This Week in The Journal

● Cellular/Molecular

Tracking Down Anomalous L Channels

Alexandra Koschak, Gerald J. Obermair, Francesca Pivotto, Martina J. Sinnegger-Brauns, Jörg Striessnig, and Daniela Pietrobon

(see pages 3855–3863)

In this week's *Journal*, Koschak et al. identify $Ca_v1.2$ as the pore-forming subunit of anomalous L-type calcium channels in neurons, a subclass of L-type channels that show long reopenings at negative voltages after a strong depolarization. These channels coexist with conventional L-type channels in rat cerebellar granule cells as well as other neurons. The authors found by quantitative reverse transcription-PCR that the bulk of L-type calcium channel transcripts in granule cells encoded $Ca_v1.2$ subunits, whereas the remainder encoded $Ca_v1.3$. Single-channel recording from granule cells in $Ca_v1.3^{-/-}$ mice revealed normal amounts of both gating types. In $Ca_v1.2DHP^{-/-}$ mice, which express mutant $Ca_v1.2$ channels that are insensitive to dihydropyridines (DHPs), the long reopenings in neurons treated with DHP were similar to anomalous currents in wild-type neurons and shorter than typical DHP-induced long openings. The authors suggest that the anomalous openings may drive L-type channel-dependent gene transcription in long-lasting plasticity.

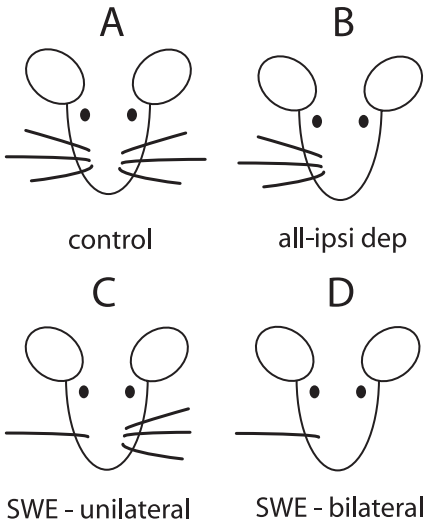
▲ Development/Plasticity/Repair

An Interhemispheric Effect on Whisker Plasticity

Stanislaw Glazewski, Brett L. Benedetti, and Alison L. Barth

(see pages 3910–3920)

Glazewski et al. did some fancy whisker trimming in mice to examine experience-dependent plasticity in barrel cortex. In rodents, whisker deflection excites neurons in the contralateral somatosensory cortex, whereas concurrent stimulation of ipsilateral whiskers is inhibitory. The authors recorded responses in single neurons in barrel cortex after deflection of contralateral whiskers. Mice deprived of ipsilateral whiskers for 1 week had increased cortical receptive fields to contralateral whisker stimulation. Next, the mice got an "all-but-one" trim in which all whiskers but one were removed on the contralateral side, with or without removal of ipsilateral whiskers. When ipsilateral whiskers were shaved, the spared whisker responses increased for neurons within the barrel and in surrounding neurons. As expected, spared whisker receptive fields expanded into neighboring neurons deprived of whiskers. However, when ipsilateral whiskers were intact, spared whisker responses were relatively reduced, suggesting that interhemispheric sensory input dampens receptive field plasticity.



The schematic shows four of the experimental conditions used by Glazewski et al. to test whisker responses in barrel cortex. ***A***, Control mice; ***B***, deprivation of ipsilateral whiskers for 7 d; ***C***, ***D***, removal of all whiskers but one on the contralateral side, with or without removal of ipsilateral whiskers. See the article by Glazewski et al. for details.

■ Behavioral/Systems/Cognitive

Stop-and-Go Tract Tracing

Adam R. Aron, Tim E. Behrens, Steve Smith, Michael J. Frank, and Russell A. Poldrack

(see pages 3743–3752)

Aron et al. this week mapped a connection between brain regions that control cognitive "stop" signals. The authors looked for a direct link between inferior frontal cortex (IFC) and subthalamic nucleus (STN) in human subjects using diffusion-weighted imaging tractography, a form of magnetic resonance imaging (MRI). They identified a white matter tract between STN and IFC in the right hemisphere; each of these regions also projected to the presupplementary motor area (preSMA). Next, subjects were instructed to stop a motor task command under some conditions and to ignore a stop signal under others. Functional MRI revealed increased activity in the IFC, STN, and preSMA when a stop signal was delivered under the noncritical condition, similar to outright stop responses. In this network, preSMA may serve a conflict-monitoring function for the stop signals involving IFC and STN.

♦ Neurobiology of Disease

An Old Treatment for Epilepsy and a New Cellular Mechanism

Weiyuan Ma, Jim Berg, and Gary Yellen

(see pages 3618–3625)

A low-carb ketogenic diet, although definitely not delicious, can be therapeutic in intractable epilepsy. However, seizure protection ends abruptly with sugar intake. Ma et al. looked for a cellular mechanism in GABAergic neurons of the substantia nigra pars reticulata. These neurons normally fire at high rates, have been implicated in seizure spread, and express a metabolic sensor, the ATP-sensitive potassium channel K_{ATP}. In rodent brain slices, ketone bodies (β-hydroxybutyrate or acetoacetate) slowed the firing of these cells by ~10%. Pharmacological activation of normally silent K_{ATP} channels also slowed or silenced neuronal firing. The ketone-induced slowing was absent in mice lacking the Kir6.2 subunit of K_{ATP} channels in plasma membranes. In a twist yet to be fully resolved, the effect also required signaling through $GABA_B$ receptors. The authors propose that loss of glycolytic ATP production under ketogenic conditions lowers the ATP concentration at the plasma membrane and thus disinhibits K_{ATP} channels.