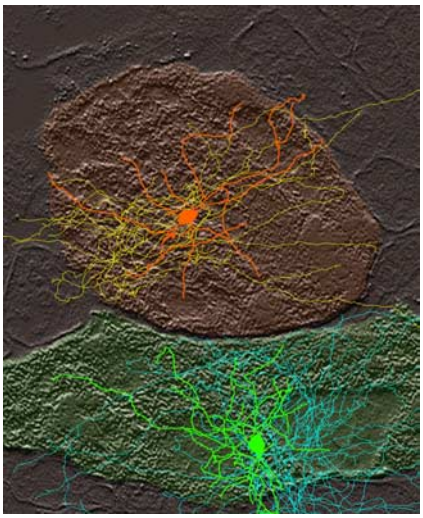
This Week in The Journal

● Cellular/Molecular

Heterologous Electrical Coupling in Neocortex

Anna Simon, Szabolcs Oláh, Gábor Molnár, János Szabadics, and Gábor Tamás
(see pages 6278–6285)

Long underappreciated, electrical synapses between neurons are enjoying a renaissance in central synaptic transmission. This week, Simon et al. characterize electrical connections formed by cortical neurogliaform (ngf) cells. Called spiderweb cells by Ramon y Cajal, these GABAergic interneurons have short radial dendrites and dense axonal arbors and mediate slow inhibition of pyramidal cells. In slices of rat somatosensory cortex, gap junctions connected ~50% of ngf cells. In addition, 20% of ngf cells also formed gap junctions with other interneurons, including fast-spiking basket cells, regular-spiking nonpyramidal cells, and bitufted cells as identified by their firing patterns and morphology. Gap junctions were identified by electron microscopy in the somatodendritic compartment. These results suggest that interneuronal electrical coupling is not strictly homologous but extends across different classes of interneurons. How heterologous electrical connections contribute to the gap junction-mediated synchronization of interneurons remains to be explored.



Neurogliaform cells establish electrical synapses and link multiple networks formed by gap junctions restricted to a particular class of interneuron. Foreground, Light microscopic reconstructions of a neurogliaform cell (soma and dendrites, orange; axon, yellow). The background shows an embossed electron microscopic image of a gap junction between dendrites of the two cells shaded according to the light microscopic reconstructions of the foreground. See the article by Simon et al. for details.

▲ Development/Plasticity/Repair

Retained Phenotypes in Dopamine Neuron Grafts

Lachlan Thompson, Perrine Barraud, Elin Andersson, Deniz Kirik, and Anders Björklund
(see pages 6467–6477)

To be maximally effective in restoring function, transplanted cells not only must retain a specific neuronal phenotype but also must become correctly wired into the existing circuitry—no small task. In the case of fetal ventral mesencephalic tissue, the two subpopulations of dopaminergic neurons, A9 neurons of the substantia nigra pars compacta (SNpc) and A10 neurons of the ventral tegmental area (VTA), have different properties and targets. To track the fate of transplanted ventral mesencephalon (VM) neurons, Thompson et al. used VM neurons from a transgenic mouse expressing green fluorescent protein under the control of a tyrosine hydroxylase promoter. 6-OHDA-denervated rats served as the host. Whereas VTA neurons were small and rounded and expressed calbindin, SNpc neurons were larger and angular and expressed the potassium channel Girk2. Retrograde tracing revealed that A9 SNpc neurons predominantly, and correctly, innervated the striatum, whereas VTA A10 neurons projected to the frontal cortex. Thus the transplanted cells in these circumstances appear to retain their phenotype and target specificity.

■ Behavioral/Systems/Cognitive

Cross-Orientation Suppression, Revisited

Frank Sengpiel and Vasily Vorobyov
(see pages 6394–6400)

Neurons of the primary visual area (V1) respond most robustly to optimally oriented stimuli. When a stimulus of the orthogonal orientation is either superimposed in the same eye or presented to the other eye, the response of the neuron is suppressed, resulting in "cross-orientation suppression." Opinions differ on whether this inhibition is rooted in cortical inhibitory circuits or thalamocortical synapses. This week, Sengpiel and Vorobyov investigate cross-orientation suppression, in which they presented orthogonally oriented stimuli to either eye of cats and made extracellular recordings from V1 neurons. They found that, unlike monocular suppression, interocular suppression was dependent on the suppressor drift rate, suggesting that the interocular version arose from cortical neurons. Interocular suppression was also subject to decay by the cortical phenomenon of adaptation and was prevented by intracortical delivery of a $GABA_A$ antagonist. Thus distinct circuitry underlies the two forms of cross-orientation suppression.

◆ Neurobiology of Disease

Making "Fierce" Mice a Bit More Human

Brett S. Abrahams, Melvin C. H. Kwok, Eric Trinh, Saeed Budaghzadeh, Sazzad M. Hossain, and Elizabeth M. Simpson
(see pages 6263–6270)

Only to the most skittish are mice considered fierce. However, in the absence of nuclear receptor 2E1 (*NR2E1*), even laboratory mice can become fierce, displaying pathological violent behavior as well as hypoplastic brain and retinal development. Such "fierce" males often kill their intended mate, whereas fierce females are poor mothers. Abrahams et al. tested whether the mouse and human *NR2E1* genes are equivalent. The authors replaced the gene in *NR2E1* null mice by crossing these animals with transgenic mice containing a genomic DNA clone spanning the human *NR2E1* locus. They assessed a variety of behaviors, such as tail rattling, wrestling, and biting in response to an intruder. The human gene completely restored normal morphology and behavior, indicating that the mouse and human gene share common functions. The authors suggest that such "humanized" mice may be useful for examining the behavioral consequences of individual genes.