<Further Development 15_03>

Closure at the Junction: A Human-Avian Connection

In human and chick embryos, there appears to be a transitional region at the junction of the anterior (primary) and posterior (secondary) neural tubes. As mentioned earlier, neural tube formation in this transition zone is referred to as junctional neurulation (see Figure 15.4 in the textbook). In human embryos, coalescing cavities are seen in the transitional region, but the neural tube also forms by the bending of neural plate cells. The junctional neural tube in the chick is a mosaic of both ventral mesenchyme cells and dorsal neural ectodermal cells. In addition to directly providing dorsal epithelial cells to the junctional neural tube, neural plate cells also undergo an epithelial-to-mesenchymal transition and ingress into the underlying mesenchyme pool (Figure 1; Dady et al. 2014). Some posterior neural tube anomalies result when the two regions of the neural tube fail to coalesce (Saitsu et al. 2007). Given the prevalence of human posterior spinal cord malformations, further understanding of the mechanisms of secondary neurulation may have important clinical implications.

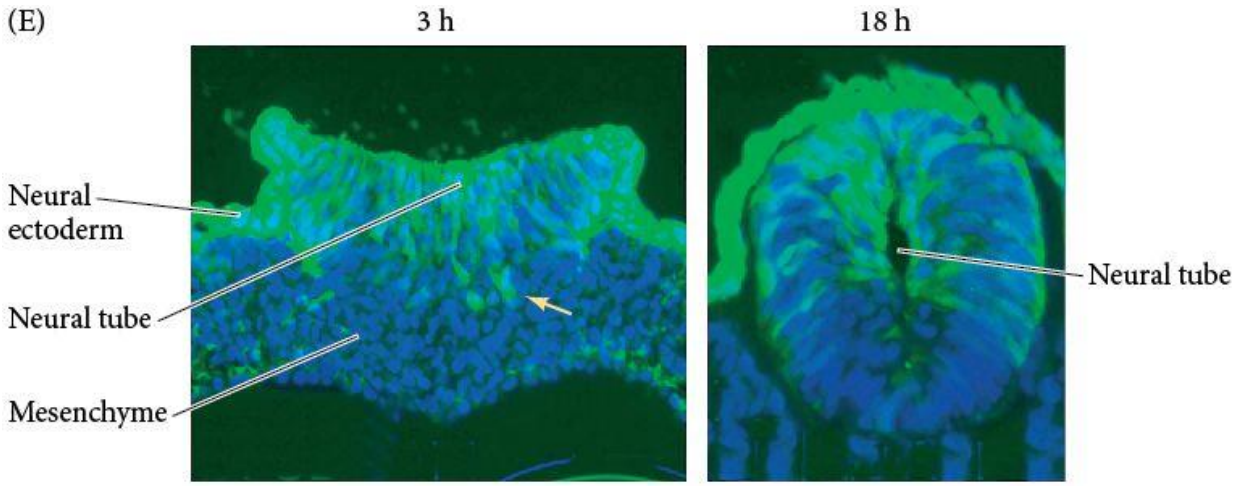

Figure 1 Tracing of cells from the superficial blastoderm of chick in the junctional neural tube region. Superficial cells of the primitive streak are labeled with a cell permanent fluorescent green dye at the position where junctional neurulation was to take place. Nuclei are stained blue with DAPI. At 3 hours, the superficial cells can be seen ingressing from the overlying neural ectoderm into the mesenchyme (arrow), which yields a neural tube (seen at 18 hours) made of cells from both locations.

Literature Cited

Dady, A., E. Havis, V. Escriou, M. Catala, and J. L. Duband. 2014. Junctional neurulation: a unique developmental program shaping a discrete region of the spinal cord highly susceptible to neural tube defects. *J. Neurosci*. 34: 13208–13221.
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Saitsu, H., S. Yamada, C. Uwabe, M. Ishibashi and K. Shiota. 2007. Aberrant differentiation of the axially condensed tail bud mesenchyme in human embryos with lumbosacral myeloschisis. *Anat. Rec.* (Hoboken) 290: 251–258.
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