This Week in The Journal

● Cellular/Molecular

Degenerating Olfactory Axons Trigger Antennal Lobe Plasticity

Hokto Kazama, Emre Yaksi, and Rachel I. Wilson

(see pages 7619–7630)

In many sensory systems, removing afferent input causes central representations of spared inputs to expand. This was not thought to occur in *Drosophila* antennal lobes, because deafferentation of some glomeruli caused neither invasion of those glomeruli by spared olfactory receptor neuron axons nor extension of dendrites from deafferented projection neurons (PNs) into adjacent glomeruli. But glomeruli receive excitatory inputs from local neurons as well as from receptor neurons, and Kazama et al. found that when antennae were removed, inputs to antennal glomeruli from local neurons increased. As a result, olfactory stimuli relayed by spared receptor neurons evoked action potentials in deafferented projection neurons. Interestingly, this plasticity was not triggered by loss of synaptic input to the projection neurons, but rather by a substance released by degenerating axons that was taken up by glia that ensheath glomeruli. Blocking degeneration by expressing a neuroprotective protein or blocking endocytosis in ensheathing glia prevented induction of plasticity.

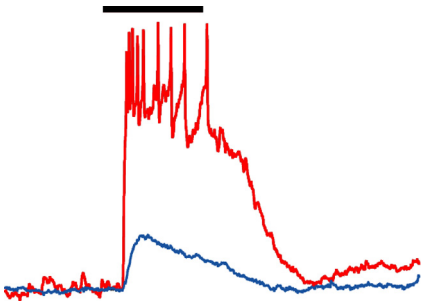
▲ Development/Plasticity/Repair

Cutting Some Adult Gustatory Nerves Triggers Growth in Others

Sara L. Corson and David L. Hill

(see pages 7591–7603)

Like other sensory afferents, gustatory nerves in rats initially branch exuberantly in their target area, but branches are pruned during maturation. The chorda tympani nerve's arborization in the rostral nucleus of the solitary track, which overlaps extensively with those of the superficial petrosal and glossopharyngeal nerves at postnatal day (P) 15, undergoes the most pruning of the three



Whole-cell current-clamp recording from an antennal PN. Odor-evoked responses in antennal projection neurons are typically small immediately after antenna removal (blue), but become much larger (red) as input from local neurons increases. See the article by Kazama et al. for details.

gustatory nerves. Corson and Hill present evidence that, like in other sensory systems, this developmental reorganization depends partly on interactions between nerves. Cutting the superficial petrosal and glossopharyngeal nerves at P15 reduced subsequent pruning of chorda tympani nerves. Surprisingly, cutting the nerves after developmental pruning had taken place resulted in regrowth of the chorda tympani arbor to the size and extent of coverage normally seen at P15. These results indicate that this gustatory nerve retains the capacity for extensive growth through adulthood and that continued nerve–nerve interactions hold growth in check.

■ Behavioral/Systems/Cognitive

Mineralocorticoid Receptors Affect Glucocorticoid Receptors via NOS

Qi-Gang Zhou, Li-Juan Zhu, Chen Chen, Hai-Yin Wu, Chun-Xia Luo, et al.

(see pages 7579–7590)

Stressful events lead to secretion of corticosteroids by the adrenal glands. Corticosteroids, in turn, enhance arousal and other behavioral and cognitive responses. The initial effects of corticosteroids in the CNS are mediated by high-affinity mineralocorticoid receptors (MRs), whereas activation of lower-affinity glucocorticoid receptors (GRs) terminates the stress response. Chronic stress is thought to produce illnesses such as depression by causing an imbalance in MR and GR activity, but the molecular mechanisms underlying the behavioral effects of chronic stress are poorly understood. Zhou et al. have gone a long way toward resolving this issue. They previously reported that chronic stress increases expression of neuronal nitric oxide synthase (nNOS) in mouse hippocampus. They now show that nNOS upregulation requires activation of hippocampal MRs, and nNOS activates extracellular signal-regulated kinase (ERK), leading to downregulation of hippocampal GRs. Blocking MRs, nNOS, or ERK prevented both downregulation of GRs and the behavioral consequences of chronic stress.

♦ Neurobiology of Disease

APP, not Aβ, Accumulates within 3xTG-AD Neurons

Matthew J. Winton, Edward B. Lee, Eveline Sun, Margaret M. Wong, Susan Leight, et al.

(see pages 7691–7699)

The hallmarks of Alzheimer's disease (AD)—extracellular plaques composed of β-amyloid (Aβ) peptides and intracellular neurofibrillary tangles composed of hyperphosphorylated tau protein—have long been recognized, yet the connection between these deposits and the pathological process remains unclear. Intracellular accumulation of Aβ has been proposed as an early pathological event. Such accumulations have been detected immunohistochemically before the onset of other AD-associated symptoms in human cells and in triple-transgenic (3xTg-AD) mice that overexpress human tau, amyloid precursor protein (APP), and presenilin (an enzyme involved in amyloidogenic cleavage of APP). But the specificity of antibodies used in previous studies has been questioned. Using a panel of antibodies specific for full-length APP and Aβ peptides, Winton et al. show that only full-length APP accumulates intracellularly in 3xTg mice. Knocking out an APP-cleaving enzyme, β-secretase, did not reduce accumulation of either intracellular APP or hyperphosphorylated tau, indicating that neither event requires Aβ production.