Making songs stick in sparrows' heads

Like college students who complete an exam and then promptly forget everything they studied, male songbirds 'forget' their songs when they no longer need them to attract mates. When breeding season ends, the region in birds' brains that controls song (called the HVC) shrinks, and neurons in the area begin to die in massive quantities. A new study by Christopher Thompson and Eliot Brenowitz (University of Washington, Seattle) may shed light on the mechanisms of this degeneration process. By inhibiting the activity of enzymes called caspases, which are known to be involved in cell suicide, the researchers managed to prevent HVC regression and neuron death. Their findings may be useful for treatment of neural degenerative diseases such as Alzheimer's and Parkinson's.

The authors built on previous studies showing that seasonal growth and regression of the neural song control system are directly correlated with the concentration of testosterone circulating in the body. The team captured and later

Frank Leung

castrated wild Gambel's white-crowned sparrows (*J. Neurosci.* **28**, 7130–7136; 2008). To simulate breeding conditions and induce maximum growth of the HVC, they implanted birds with testosterone capsules and exposed them to long photoperiods (20 h light per day). A few days later, the scientists implanted cannulas into one side of birds' brains, near the HVC. They connected the cannulas to osmotic pumps, which birds wore like 'backpacks' between their wings. Some of the osmotic pumps delivered caspase inhibitors to birds' brains, whereas others delivered a control substance. The researchers then simulated the end of the breeding season by removing birds' testosterone implants and gradually shortening the photoperiod to 8 h.

Thompson and Brenowitz euthanized groups of sparrows 1, 3 and 7 d after beginning testosterone withdrawal and analyzed their brain tissue. In all cases, birds that received caspase inhibitors showed significantly less HVC regression on the side of the brain in which the cannula had been implanted, compared with the other side of the brain. Birds that received the control substance also showed substantial neuronal death.

Notably, the caspase inhibitors managed to prevent deterioration in a second brain region that was connected to the HVC, on the same side as the cannula. This finding may have implications for stroke victims, Brenowitz notes, as studies have shown that stroke-related degeneration occurs not only in areas of the brain that are directly affected by the loss of blood supply, but in connected neural regions as well.

Karen Marron

NEW UV SWITCH MAKES WORMS MOVE

Get out that disco ball—it seems mutant worms have some brand new moves to show us. New research, led by Kenneth Miller (Oklahoma Medical Research Foundation, Oklahoma City), looked at phototaxia in *Caenorhabditis elegans*, which lack eyes as well as any of the proteins known to transduce light signals. The group used *C. elegans* mutants engineered to lack the synaptic signaling molecules cyclic adenosine monophosphate (cAMP) and diacylglycerol (DAG), resulting in paralysis and lack of response to harsh physical stimuli.

When they exposed these paralyzed *C. elegans* mutants to ultraviolet (UV) light, they observed a strong locomotive response (*PLoS Biol.* **6**, e198; 2008). In fact, UV light rescued the paralysis and restored locomotion to normal levels. The UV response had not been noted previously, despite decades of research using the nematodes, because wild-type *C. elegans* can move freely. Miller and colleagues then traced the locomotion response to a new UV-sensitive light receptor that they called LITE-1. "This sensor doesn't resemble any other light sensors previously discovered," noted Miller.

The scientists then expressed the sensor in muscle cells that are not normally responsive to light. LITE-1 expression in these cells resulted in light sensitivity. They also found that exposing only the tails of the mutant worms to UV light rescued the paralysis as effectively as did whole-body exposure. In addition, they observed that the light-driven locomotion is directionally oriented toward the UV light.

Miller's group believes that the UV-induced phototaxia is consistent with recent indications that *C. elegans* may spend substantial amounts of time above ground, despite previous notions that the species was primarily subterranean. If they do remain above ground for any length of time, they would require a sensory mechanism for detecting and avoiding harmful exposure to sunlight.

LITE-1 is not found in humans, but research into its mode of function may shed light on the molecular mechanisms of neuronal communication, which underlies perception, behavior, learning and memory in humans and other organisms. "It gives us a tool that we can use to solve the mysteries of nerve cell communication and could ultimately help us understand the biology of everything from sleep and memory to depression," said Miller. But there is much work to be done before this discovery could lead to treatments for any human disorders.

Monica Harrington