# Human brains pay a price for being big

August 5 2008

Metabolic changes responsible for the evolution of our unique cognitive abilities indicate that the brain may have been pushed to the limit of its capabilities. Research published today in BioMed Central's open access journal *Genome Biology* adds weight to the theory that schizophrenia is a costly by-product of human brain evolution.

Philipp Khaitovich, from the Max-Planck-Institute for Evolutionary Anthropology and the Shanghai branch of the Chinese Academy of Sciences, led a collaboration of researchers from Cambridge, Leipzig and Shanghai who investigated brains from healthy and schizophrenic humans and compared them with chimpanzee and rhesus macaque brains. The researchers looked for differences in gene expression and metabolite concentrations and, as Khaitovich explains, "identified molecular mechanisms involved in the evolution of human cognitive abilities by combining biological data from two research directions: evolutionary and medical".

The idea that certain neurological diseases are by-products of increases in metabolic capacity and brain size that occurred during human evolution has been suggested before, but in this new work the authors used new technical approaches to really put the theory to the test.

They identified the molecular changes that took place over the course of human evolution and considered those molecular changes observed in schizophrenia, a psychiatric disorder believed to affect cognitive functions such as the capacities for language and complex social relationships. They found that expression levels of many genes and

metabolites that are altered in schizophrenia, especially those related to energy metabolism, also changed rapidly during evolution. According to Khaitovich, "Our new research suggests that schizophrenia is a by-product of the increased metabolic demands brought about during human brain evolution".

The authors conclude that this work paves the way for a much more detailed investigation. "Our brains are unique among all species in their enormous metabolic demand. If we can explain how our brains sustain such a tremendous metabolic flow, we will have a much better chance to understand how the brain works and why it sometimes breaks", said Khaitovich.

Citation: Metabolic changes in schizophrenia and human brain evolution; Philipp Khaitovich, Helen E Lockstone, Matthew T Wayland, Tsz M Tsang, Samantha D Jayatilaka, Arfu J Guo, Jie Zhou, Mehmet Somel, Laura W Harris, Elaine Holmes, Svante Pääbo and Sabine Bahn; *Genome Biology* 'in press'

Source: BioMed Central