

Rare cell prevents rampant brain activity

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One of the mysteries of the brain is how it avoids ending up in a state of chaos, something which happens only on exceptional occasions, when it can lead to epileptic fits. Scientists at Karolinska Institutet have now uncovered a new mechanism controlling how the brain keeps its neuronal activity in check.

The human brain consists of around a hundred million nerve cells linked together by around ten billion contact junctions called synapses. The activity of this extremely complex network is regulated through a dynamic balance between excitatory signals, which are transmitted by one type of synapse, and inhibitory counter-signals, which are transmitted by another.

An imbalance between excitatory and inhibitory activity is associated with diseases such as epilepsy, schizophrenia, and anxiety. But despite the fact that excitatory synapses are much more common than their inhibitory counterparts, the system is generally kept in a state of equilibrium. Just how the brain manages this feat is a puzzle to scientists.

Scientists at Karolinska Institutet and the Brain Mind Institute in Switzerland have now discovered a mechanism that might explain how the most common type of neuron in the cerebral cortex – the pyramid cell – is prevented from becoming over-activated. Their results show that a rarer cell type that links collections of pyramid cells – called a Martinotti cell – acts as a kind of safety device. When a Martinotti cell receives signals above a certain frequency, it responds by sending back inhibitory signals

that moderate surrounding pyramid cells.

Gilad Silberberg, one of the researchers behind the study, believes that the mechanism is essential to understanding brain disorders like epilepsy.

"A characteristic feature of epilepsy is the hyperactivation of cortical pyramid cells, which is exactly what this mechanism inhibits. It is possible that epilepsy is related to a deficit of Martinotti cells or a deficiency of Martinotti activity in the brain."

Source: Karolinska Institutet

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