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# Capturing the birth of a synapse

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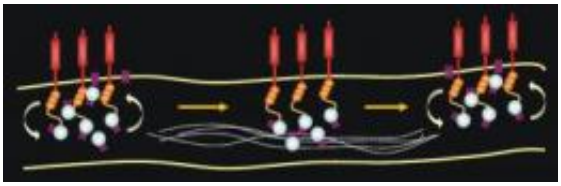

Receptors are needed for synapses to become functional. Neuroligin (red) on the surface of the cell is tethered to neurotransmitter receptors (mauve) that reside in intracellular vesicles. This enables both synaptic components to move together to a site of synapse formation. Credit: Courtesy of Philip Washbourne

Researchers have identified the locking mechanism that allows some neurons to form synapses to pass along essential information. Mutations of genes that produce a critical cell-adhesion molecule involved in the work were previously linked to autism.

The discovery -- captured with fluorescent imaging of excitatory neurons harvested from rat pups shortly after birth and studied in culture as they continued to develop -- is described in a paper placed online May 18 ahead of formal publication in the open-access journal *Neural Development*.

"We've caught two neuronal cells in the act of forming a synapse," said principle investigator Philip Washbourne, professor of biology at the University of Oregon. He describes the cell-adhesion neuroligin proteins on the membranes of receptor neurons as "molecular Velcro."

The research team of six UO and University of California, Davis, scientists found one of many finger-like filopodia, or spines, that reach out from one neuron is nabbed by neuroligin molecules on the membrane of another neuron. In turn, neuroligins recruit at least two other key proteins (PSD-95 and NMDA receptors) to begin building a scaffold to hold the synapse components in place. The moment of locking is captured in a video (link below) that will appear with the paper's final version at the journal's Web site.

Two neuroligin family members (3 and 4) have been linked to autism in the last decade.

"Chemical synapses are the primary means for transmitting information from one neuron to the next," said Washbourne, who is a member of the UO's Institute of Neuroscience. "Synapses are initially formed during development of the nervous system, and formation of appropriate synapses is crucial for establishing neuronal circuits that underlie behavior and cognition. Minor irregularities can lead to developmental disorders such as autism and mental retardation, and they may contribute to psychological disorders."

The findings, he added, reflect a clearer understanding of how synapses form, providing a roadmap for research that someday may lead to new therapies or a cure for autism, a brain development disorder that affects a person's social and communication abilities. The disorder affects 1 in every 150 American children, according to the Autism Society of America.

The new window opened by Washbourne's team captures the essence of synapse development, which occurs over and over among the estimated 100 billion neurons that make some 100 trillion synapses in a single human being. That leaves a lot of room for errors in the DNA-driven instructions for synthesizing molecules responsible for synapse

formation, Washbourne said.

"Basically," Washbourne said, "we have found mechanisms by which two very important molecules, NMDA and PSD-95, are brought to a newly forming synapse."

Source: University of Oregon (news : web)