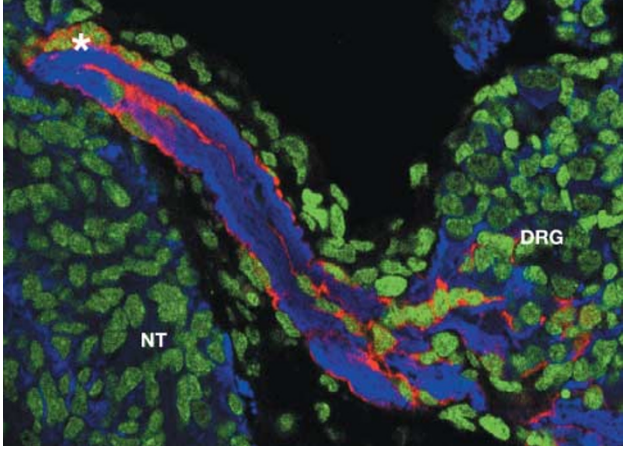

Boundary cap (BC) cell derivatives, labelled in red, migrating along the nerve root into the dorsal root ganglion (DRG). The star marks the position of the BC. The neuronal marker β-III-tubulin is immunolabelled in blue and nuclei are counterstained in green. NT, neural tube. Image courtesy of P. Charnay, INSERM U 368, Paris, France.

NEUROGENESIS

To cap it all…

Boundary cap (BC) cells are a neural-crest-derived cell population that cluster at the peripheral-nerve entry and exit points of the developing spinal cord (the dorsal root entry zone and motor exit point, respectively). Here, they 'police' the CNS/PNS interface, where they allow axons, but not whole cells, to pass through. Until recently, little was known about their fate on completion of this task, but an intriguing new report in *Nature Neuroscience* provides evidence that they make a substantial cellular contribution to the somatic PNS.

In mice, there is a time window — between embryonic day (E) 10 and E15.5 — when expression of the *Egr2* (*Krox20*) gene in the trunk region is confined to BC cells. Maro and colleagues exploited this fact to generate knock-in mice, in which *Egr2* expression triggered a recombination event that resulted in permanent activation of a marker gene (either β-galactosidase or yellow fluorescent protein). This enabled them to track the fate of both the BC cells and their progeny.

The authors found that the labelled cells migrated along peripheral axons and colonized the spinal nerve roots and dorsal root ganglia (DRGs). They seemed to give rise to all of the Schwann cells in the dorsal root, as well as a subset of DRG neurons and satellite cells. Most of the BC-derived neurons in the DRG expressed TrkA, a marker of nociceptive neurons, and this observation provided a clue to the sequence of developmental events. Primary sensory neurons are known to arise in two waves — the first wave generates large-diameter proprioceptive and mechanoreceptive neurons, and the second wave generates small-diameter nociceptive neurons. The origin of the second wave was previously unclear, but these results indicate that BC neurons are at least partly responsible.

So, it seems that the neural crest can generate components of the PNS both directly, through an early-migrating cell population, and indirectly, through a BC-cell intermediate. It will be interesting to investigate whether the BC cells represent a true multipotent stem-cell population or a heterogeneous collection of precursors that are already committed to a neuronal or glial cell fate.

Heather Wood

References and links

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FURTHER READING Mosher, J. T. & Morrison, S. J. Crossing the boundaries of sensory neurogenesis. *Nature Neurosci.* **7**, 900–902 (2004)

SYSTEMS NEUROSCIENCE

A place for everything

Three recent papers provide new insights into the encoding of spatial information by the hippocampus and entorhinal cortex. The first delves into the importance of the entorhinal cortex in providing spatial information to the hippocampus, and the other two investigate the functional differences between hippocampal subfields.

The entorhinal cortex is the main route by which the neocortex communicates with the hippocampus. Neurons in the hippocampus have 'place fields' — they fire strongly when the animal is in a particular location — but neurons in the entorhinal cortex have been thought not to show this property. However, when Fyhn and colleagues recorded from the entorhinal cortex, they found that neurons in one part — the dorsolateral band — showed strong place fields, although this activity was less marked in more ventromedial neurons.

Surprisingly, neurons in the dorsolateral band of the entorhinal cortex carried just as much information about location as did hippocampal neurons. To check whether the spatial information was being fed back to this area from the hippocampus, the authors recorded from entorhinal dorsolateral-band neurons in rats with hippocampal lesions. These neurons still showed strong place fields, indicating that spatial information is calculated in this part of the entorhinal cortex.

The other two papers investigated the roles of two subdivisions of the hippocampus, CA1 and CA3. CA3 contains a network of recurrent connections, whereas CA1 does not, but both contain 'place cells' with strong place fields. Leutgeb and colleagues tested rats in three different testing enclosures that could be placed in any of three rooms. Neurons in CA3 were particularly sensitive to the background context — the room in which the enclosure was placed. By contrast, the activity of CA1 neurons was modulated more by the specific enclosure, and less by context.

Vazdarjanova and Guzowski also investigated the roles of local landmarks and background context in modulating CA1 and CA3 activity. They looked at the activation of immediate-early genes after testing in the same or different rooms, and with the same or different local cues. They also found that the pattern of activation in CA3 was more sensitive to context, and to specific cues in CA1. So CA1 and CA3 might have different but complementary functions in encoding spatial information.

Rachel Jones

References and links

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