Jumping DNA in the brain may be a cause of schizophrenia

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Stretches of DNA called retrotransposons, often dubbed "junk DNA", might play an important role in schizophrenia. In a study published today in the journal *Neuron*, a Japanese team revealed that LINE-1 retrotransposons are abnormally abundant in the schizophrenia brain, modify the expression of genes related to schizophrenia during brain development, and may be one of the causes of schizophrenia.

Retrotransposons are short sequences of DNA that autonomously amplify and move around the genome. One class of retrotransposons named Long Interspersed Nuclear Elements (LINE) make up a large part of the eukaryotic genome and it is believed that they may contribute to a number of disorders and diseases such as cancer.

LINE-1 have been shown to be more abundant in brain cells than in other cells in the body in adults, providing evidence for enhanced activity of LINE-1 in the human brain. However, the role played by LINE-1 in mental disorders, and in particular schizophrenia, has remained unclear.

The team led by Dr Kazuya Iwamoto from the University of Tokyo and Dr Tadafumi Kato from the RIKEN Brain Science Institute demonstrated that the number of LINE-1 copies is elevated in the post-mortem brains of patients with schizophrenia. They show using mouse and macaque models for schizophrenia and iPS cells that exposure to environmental risk factors during development, as well as the presence of genetic risk factors for schizophrenia, can lead to increased levels of

LINE-1 in neurons. The authors reveal employing whole genome analysis that in schizophrenia patients LINE-1 reinserts into genes involved in synaptic function or schizophrenia and may result in disruptions in their normal functions.

"Our findings strongly suggest that abnormal, enhanced retrotransposition of LINE-1 in neurons, triggered by environmental factors and/or combined with a genetic risk factor, plays a defining role in schizophrenia," conclude the authors.

"This study proposes a brand new mechanism of pathophysiology of schizophrenia. Previously, schizophrenia was regarded as a disease caused by gene-environment interactions, but our study shows that the environment can alter the genome and may contribute to the disease," explains Tadafumi Kato.

More information: "Increased L1 Retrotransposition in the Neuronal Genome in Schizophrenia" *Neuron*, 2013
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