This Week in The Journal

Cellular/Molecular

Amine-Sensing Olfactory Neurons Are Extremely Sensitive

Jingji Zhang, Rodrigo Pacifico, Dillon Cawley, Paul Feinstein, and Thomas Bozza

(see pages 3228–3239)

Trace amine-associated receptors (TAARs) are a small group of chemosensory receptors that, like canonical odorant receptors, are expressed in olfactory sensory neurons (OSNs). Several ligands for mouse TAARs are found in urine of conspecifics or predators, suggesting that the receptors are important for detecting social signals or threats. Little is known about odorant response properties of OSNs that express TAARs or the signaling cascades normally activated by TAAR ligands, however. Therefore, Zhang et al. recorded from fluorescently labeled TAAR-expressing OSNs in mouse nasal epithelial explants and measured responses to various volatile compounds. The OSNs responded preferentially and sometimes exclusively to amines. Unlike heterologous cells that were transfected with TAARs, TAAR-expressing OSNs were broadly tuned, responding to all six structurally diverse amines tested; response selectivity appeared only at low concentrations. TAAR4 was particularly sensitive, responding to femtomolar concentrations of amines—100-fold more sensitive than the most sensitive OSNs that express canonical odorant receptors, and as sensitive as pheromone receptors in the vomeronasal organ.

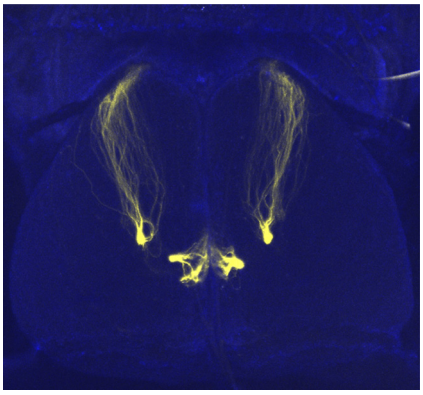
Development/Plasticity/Repair

CNTF Promotes Migration of Oligodendrocyte Precursors

Julien Vernerey, Magali Macchi, Karine Magalon, Myriam Cayre, and Pascale Durbec

(see pages 3240–3250)

After brain injury, oligodendrocyte precursors migrate from the subventricular zone (SVZ) to the site of injury, where they differentiate, mature, and remyelinate axons. Ciliary neurotrophic factor (CNTF) is upregulated in demyelinating diseases, and it has been shown to promote progenitor proliferation, survival, and maturation, as well as remyelination. Vernerey et al. now show that CNTF also promotes migration of SVZ-derived oligodendrocyte precursors to injury sites in mice. After lysolecithin-induced demyelination of the corpus callosum, CNTF levels increased and SVZ-derived progenitors appeared at the site. CNTF-neutralizing antibodies halved the number of SVZ-derived progenitors and significantly decreased proliferation of local parenchymal oligodendrocyte precursor cells (OPCs) in the corpus callosum without affecting cell survival. In contrast, grafting CNTF-secreting HEK cells in the corpus callosum of healthy mice greatly increased the number of SVZ-derived neurons in this area and increased proliferation of local OPCs without affecting proliferation or cell survival in the SVZ. Finally, SVZ-derived neural progenitors and OPCs migrated toward sources of CNTF *in vitro*.



Mouse OSNs expressing human TAAR5, like those expressing endogenous TAAR4, are located throughout the dorsal recess of the olfactory epithelium and project to glomeruli in the dorsal aspect of the main olfactory bulb. See the article by Zhang et al. for details.

Behavioral/Cognitive

Medullar Inhibition Induces Torpor-Like State

Matteo Cerri, Marco Mastrotto, Domenico Tupone, Davide Martelli, Marco Luppi, et al.

(see pages 2984–2993)

Many mammals enter a state of torpor in which body temperature, metabolic rate, heart rate, and activity are reduced to conserve energy in harsh conditions. Induction of a torpor-like state might be protective in cases of trauma and ischemia, but attempts to induce such states in non-hibernating animals have had limited success. Because metabolic slowing is the initial event in natural torpor, attempts to induce torpor have used molecules that slow metabolism. Cerri et al. took a different approach, targeting the rostral ventromedial medulla (RVMM), a brain region that helps maintain body temperature by promoting thermogenesis, blood vessel constriction, and increased heart rate. After rats were placed in total darkness at 15°C, injections of $GABA_A$ receptor agonist into the RVVM increased heat loss, likely due to vasodilation. Consequently, brain temperature dropped from 37 to 22°C, heart rate was halved, electroencephalographic activity nearly disappeared, and most movement ceased. After ambient temperature was raised to 28°C, all measures returned to control levels within 4 h.

Neurobiology of Disease

PrP^C Has Role in PKA-Dependent Plasticity

Maddalena D. Caiati, Victoria F. Safiulina, Giorgia Fattorini, Sudhir Sivakumaran, Giuseppe Legname, et al.

(see pages 2973–2983)

Mossy fiber connections between dentate granule cells and hippocampal CA3 pyramidal cells mature postnatally in rodents. During this time, giant depolarizing potentials (GDPs) driven by synergistic actions of depolarizing GABAergic and glutamatergic synapses in developing networks are thought to promote synaptic efficacy. The nontoxic cellular form of prion protein (PrP^C), which causes neurodegenerative disease when misfolded, is also highly expressed in the developing hippocampus at this stage, and its predominant synaptic localization suggests it may be involved in shaping connections. Caiati et al. confirmed this hypothesis, showing that stimulation of mossy fibers during GDPs—which produced long-term potentiation with increased release probability in hippocampal slices from wild-type mice—produced long-term depression (LTD) with lower release probability in PrP^C-null hippocampus. This effect was similar to that produced by the same stimulation in wild-type mice when depolarization, calcium increase, or protein kinase A (PKA) activation was prevented in postsynaptic cells. The authors conclude that PrP^C is required to induce LTP that involves postsynaptic PKA activation.