Scientists chart gene expression in the brain across lifespan

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The "switching on" or expression of specific genes in the human genome is what makes each human tissue and each human being unique. A new study by researchers at the Johns Hopkins Bloomberg School of Public Health, the Lieber Institute for Brain Development, and the National Institute of Mental Health found that many gene expression changes that occur during fetal development are reversed immediately after birth. Reversals of fetal expression changes are also seen again much later in life during normal aging of the brain.

Additionally, the team observed the reversal of fetal expression changes in Alzheimer's disease findings reported in other studies. The research team also found that gene expression change is fastest in human brain tissue during fetal development, slows down through childhood and adolescence, stabilizes in adulthood, and then speeds up again after age 50, with distinct redirection of expression changes prior to birth and in early adulthood. Their findings are published in the Oct. 27, 2011, edition of *Nature*.

All of the data are available to the public as a web-based resource at: http://www.libd.org/braincloud.

Using a number of genomic analysis technologies, the research team conducted genome-wide genetic (DNA) and gene expression (RNA) analyses of brain tissue samples from the prefrontal cortex. Tissue represented the various stages of the human lifespan.

"We think that these coordinated changes in gene expression connecting fetal development with aging and neurodegeneration are central to how the genome constructs the human brain and how the brain ages," said Carlo Colantuoni, PhD, one of the lead authors of the study and a former research associate with the Department of Biostatistics at the Johns Hopkins Bloomberg School of Public Health. Colantuoni recently joined the Lieber Institute for Brain Development on the Johns Hopkins Medical Campus.

The research also showed that brain gene expression differences between genetically diverse individuals (of different races, for example) are no greater than the differences between individuals sharing many more genetic traits.

"Our findings highlight the fact that current technologies and analysis methods can address the effects of individual genetic traits in isolation, but we have virtually no understanding of how our many millions of genetic traits work in concert with one another," added Colantuoni.

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