculture and fisheries, and biotechnology' Theme of the Seventh Framework Programme (FP7). The aim of TORNADO is to shed light on the influence of diet on the gut microbes and in turn the influence of these microbes on the immune system and other organ systems. TORNADO started in 2009 and is slated to end in 2013.

It is well known that our environment in early life has a major influence on our development. Shortly after birth, baby mammals' guts are rapidly colonised by a diverse community of bacteria. Studies have shown that this process is essential for the healthy development of a number of bodily systems including immune function, blood vessel development and liver function.

Like many other organs, the brain is affected by environmental factors experienced by the organism when it is born. Research has demonstrated an association between

infection with pathogenic microbes at birth and neurodevelopmental disorders like autism and schizophrenia.

In this study, scientists from the Karolinska Institute and Stockholm Brain Institute in Sweden, together with colleagues from the Genome Institute of Singapore, set out to investigate the influence of 'normal' gut microbes on brain development and function.

The team compared the behaviour of mice that had been raised with normal microorganisms with mice that had been raised in a microorganism-free environment ('germ-free' mice).

Experiments showed that the germ-free mice were more active than their microbe-bearing counterparts and also engaged in more 'risky' behaviour. Exposing germ-free mice to microbes early on in life resulted in adults that behaved in a similar way to mice that had been exposed to bacteria from birth. However, colonising adult germ-free mice with bacteria did not affect their behaviour; they continued to act like germ-free mice.

'The data suggests that there is a critical period early in life when gut microorganisms affect the brain and change the behaviour in later life,' commented the lead author of the paper, Dr Rochellys Diaz Heijtz of the Karolinska Institute and the Stockholm Brain Institute.

An analysis of gene activity in the brains of the two groups of mice revealed differences in the activity levels of genes involved in learning, memory and motor control.

'Our results suggest that during evolution, the colonisation of gut microbiota has become integrated into the programming of brain development, affecting motor control and anxiety-like behaviour,' the researchers conclude.

'Gut microbiota may also be able to modify expression of risk genes or be part of mechanisms that alter cognitive functions observed in patients with gastrointestinal diseases,' the researchers note. 'Finally, the observed behavioural changes imposed by the presence of the gut flora in rodents, reported in this paper, may have wider implications when considering psychiatric disorders in humans.'For more information, please visit: Karolinska Institute:http://ki.seProceedings of the National Academy of Sciences (PNAS):http://www.pnas.orgTORNADO project:http://www.fp7tornado.eu/

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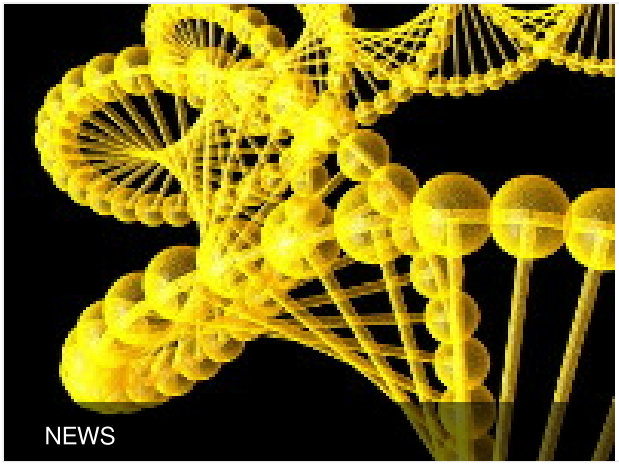

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