

# Found in the developing brain: Mental health risk genes and gender differences

October 26 2011

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Most genes associated with psychiatric illnesses are expressed before birth in the developing human brain, a massive study headed by Yale University researchers discovered. In addition, hundreds of genetic differences were found between males and females as their brains take shape in the womb, the study in the Oct. 27 issue of the journal *Nature* shows.

The creation of a hundred billion [brain cells](#) and the incalculable number of connections between them is such a complex task that 86 percent of 17,000 [human genes](#) studied are recruited in the effort. The study tracked not only what genes are involved in development, but where and when they are expressed, or activated.

"We knew many of the genes involved in the development of the brain, but now we know where and when they are functioning in the [human brain](#)," said Nenad Sestan, associate professor of neurobiology, researcher for the Kavli Institute for Neuroscience and senior author of the study. "The complexity of the system shows why the human brain may be so susceptible to psychiatric disorders."

The study identified genes expressed in the human brain, and when and where in the brain they were expressed in 1340 tissue samples taken from 57 subjects aged from 40 days after conception to 82 years. The analysis of 1.9 billion data points gives an unprecedented map of [genetic activity](#) in the brain at different stages of development. In dramatic fashion, the findings show just how much of the human brain is shaped

prior to birth.

For instance, the team analyzed genes and variants previously linked with autism and schizophrenia, the symptoms of which are evident in the first few years of life or during [early adulthood](#), respectively. The new analysis shows molecular evidence of expression of these suspect genes prior to birth.

"We found a distinct pattern of gene expression and variations prenatally in areas of the brain involving higher cognitive function," Sestan said. "It is clear that these disease-associated genes are developmentally regulated."

The team also looked for differences in brains of [males and females](#). They expected to find clear differences in Y chromosome genes that are possessed only by males. However, they also demonstrated that men and women showed distinct differences in many genes that are shared by both sexes – both in whether the gene was expressed and the level of the gene's activity. Most of the differences were noted prenatally.

Provided by Yale University

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