This Week in The Journal

Cellular/Molecular

New Technique Identifies Receptors for Specific Odors

Timothy S. McClintock, Kaylin Adipietro, William B. Titlow, Patrick Breheny, Andreas Walz, et al.

(see pages 15669–15678)

Visual and auditory stimuli vary on continuous scales of position and wavelength, making it easy to define the relationships between stimuli. These features are represented topographically in primary visual and auditory cortex. In contrast, relationships between odors are generally difficult to define objectively, and this—along with the existence of thousands of different odorant receptors—has hindered attempts to understand the neural mechanisms of odor representation. Before one can begin deciphering these mechanisms, one must first determine which odors various odor receptors respond to. McClintock et al. have developed a technique to facilitate this process. First, specific odors were delivered intermittently to mice in which a fluorescent protein was produced in active olfactory sensory neurons (OSNs). Activated OSNs were then isolated using fluorescence-activated cell sorting. Finally, microarrays were used to identify the odorant receptors expressed by activated cells. The technique identified most previously identified receptors for two odors, along with several new receptors for these odors.

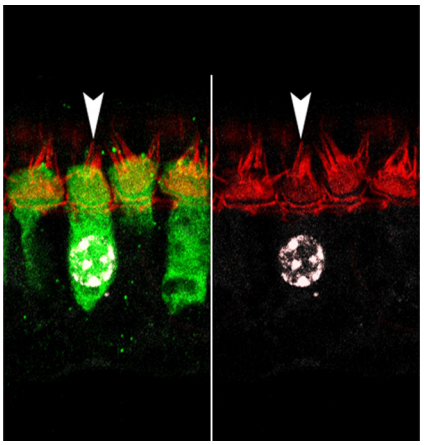
Development/Plasticity/Repair

Loss of p27^{Kip148} Lets Hair Cells Proliferate

Bradley J. Walters, Zhiyong Liu, Mark Crabtree, Emily Coak, Brandon C. Cox, et al.

(see pages 15751–15763)

Hair cell degeneration causes permanent hearing loss in mammals, but in birds, hair cell death causes surrounding supporting cells to re-enter the cell cycle and produce new hair cells. Although attempts to replicate this process in mammalian supporting cells have been somewhat successful, inducing hair cells themselves to re-enter the cell cycle and replicate may enhance efforts to restore hearing in humans. Walters et al. show that this may be possible. Conditionally knocking out p27^{Kip148}—a protein that maintains cell-cycle arrest—selectively in mouse neonatal hair cells caused the cells to proliferate and generate new inner hair cells that had stereocilia, expressed essential hair-cell proteins, and survived at least 6 weeks. Many postnatally derived hair cells appeared to be contacted by innervating nerve fibers. Importantly, auditory brainstem responses were normal despite the presence of supernumerary hair cells in transgenic mice. The next steps will be to determine whether postnatally derived hair cells contribute to auditory function and whether they can restore lost function.



Postnatally generated inner hair cells, marked by incorporation of EdU (white) and expression of calbindin (green), develop stereocilia, as indicated by phalloidin (actin) staining (red). See the article by Walters et al. for details.

Behavioral/Cognitive

TRP Channels and Serotonin Drive Worms to Cool Locales

Takeshi Inoue, Taiga Yamashita, and Kiyokazu Agata

(see pages 15701–15714)

Dugesia japonica is a species of nonparasitic flatworms best known for the ability to regenerate two separate worms when cut in half. Their relatively simple nervous system also makes them a useful model for studying behavioral control. Inoue et al. found that when placed in a thermal gradient, flatworms moved toward the coolest available temperature. This thermotaxis was also exhibited by amputated head portions, but not by headless bodies, even though these bodies moved at normal speeds. This suggests that the brain was required to generate thermotaxic behavior. Indeed, thermotaxis was restored after the head and brain regenerated in decapitated worms. Furthermore, knocking out synaptotagmin and thus preventing synaptic transmission in the regenerating brain prevented the reemergence of thermotaxis. Of the two transient receptor potential (TRP) channels expressed in a pattern suggestive of peripheral thermoreceptors, only one, a member of the melastatin family, was required for thermotaxis. In addition, although GABAergic neurotransmission in the brain is required for phototaxis, only serotonergic neurotransmission was required for thermotaxis.

Neurobiology of Disease

Developmental Regulators Are Linked to Anxious Temperament

Reid S. Alisch, Pankaj Chopra, Andrew S. Fox, Kailei Chen, Andrew T. J. White, et al.

(see pages 15548–15556)

Anxious people are more easily distracted by novel, potentially threatening stimuli, and they remain focused on such stimuli for longer than other people. These behavioral characteristics are accompanied by greater activation of the extended amygdala when threatening stimuli appear. Such individual differences in anxious temperament are heritable, and they are apparent even in infants. Importantly, toddlers who show heightened sensitivity to and withdrawal from novel stimuli are at increased risk for developing anxiety disorders. Like humans, monkeys vary in their responses to novel threatening stimuli, and anxious temperament in monkeys is heritable, appears early in development, and is reflected in heightened amygdalar activation. To identify genes that might contribute to anxious temperament, Alisch et al. examined gene expression and DNA methylation—an epigenetic modification that regulates gene expression—in the amygdala of monkeys varying in this trait. They report that *BCL11A* and *JAG1*, two genes involved in nervous system development, were more methylated and had lower expression levels in more anxious monkeys.