This Week in The Journal

● Cellular/Molecular

Hair Cell Synapses Undergo Facilitation

Juan D. Goutman and Elisabeth Glowatzki

(see pages 7974–7981)

The resting membrane potential of cochlear inner hair cells is more depolarized than that of most neurons, so some of their voltage-sensitive calcium channels are activated at rest and the cells release neurotransmitter even in the absence of overt stimulation. Sound stimulation further depolarizes hair cells, causing a graded increase in vesicle release and increased firing of afferent nerves. With prolonged stimulation, auditory nerve firing shows adaptation resulting from synaptic depression as the pool of readily releasable vesicles is depleted. Hair cell synapses also undergo facilitation, and vesicle release *in vivo* may be greater than previously thought. Hair cell transmission has typically been studied using holding potentials of −89 mV to enhance currents and reduce inactivation of voltage-sensitive channels. But Goutman and Glowatzki found that depolarizing cells to more physiological resting potentials (approximately −50 mV) before delivering a depolarizing test pulse resulted in fewer synaptic failures, larger EPSCs, and shorter synaptic latencies.

▲ Development/Plasticity/Repair

Cranial Window Reveals Net Addition of Olfactory Bulb Neurons

Yoav Adam and Adi Mizrahi

(see pages 7967–7973)

Neurogenesis in the adult mammalian CNS is most prominent in the olfactory bulb, where local interneurons are continually replaced by newborn neurons. Fate-mapping studies in adult mice have suggested that new neurons are added to the juxtaglomerular neuron population at a rate of ~2.5% per month. Although some studies have suggested that this rate of addition approximately balances the rate of neuronal death, others have suggested that it results in a net increase in the neuronal population of the bulb. The discrepancy might result in part from interindividual differences in neuronal addition and death. Adam and Mizrahi therefore examined neuronal turnover in living animals, using a newly developed cranial-window technique to examine fluorescently labeled dopaminergic olfactory bulb interneurons over several imaging sessions. They found that the number of dopaminergic neurons added exceeded the number lost, resulting in a net increase of ~13% between 3 and 12 months of age.

■ Behavioral/Systems/Cognitive

Pair Bonding Reduces Amphetamine-Induced Conditioning

Yan Liu, Kimberly A. Young, J. Thomas Curtis, Brandon J. Aragona, and Zuoxin Wang

(see pages 7960–7966)

Studies in humans suggest that positive social experiences reduce drug seeking and taking. Prairie voles are valuable for studying the neurological effects of social relationships because they form long-term monogamous relationships. When voles receive rewarding drugs such as amphetamine in a specific cage chamber, they subsequently spend more time in that chamber. This phenomenon is called conditioned place preference (CPP). Both CPP and the formation and maintenance of pair bonds in male voles require dopamine release in the nucleus accumbens (NAcc). Liu et al. previously showed that amphetamine-induced CPP in male voles prevented subsequent formation of pair bonds. They now show the reciprocal effect: formation of pair bonds impaired the development of amphetamine-induced CPP. Amphetamine increased dopamine release in the NAcc to a similar degree in sexually naive and pair-bonded voles, but only the former developed CPP. Amphetamine-induced reduction in D1 dopamine receptor occupation in pair-bonded males might underlie this effect.

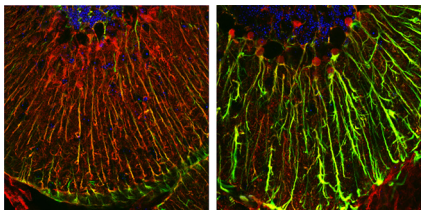
♦ Neurobiology of Disease

Loss of Astrocytic MicroRNAs Causes Cerebellar Degeneration

Jifang Tao, Hao Wu, Quan Lin, Weizheng Wei, Xiao-Hong Lu, et al.

(see pages 8306–8319)

MicroRNAs are noncoding RNAs that bind to matching sequences in the 3′ untranslated region of coding mRNAs and inhibit mRNA translation. MicroRNAs are derived from long transcripts that are subsequently cleaved and processed to form double-stranded RNA of 22 bp. Knocking out Dicer, a microRNA-processing protein, depletes most cellular microRNAs and has revealed the importance of microRNAs in neuron and oligodendrocyte differentiation. Tao et al. have now selectively knocked out Dicer in mouse astrocytes beginning shortly after birth. The mice appeared to develop normally for several weeks, but then genes characteristic of immature or reactive astrocytes were upregulated and genes related to mature astrocyte functions, such as removing glutamate and D-serine from synapses, were downregulated. Surprisingly, although knock-down of Dicer in the cerebellum was restricted to astroglia, it resulted in degeneration of cerebellar granule and Purkinje neurons, probably from excitotoxicity. The neuronal degeneration led to ataxia, paralysis, and, ultimately, death.



At P42, although processes of cerebellar Bergmann glia lacking Dicer (right) expressed a marker of mature glia (S100b, red), they were thicker and more disorganized than those in wild-type mice (left), and they had higher levels of GFAP (green). See the article by Tao et al. for details.