Neurons use chemical 'chords' to shape signaling

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Researchers have discovered that neurons can use two different neurotransmitters that target the same receptor on a receiving neuron to shape the transmission of a nerve impulse. Although the researchers' experiments identified the "co-release" of the two neurotransmitters only in specific types of neurons in the brain's auditory center, their finding may apply more broadly in the brain, they said. Thus, the finding may represent a new way in which the brain precisely modulates the nerve impulses that travel from neuron to neuron in its circuitry.

Tao Lu and colleagues Maria Rubio and Laurence Trussell reported their findings in the February 28, 2008, issue of the journal *Neuron*, published by Cell Press.

To propagate a nerve impulse within neural circuitry, one neuron launches a burst of chemical signal called a neurotransmitter at a receiving neuron, where the neurotransmitter attaches to a specific receptor—like a key fitting a lock. That neurotransmitter-specific receptor is activated to trigger a nerve impulse in the receiving neuron.

Such nerve impulses, however, rather than being the electrical equivalent of a shotgun blast, are precisely modulated signals, like the finely shaped notes of an orchestra.

In studies over the past several decades, researchers had found evidence for co-release of different neurotransmitters by the same neuron. But

they had assumed that in such cotransmission, each neurotransmitter targeted its own receptor on the receiving neuron.

However, Lu and colleagues performed biochemical and electrophysiological experiments on rat neurons and established that two neurotransmitters—called GABA and glycine—both target the glycine receptor in specific types of neurons. The neurons they studied reside in the part of the rat auditory system that processes sound location. Thus, shaping the timing of the nerve impulse is important for such processing.

Glycine acts as an inhibitory neurotransmitter in such neurons, and Lu and colleagues found that GABA acts on the glycine receptor to accelerate glycine-produced inhibition.

Lu and colleagues wrote that, although their studies only establish the role of GABA/glycine cotransmission in the specialized auditory neurons, other studies had found evidence for cotransmission in other areas of the brain. Such findings hint that the two neurotransmitters may work in concert elsewhere “at a single receptor to enhance the temporal resolution of inhibition.”

“Of course, a hallmark of a great scientific study is the ability to approach an established problem from a fresh perspective,” wrote Joshua Singer in a preview of the article in the same issue of Neuron. “And certainly the present work by Lu, Rubio, and Trussell characterizes this.” Singer, who is at Northwestern University, asked, “Who would have thought that GABA [is a natural trigger for glycine receptors]" Not me, unfortunately.”

Source: Cell Press