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Marine Snail's Neural Network Sheds Light On The Basis For Flexible Behavior

ScienceDaily (Oct. 12, 2005) — From snail to man, one of the hallmarks of the brain is the ease with which behavioral variants are generated--for example, humans can easily walk with different stride lengths or different speeds. By studying how a relatively simple motor network of the marine snail *Aplysia* produces variants of a particular feeding behavior, researchers have found that the ability to generate a large number of behavioral variants stems from the elegant hierarchical architecture of the brain's motor network.

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that are active during biting behavior employ a combinatorial mechanism to produce variations in one particular movement parameter of the biting behavior. The researchers showed that, tellingly, these higher-order neurons accomplish their roles through their specific actions on two groups of lower-order interneurons that directly influence the particular biting-behavior movement parameter. Therefore, in this system, and likely others, the generation of large numbers of behavioral variants is characterized by higher-order neurons that flexibly combine an "alphabet system" of outputs that are generated by lower-order modules within the brain's motor network.

Most motor systems are organized into a hierarchy of at least two layers of neurons, with higher-order neurons acting on lower-order neurons, which form a small number of building blocks or modules that produce a variety of behaviors.

However, it was not clear how variants of a single motor act are generated in such a hierarchical system.

In the new work, Jian Jing and Klaudiusz Weiss of the Mount Sinai School of Medicine in New York studied the feeding network of *Aplysia*, which exhibits a biting behavior in response to the presence of food. The researchers showed that within the feeding network, two higher-order neurons



*By studying how a relatively simple motor network of the marine snail *Aplysia* produces variants of a particular feeding behavior, researchers have found that the ability to generate a large number of behavioral variants stems from the elegant hierarchical architecture of the brain's motor network. (Credit: Timothy Kang, Jin-sheng Wu, Jian Jing)*

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Jing et al.: "Generation of Variants of a Motor Act in a Modular and Hierarchical Motor Network." Publishing in Current Biology, Vol. 15, 1712-1721, October 11, 2005. DOI 10.1016/j.cub.2005.08.051 <http://www.current-biology.com/>

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