



Neurulation in the chick embryo

Database Info:

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Organism: Chicken

CoRe Topic: Organogenesis, Morphogenesis

CoRe Subtopic: *To be determined*

Education: Undergraduate, Graduate

Keywords: neurulation, neural folds, neural tube, neural plate, chick, convergence, neural tube defects, convergent extension, involution

Description: Scanning electron microscopy of chick neurulation. Transverse section of a one-day chick embryo undergoing neural fold convergence.

Brief Entry: Neurulation

Neurulation is the process through which the neural ectoderm or neural plate forms the neural tube. The neural tube is critical in vertebrate development as it forms brain and spinal cord. The morphogenic movements of neurulation, as well as their timing, vary across species. In the chick, neural plate bending is initiated at the future midbrain level and progresses both rostrally and caudally along the neural axis simultaneously. As the neural plate bends, its lateral edges rise, forming the elevating neural folds. Neural folds converge and fuse at the midline, forming the neural tube. This process, called primary neurulation, characterizes the rostral or anterior portion of the chick embryo. In the caudal or posterior portion of the chick embryo, the neural tube forms by a different process, secondary neurulation. In this process, the neural ectoderm condenses to form a solid rod called the medullary cord that then hollows out to form a tube. Despite their different origins, anterior and posterior portions of the neural tube then fuse to form one continuous tube.

Birds, amphibians, and mammals undergo both primary and secondary neurulation. In fish (teleosts), secondary neurulation characterizes the entire length of the neural axis. Both halves of the neural plate converge at the midline to form a solid neural keel and then a neural rod. The neural rod rapidly hollows out to form the neural tube.

References:

1. Colas, J. F., & Schoenwolf, G. C., Towards a cellular and molecular understanding of neurulation. *Developmental Dynamics* **221**, 117-145 (2001)
2. Papan C., & Campos-Ortega, J. A., On the formation of the neural keel and neural tube in the zebrafish *Danio (Brachydanio) rerio*. *Developmental Biology* **203**, 178-186 (1994)