This Week in The Journal

Cellular/Molecular

The Hair Cells of the Tokay Gecko
M. Eugenia Chiappe, Andrei S. Kozlov, and A. J. Hudspeth
(see pages 11978 –11985)

What does a nocturnal, tree-climbing, not-so-friendly lizard have to offer neuroscience? These animals have finely tuned hearing, presumably because they emit vocal signals for territoriality, mating, and distress calls. Chiappe et al. show that, like evolutionarily distinct mammals and birds, geckos have two distinct classes of hair cells. Salletal hair cells in the gecko had afferent innervation, as expected for a role in sensory transduction and transmission, whereas tectorial hair cells had smaller ionic currents and lacked afferent innervation. Tectorial or outer hair cells are considered responsible for the “active process” of the cochlea because their hair bundles have active motility. The authors suggest that separate evolution of this pattern in three distinct animal groups (mammals, archosaurs [birds], and lepidosaurs [geckos]) reflects their shared abilities in high-frequency hearing. Two hair cell types may be necessary because of conflicting requirements for efficient mechanical transduction compared with mechanical amplification of high-frequency sounds.

Development/Plasticity/Repair

Pericytes and Blood Vessels in the Germinal Matrix
Alex Braun, Hongmin Xu, Furong Hu, Praneeth Kocherlakota, Donald Siegel, Praveen Chander, Zoltan Ungvari, Anna Csiszar, Maiken Nedergaard, and Praveen Ballabh
(see pages 12012–12024)

The germinal matrix (GM), a richly vascularized collection of neural precursor cells in the neonatal brain, is particularly susceptible to hemorrhage in premature infants. Braun et al. reasoned that rapid angiogenesis in GM might contribute to an unstable vasculature network. The authors focused on pericytes, cells that lend structural support to small blood vessels. Pericytes were sparser in GM than in white matter or cortex throughout gestation, as determined by labeling for pericyte marker proteins in postmortem samples of human fetuses and premature infants. Ultrastructural morphology from these samples as well as from premature rabbit pups confirmed the finding. When the authors suppressed angiogenesis in pregnant rabbits by inhibiting vascular endothelial growth factor (VEGF) signaling, pericyte coverage and density increased in the GM of premature pups. The GM also had a lower expression of molecules that can recruit pericytes including transforming growth factor-β1.

Behavioral/Systems/Cognitive

Sleeping Fur Seals
Jennifer L. Lapierre, Peter O. Kosenko, Oleg I. Lyamin, Tohru Kodama, Lev M. Mukhametov, and Jerome M. Siegel
(see pages 11999 –12006)

By necessity, whales and dolphins have mastered the art of underwater sleeping. Instead of us terrestrial who have bilateral slow-wave sleep (BSWS), these marine mammals show unihemispheric slow waves during sleep while the other hemisphere has desynchronized activity characteristic of the waking state. This week, Lapiere et al. investigated sleep in the northern fur seal that switches between BSWS and asymmetric slow-wave sleep (ASWS) as it moves from land to sea. At the Utrish Marine Station in Russia, microdialysis samples were collected from a set of bilateral, cortically implanted probes. Phases of the sleep–wake cycle were monitored by electroencephalogram (EEG) and physiological measures. Acetylcholine (ACh) release peaked during active waking, was lower during quiet waking and rapid eye movement (REM) states, and dramatically declined during BSWS. However, during ASWS, ACh levels were lateralized, with greater release in the more “awake” hemisphere. Seems it’s OK for a seal to be half-asleep.

Neurobiology of Disease

Imaging Axonal Injury
Christine L. Mac Donald, Krikor Dikranian, Philip Bayly, David Holtzman, and David Brody
(see pages 11869 –11876)

Traumatic axonal injury can be dramatic as following a motor vehicle accident or more insidious as can occur with multiple concussions. This week, Mac Donald et al. evaluated the sensitivity of diffusion tensor imaging (DTI) in detecting axonal injury. DTI measures water diffusion in independent directions; thus disruption of axons reduces the anisotropy that is normally associated with highly laminated white matter. The authors evoked a cortical impact injury in anesthetized mice and assessed axonal injury to the corpus callosum and external capsule. Three phases could be identified histologically. In the first 24 h after injury, there was pure axonal injury that then was followed by marked gliosis by d. After 7–30 d, axonal injury was less apparent, but thinning of myelin and active demyelination was prominent. DTI was quite sensitive, revealing reduced anisotropy at all intervals with changes that correlated with the degree of histological injury and the time after injury.

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