This Week in The Journal

● Cellular/Molecular

Radial Glia Move Up by Notch1

Sequential Signaling through Notch1 and erbB Receptors Mediates Radial Glia Differentiation

Brooke A. Patten, Jean Michel Peyrin, Gerry Weinmaster, and Gabriel Corfas

(see pages 6132–6140)

Radial glia cells have a dual role in cortical development, both as a source of newborn neurons and as the source of "guidewires" for the migration and targeting of neurons. However, radial glial cells are not soloists. Neuronal–glial signaling via direct cell–cell contact is thought to be critical to these events, as originally proposed in the cerebellum. Neuregulin (NRG)–erbB receptor signaling is known to be involved in this interaction. Patten et al. now make use of cerebellar astrocyte–granule cell cultures to unmask a sequential signaling cascade involving two ligand–receptor pairs, NRG–erbB and Jagged1–Notch1. Notch1 receptors on cerebellar astrocytes were activated by direct contact with granule cells that express Notch1 ligand. Notch1 activation triggered transcriptional activation in astrocytes as well as the characteristic development of radial glial fibers. Notch1 signaling was upstream of erbB signaling and led to increased expression of erbB receptors. Because erbB receptor activation was required for the glial morphological transformation, the authors suggest that a Notch1-mediated increase in erbB receptors could enhance the effect of neuronal NRG, leading to erbB activation and to the development of radial glial fibers. Notch1 and erbB may pair up in other developmental contexts.

▲ Development/Plasticity/Repair

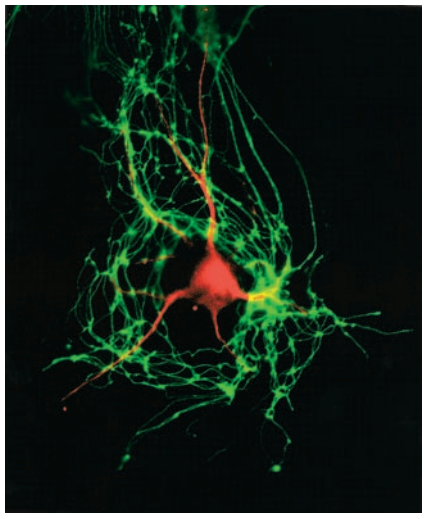
Transsynaptic BDNF Signaling in GABAergic Neurons

Inhibitory But Not Excitatory Cortical Neurons Require Presynaptic Brain-Derived Neurotrophic Factor for Dendritic Development, as Revealed by Chimera Cell Culture

Keigo Kohara, Akihiko Kitamura, Naoki Adachi, Megumi Nishida, Chiaki Itami, Shun Nakamura, and Tadaharu Tsumoto

(see pages 6123–6131)

Brain-derived neurotrophic factor (BDNF) is involved in the maturation and maintenance of neuronal circuits throughout the CNS. BDNF affects inhibitory neurons, yet it is widely accepted that inhibitory neurons do not produce BDNF. Kohara et al. used an elegant "chimera culture" system to examine the source of BDNF acting on inhibitory neurons. GABAergic cortical neurons from a *BDNF−/−* mouse were cocultured with neurons from another mouse whose neurons expressed green fluorescent protein (GFP) (and contained BDNF). BDNF was detected only in those inhibitory neurons that received presynaptic input from a GFP-labeled excitatory neuron, suggesting an anterograde transfer of the trophic factor.



A cortical inhibitory neuron (red) contacted by GFP-positive excitatory afferents in "chimera cell culture." See Kohara et al. for details.

Dendritic development was enhanced in inhibitory neurons contacted by BDNF-containing presynaptic terminals. In contrast, excitatory neurons seemed indifferent to presynaptic BDNF, perhaps suggesting that they receive BDNF via an autocrine loop. However, the BDNF requirement for dendritic development of excitatory neurons was not directly tested in these experiments.

■ Behavioral/Systems/Cognitive

Jet-Lagging the Rat

An Abrupt Shift in the Day/Night Cycle Causes Desynchrony in the Mammalian Circadian Center

Mamoru Nagano, Akihito Adachi, Ken-ichi Nakahama, Toru Nakamura, Masako Tamada, Elizabeth Meyer-Bernstein, Amita Sehgal, and Yasufumi Shigeyoshi

(see pages 6141–6151)

The light-sensitive biological "clock" that resides in the hypothalamic suprachiasmatic nucleus (SCN) controls circadian rhythms (and mood for those who suffer from seasonal affective disorder). Now Nagano et al. report a potential mechanism in the SCN for another human condition: jet lag. When we are exposed to rapid shifts in the light/dark cycle, our SCN must adjust to reset the proper sleep–wake rhythm. The circadian pacemaker is regulated by the so-called "clock genes," including period (*Per*) and cryptograph (*Cry*). After manipulating the light/dark cycle in rats, Nagano et al. examined the coordinated readjustment of mRNA expression of rat *Per-1* (r*Per-1*), r*Per-2*, and r*Cry-1* with that of the behavioral sleep cycle. Clock gene expression in the ventrolateral SCN, the target of incoming retinal fibers, shifted rapidly, while the dorsomedial SCN lagged. Thus the two subregions were out of "synch." These results are consistent with two spatially segregated clocks in the SCN, with the dorsomedial region presumably dependent on input from the ventrolateral region for clues about the light cycle. Resynchronization of the two subregions took a surprisingly long time: a 10 hr delay in the cycle required 5–7 d to reset; a 6 hr advance required 9–13 d. The message? Eastbound travelers, be patient with your biological clock.