SCIENCE

Developmental Neurobiology

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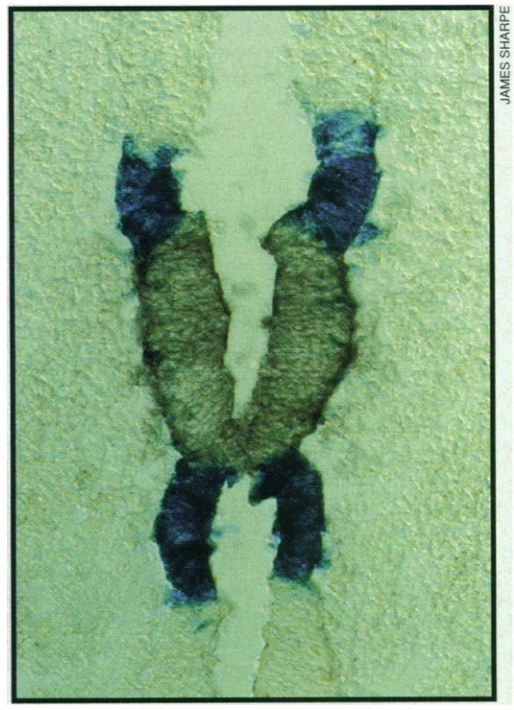
A Special Report


JAMES SHARPE

The nervous system, once thought to be so complicated that it would defy our efforts to understand it, has begun to yield its secrets with accelerating speed. Indeed, researchers' efforts to understand how the nervous system develops have succeeded to the point that Martin Raff of London's University College can aptly describe the progress as "staggering" in the guest Editorial that opens this Special Issue on Developmental Neurobiology. The articles in this issue describe some of that staggering progress.

Two deal with the earliest stages of vertebrate neurodevelopment, from the first formation of the neural ectoderm, the tissue that will give rise to the brain and spinal cord, to the later division of the central nervous system into the regions that will go on to acquire specific functions. Using the hindbrain and midbrain as examples, A. Lumsden and R. Krumlauf focus on how the overall anterior-posterior pattern of the nervous system is specified. Both the *Hox* genes and a variety of signaling molecules, such as retinoic acid, are important players in establishing the fates of these early cells. In their article, Y. Tanabe and T. M. Jessell take up dorsal-ventral patterning. Here the spinal cord serves as a useful example. Signals, such as Sonic Hedgehog, emanate from the floor plate of the spinal cord and the underlying notochord to direct the fate of the spinal neurons.

As neurons acquire particular identities, they begin forming the interconnections that wire the mature nervous system. M. Tessier-Lavigne and C. S. Goodman describe axon guidance, the process by which a growing axon finds a reasonable route toward a likely target. The signposts along the way include both soluble and nondiffusible molecules, which give instructions that can either attract or repel the elongating axon.

Once the neural circuits are roughly sketched in early development, their final structure is refined by neuronal activity. L. C. Katz and C. J. Shatz discuss how both sensory experience and spontaneous neural activity can polish the final development of functional neural circuits as well as enable the mature central nervous system to respond to changing inputs.

To complement these articles, the News report offers two stories. One describes the human and mouse mutations that are helping reveal the molecules that guide newborn cortical neurons to their final destinations in the brain; another examines new developments in understanding the plasticity of the neuromuscular junction, findings that may also shed light on learning and memory.

And finally, F. E. Bloom provides an analysis of the neuroscience resources available on the World Wide Web, including those devoted to the intersection of neuroscience and developmental biology.

–Pamela J. Hines and Jean Marx