This Week in The Journal

Cellular/Molecular

Characterization of Cough Receptors
Stuart B. Mazzone, Sandra M. Reynolds, Nanako Mori, Marian Kollarik, David G. Farmer, et al.
(see pages 13662–13671)

Surprisingly little is known about the neural mechanism of cough. Although slow and fast adapting stretch receptors in the air passages have been hypothesized to trigger cough, stimuli that activate these receptors do not induce cough. Recently, a new receptor type responsive to touch and acid—stimuli that also evoke cough—was identified in guinea pigs. Mazzone et al. have further characterized these receptors. The cough receptors are Aβ afferents that arise from the nodose ganglia and terminate in the extracellular matrix between the smooth muscle and epithelial layers of the trachea and larynx. Unlike other cells in the airways, cough receptors expressed the sodium pump α3 subunit, and activity of this pump appeared to cause unique labeling of the receptors with the vital dye FM2–10. An α3-selective concentration of the sodium pump inhibitor ouabain reduced cough receptor excitability and cough evoked by acid or touch, without noticeably affecting other sodium-pump-dependent responses.

Development/Plasticity/Repair

Developmental Organization of Zebrafish Motor Networks
David L. McLean and Joseph R. Fetcho
(see pages 13566–13577)

As babies develop, their motor control becomes more refined: initially they make large, ballistic movements, but they gradually develop the ability to make smaller, more controlled movements. A similar pattern occurs in zebrafish: embryos make large head and tail movements during swimming, regardless of the speed; larvae produce slower swimming movements by moving only the tail. Previously, McLean et al. showed that spinal neurons controlling fast and slow larval movements are organized such that, as swimming speed increases, more dorsal neurons become active. Dorsal motor neurons are added to an expanding active pool, whereas ventral premotor interneurons are inhibited as more dorsal premotor interneurons become active. McLean and Fetcho now report that this topographical organization emerges gradually during development and reflects the development of behavior. The earliest appearing neurons, which drive fast, strong movements, are displaced dorsally by the subsequent development of more ventral neurons, which control slower, weaker movements.

Behavioral/Systems/Cognitive

Visual Enhancement of Speech Comprehension
Luc H. Arnal, Benjamin Morillon, Christian A. Kell, and Anne-Lise Giraud
(see pages 13445–13453)

Speech is easier to understand when the speaker is seen as well as heard. This could be because seeing mouth movements, which begin before sound is produced, allows the listener to anticipate the auditory stimulus. Additionally, because many spoken syllables are recognizable by mouth movements alone, visual inputs help the listener interpret ambiguous auditory inputs.

The first method of enhancement could be achieved by direct connections between visual-motion areas and auditory cortex, whereas the second would likely require comparison between the stimuli, perhaps in the superior temporal sulcus (STS), which responds to both auditory and visual speech. To distinguish these possibilities, Arnal et al. used magnetoencephalography and functional imaging to measure subjects’ responses to videos in which the audio and visual components presented the same or different syllables. Their results suggest that the shortest latency visual enhancement of auditory responses does not require comparison, but comparison involving the STS becomes involved secondarily.

Neurobiology of Disease

Pro- and Anti-Inflammatory Macrophages in Injured Spinal Cord
(see pages 13435–13444)

Tissue damage causes release of proinflammatory cytokines that attract macrophages to the injured site. After cutaneous injuries, M1 macrophages appear first; they release additional proinflammatory cytokines as well as oxidative metabolites that kill microbes but can also damage healthy tissue. Subsequently, M2 macrophages appear; they limit inflammation and promote wound healing. Kigerl et al. report that M1 macrophages increase rapidly and persist for weeks in vivo after spinal cord injury, whereas M2 macrophages are less prevalent and disappear within a few days. Although both types of macrophages promoted neurite growth in cultured neurons, M1 macrophages were also toxic. In contrast, M2 macrophages more potently enhanced growth of long axons—even in the presence of inhibitory molecules—and did not kill neurons. Because much of the functional loss associated with spinal cord injury results from macrophage-associated inflammation, these results suggest that pushing macrophages toward an M2 phenotype could both limit damage and promote recovery.

Terminals of cough receptors in guinea pig air passages labeled with FM2–10. See the article by Mazzone et al. for details.