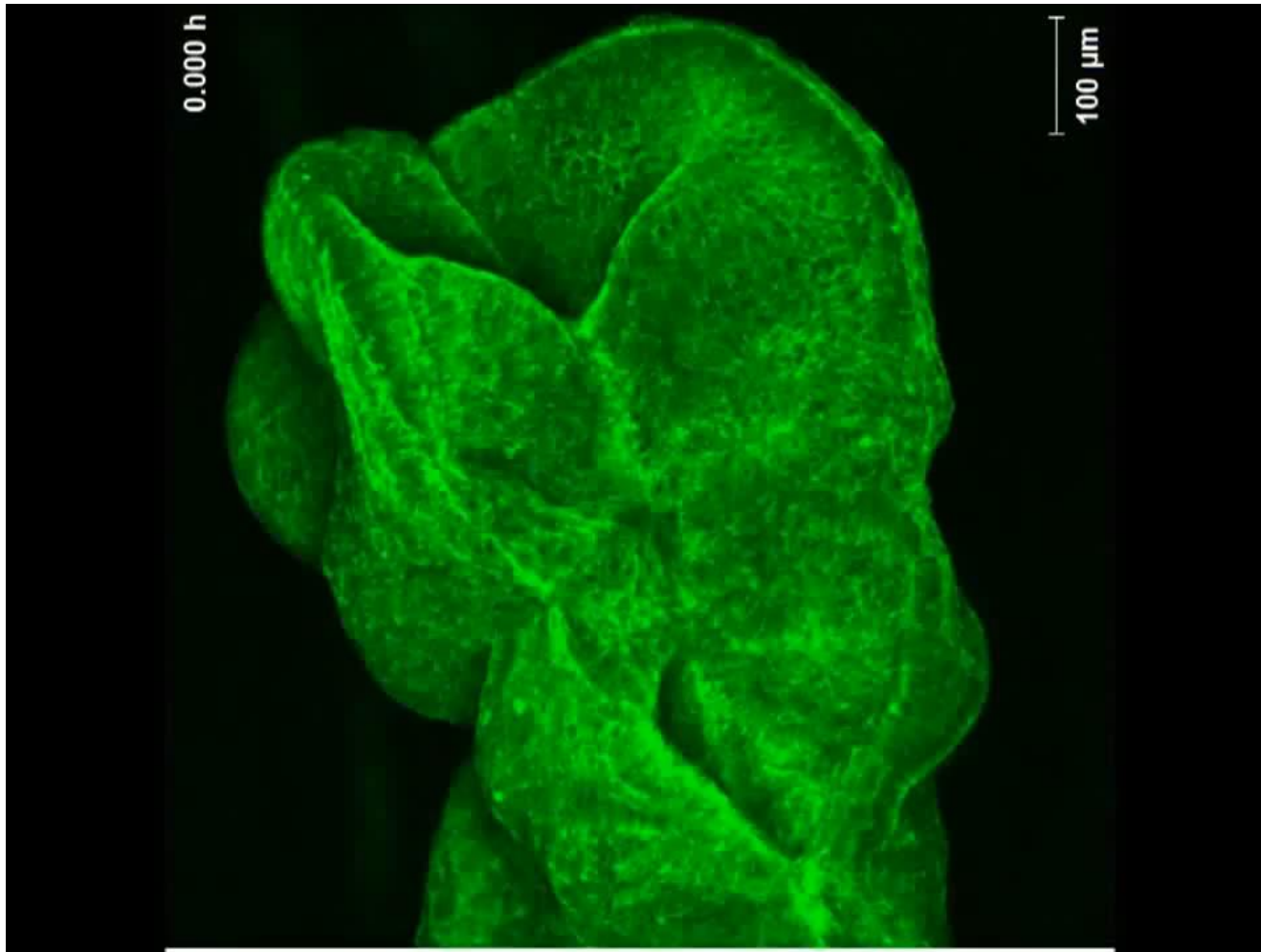


# Desarrollo temprano en metazoarios III



Gonzalo Aparicio

**Clivaje (o segmentación)**

**Blástula**

**Gastrulación**

**Embrión trilaminar**

**Endodermo**

**Mesodermo**

**Ectodermo**

**Neurulación**

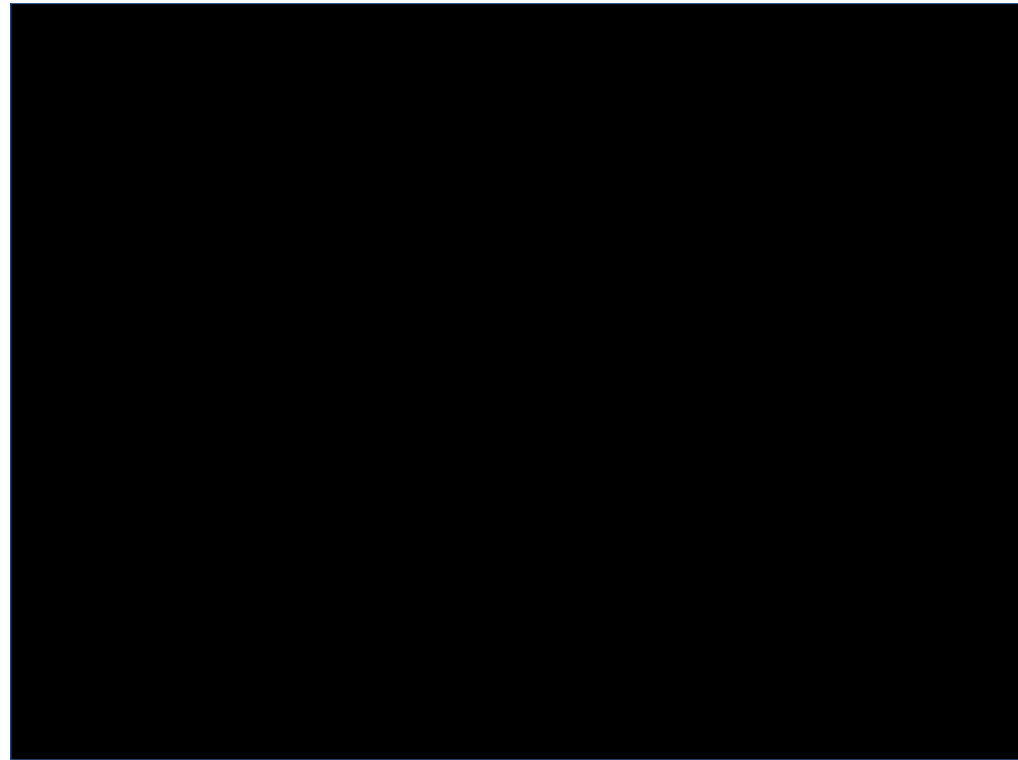
**Sistema nervioso**

**Establecimiento de ejes embrionarios**

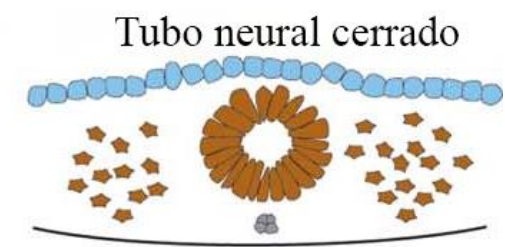
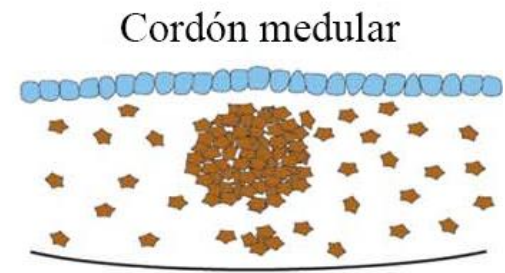
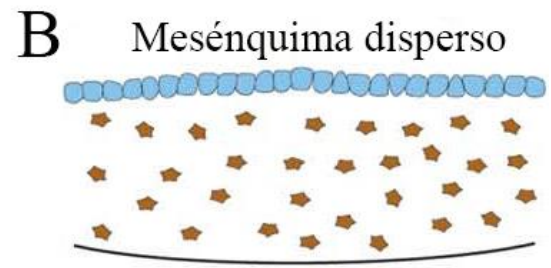
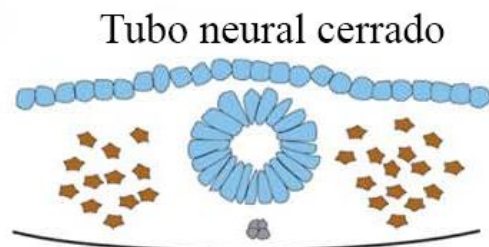
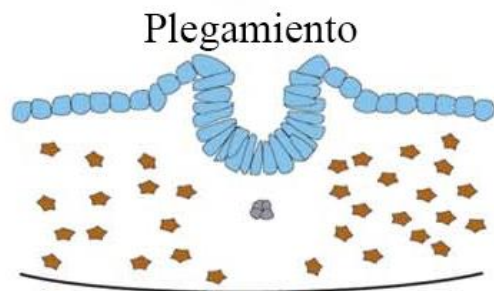
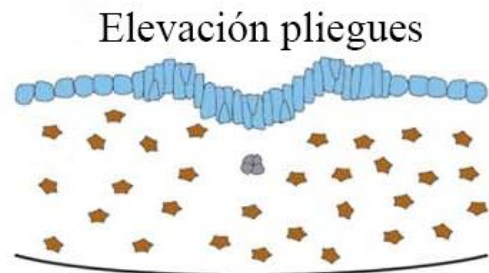
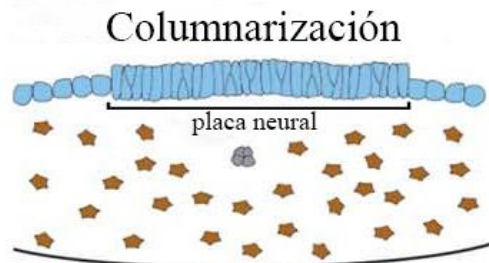
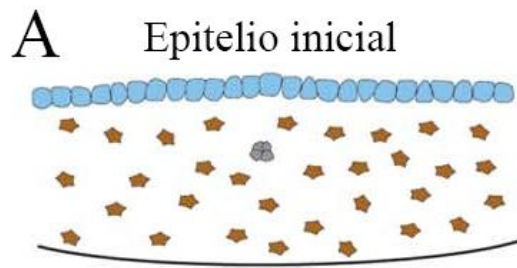
# Neurulación: cierre del tubo neural



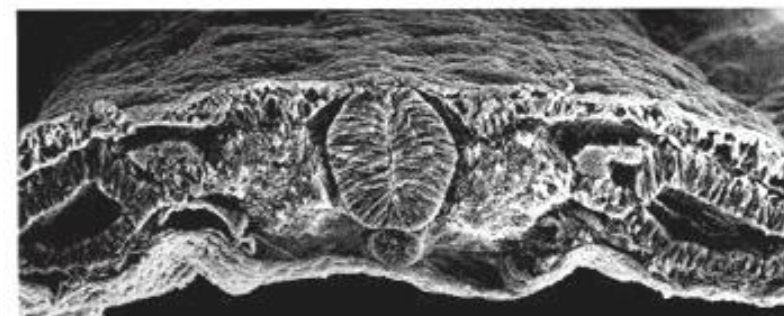
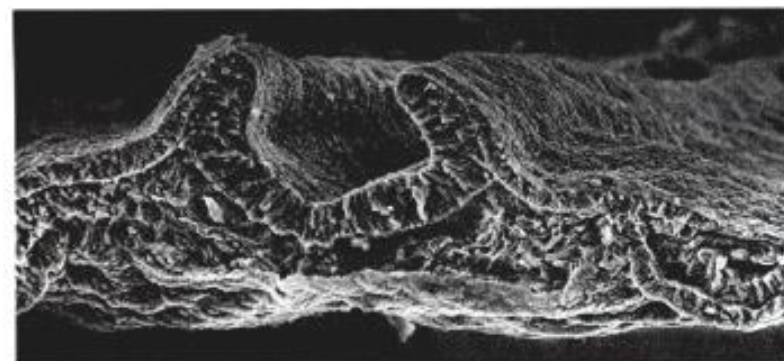
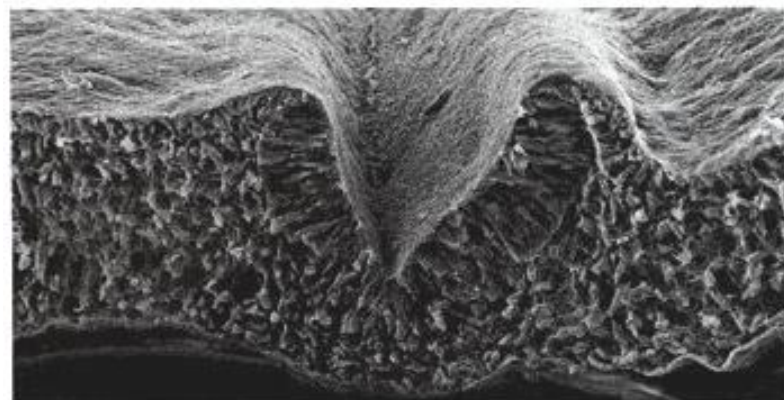
Xenopus



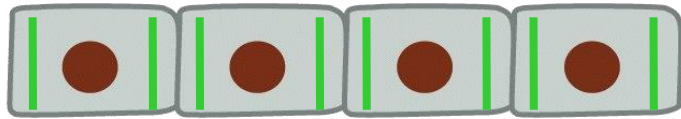
Pollo



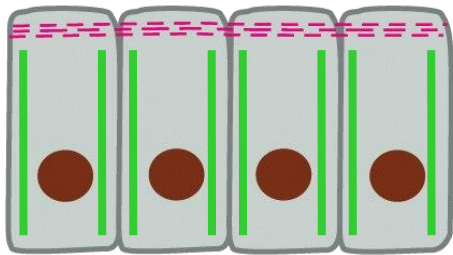
# Cierre del tubo neural: Neurulación primaria



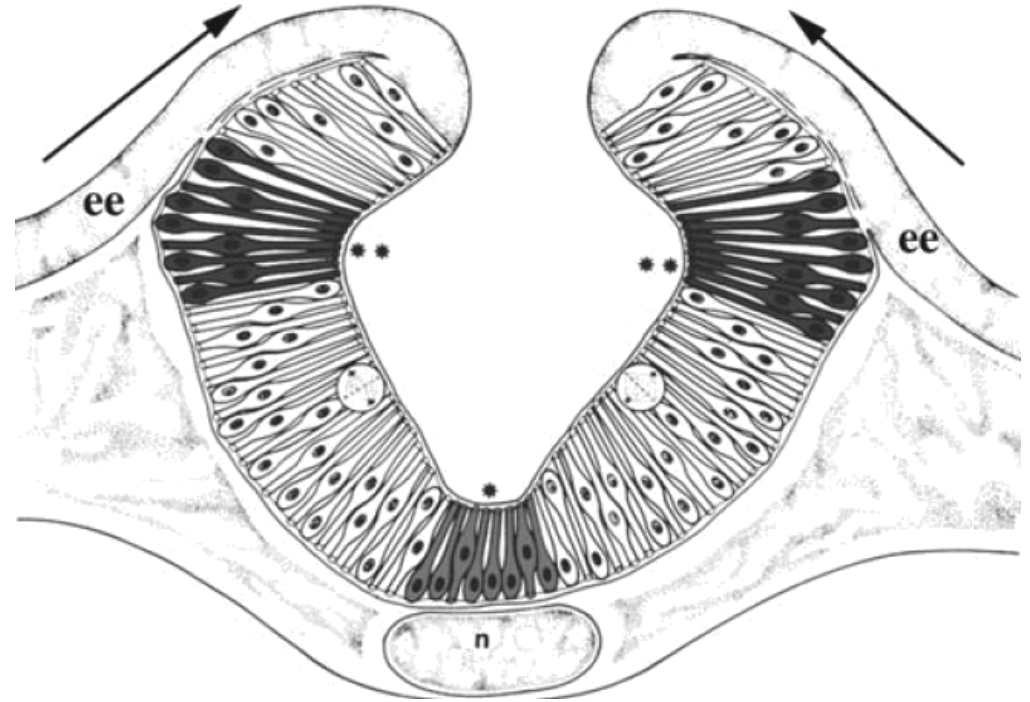
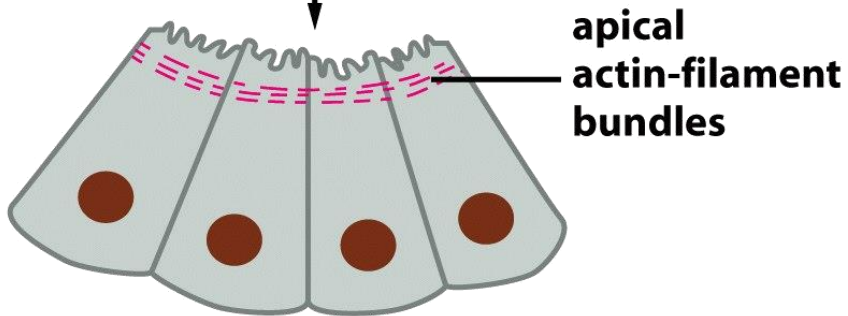
# Fuerzas intrínsecas/extrínsecas a la placa neural



microtubules elongate, causing cells to become columnar

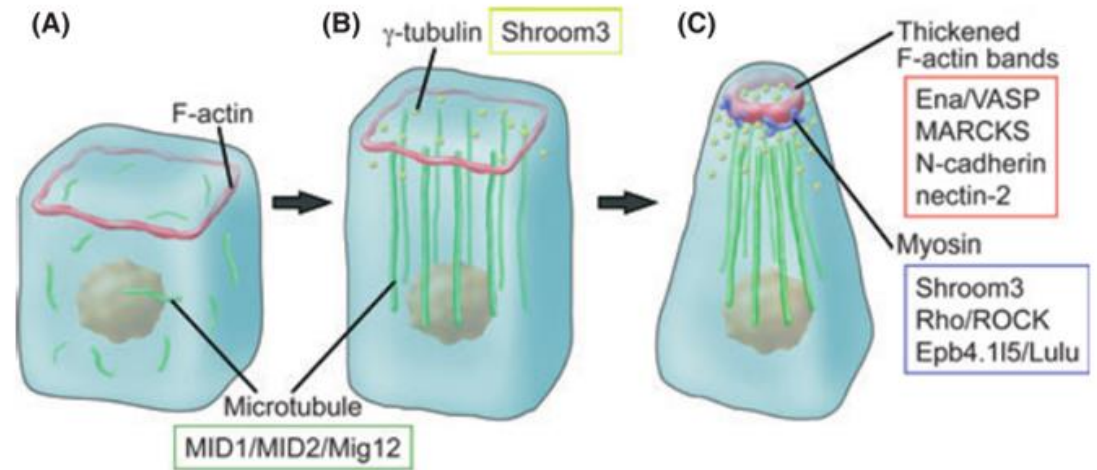


apical actin-filament bundles contract, narrowing the cells at their apices

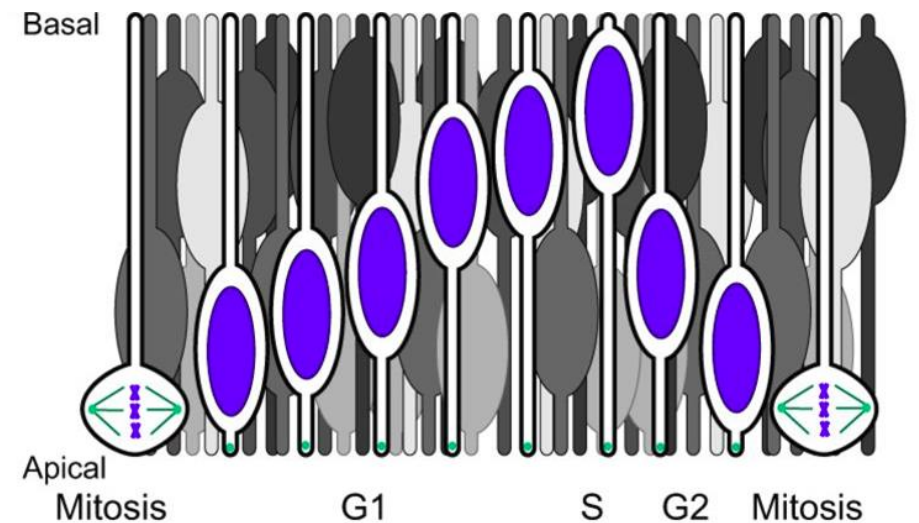


# Formación de puntos de bisagra

Constricción apical

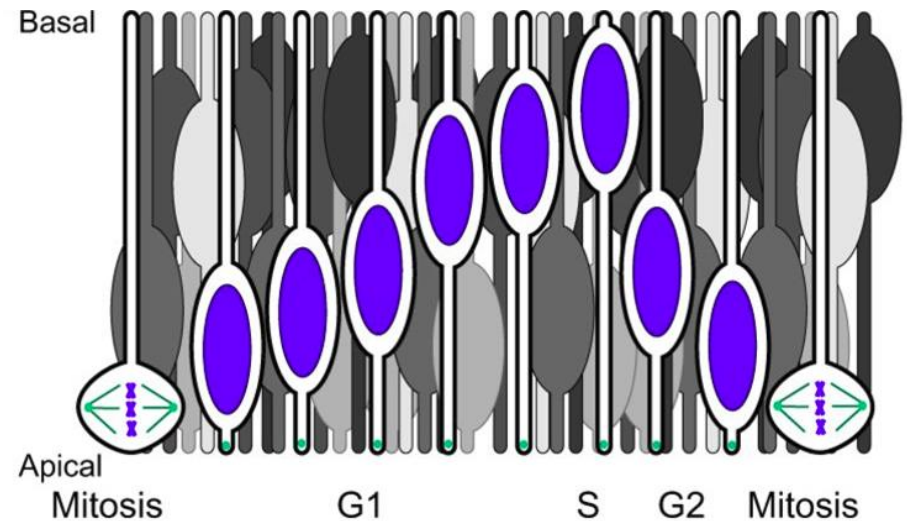
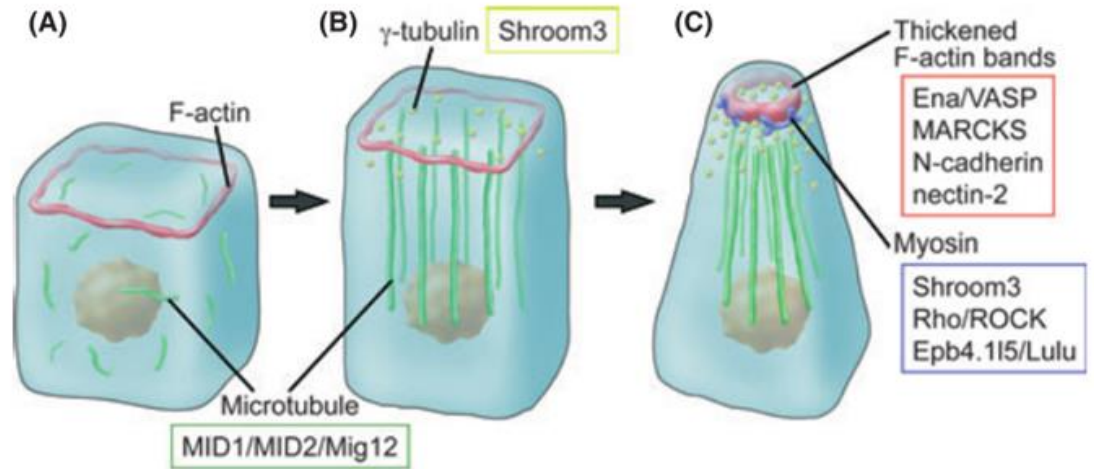
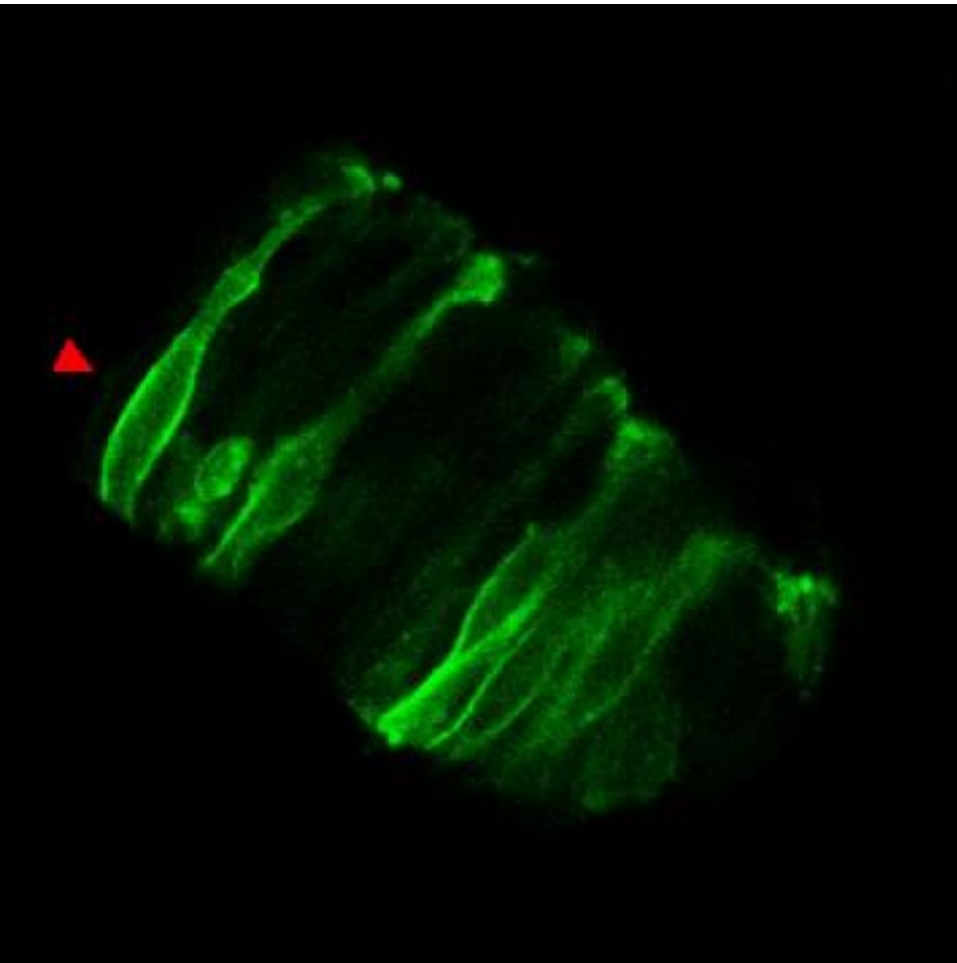


Ensanchamiento basal



Migración nuclear intercinética

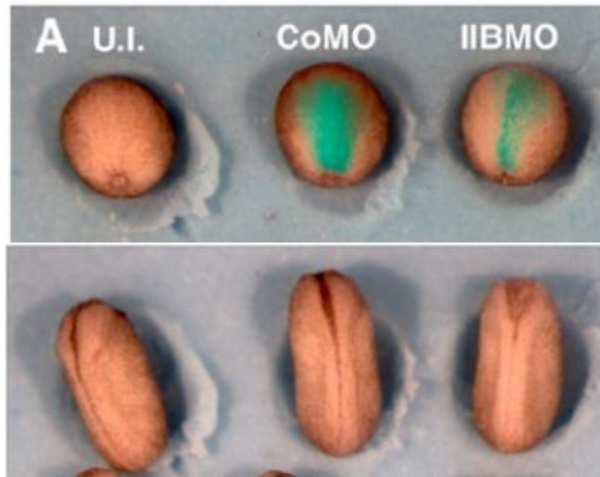
# Formación de puntos de bisagra



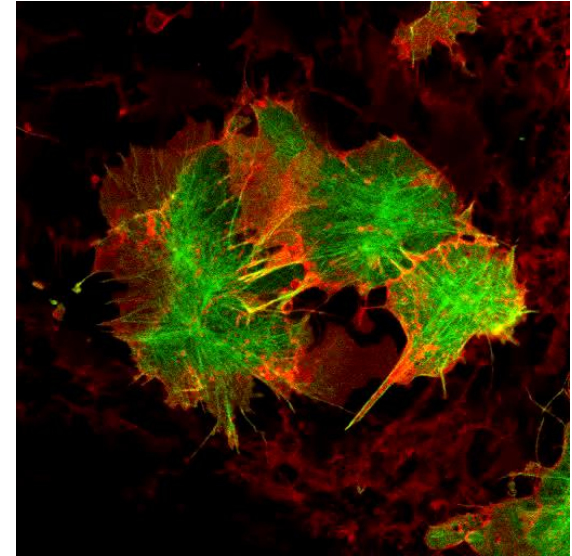
**Migración nuclear intercinética**



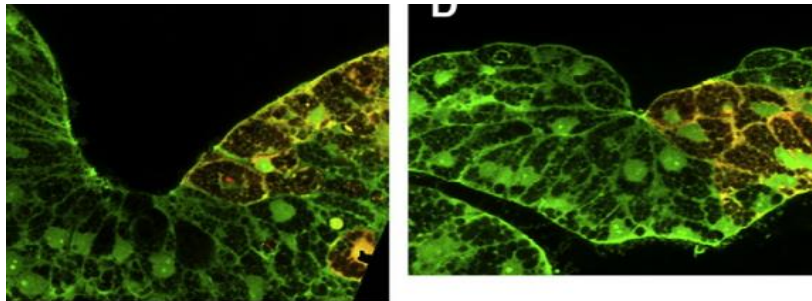
# Cierre del tubo neural: movimientos celulares y citoesqueleto de actina



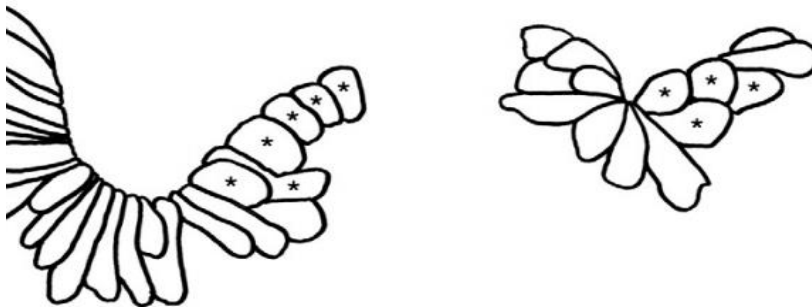
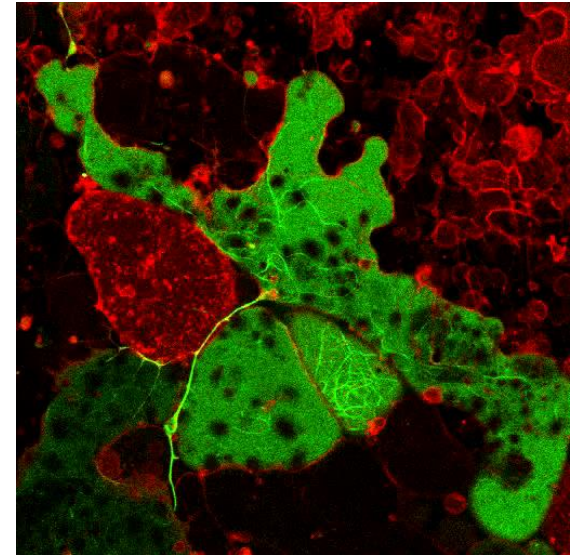
Control



Miosina IIB

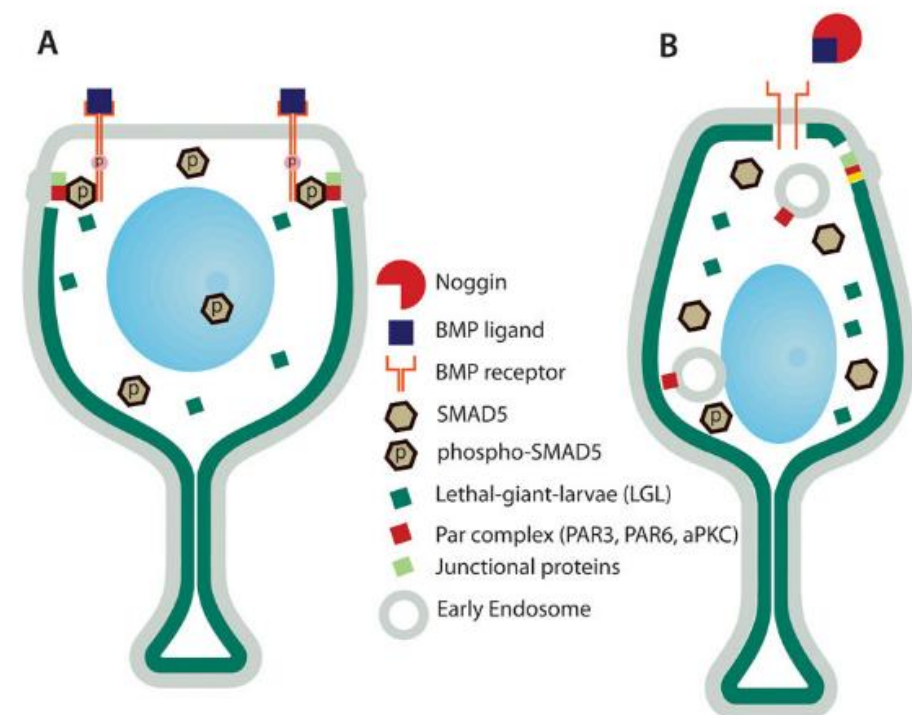
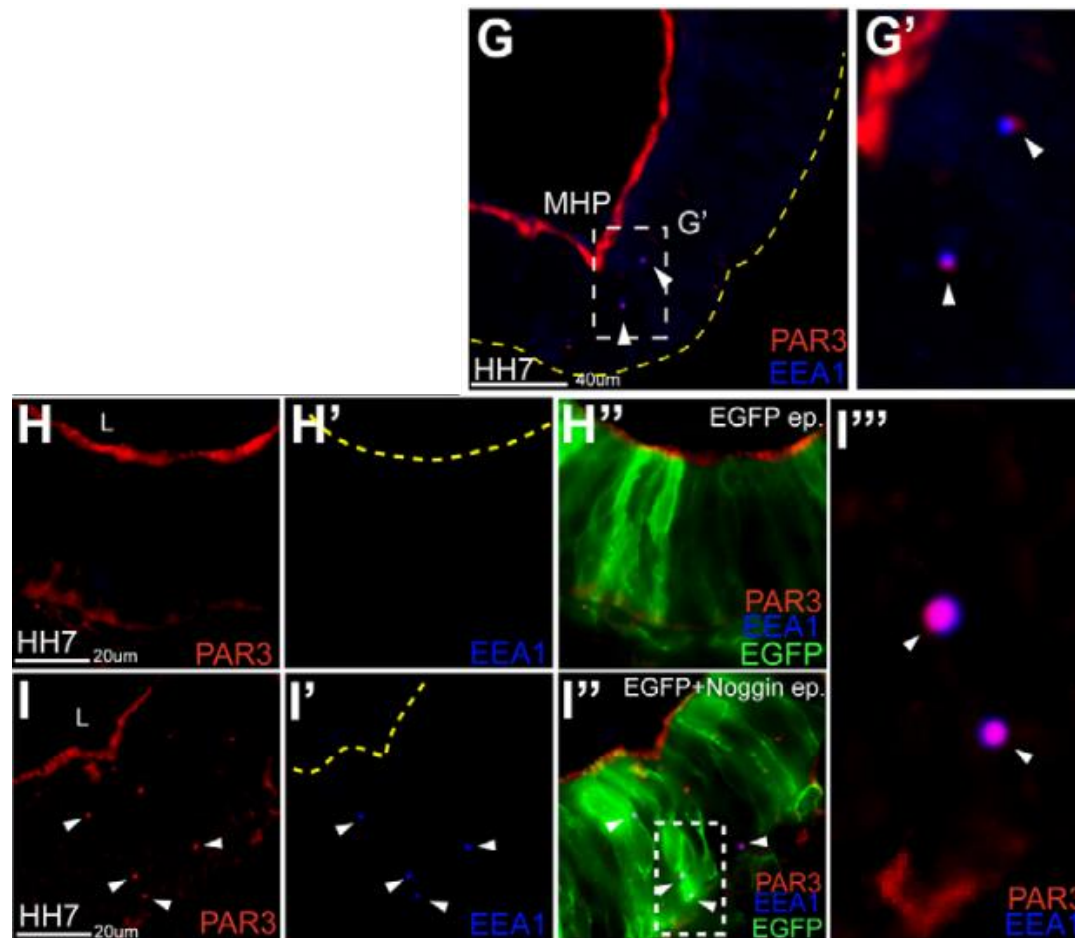


Morfolino

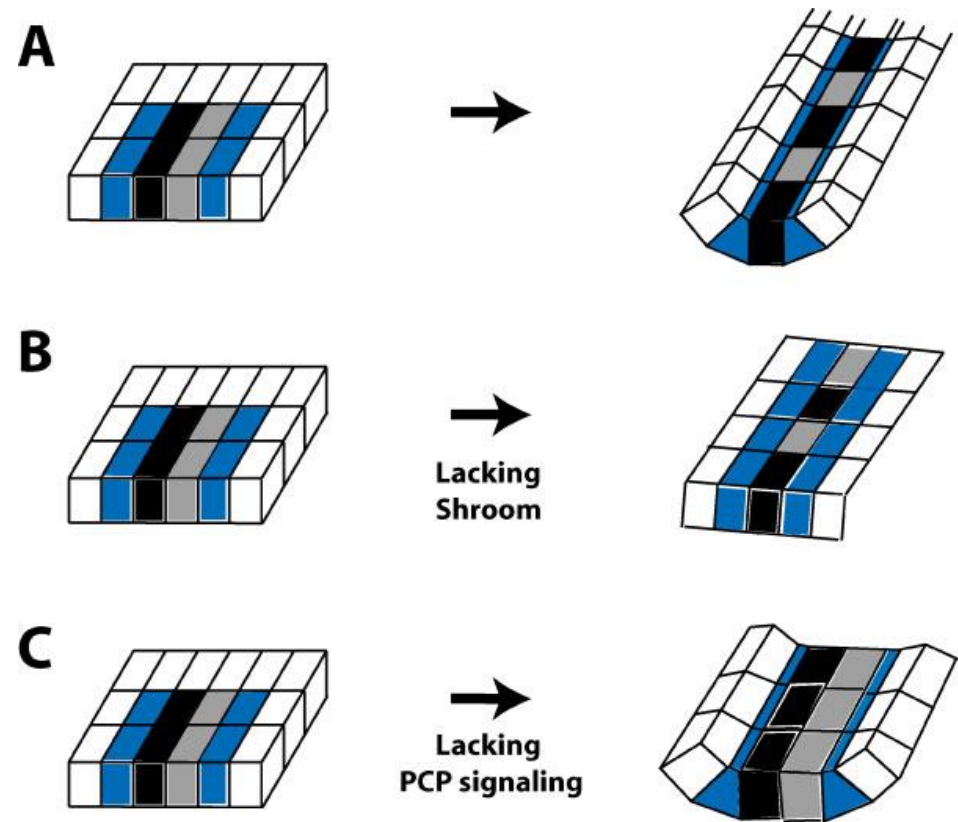
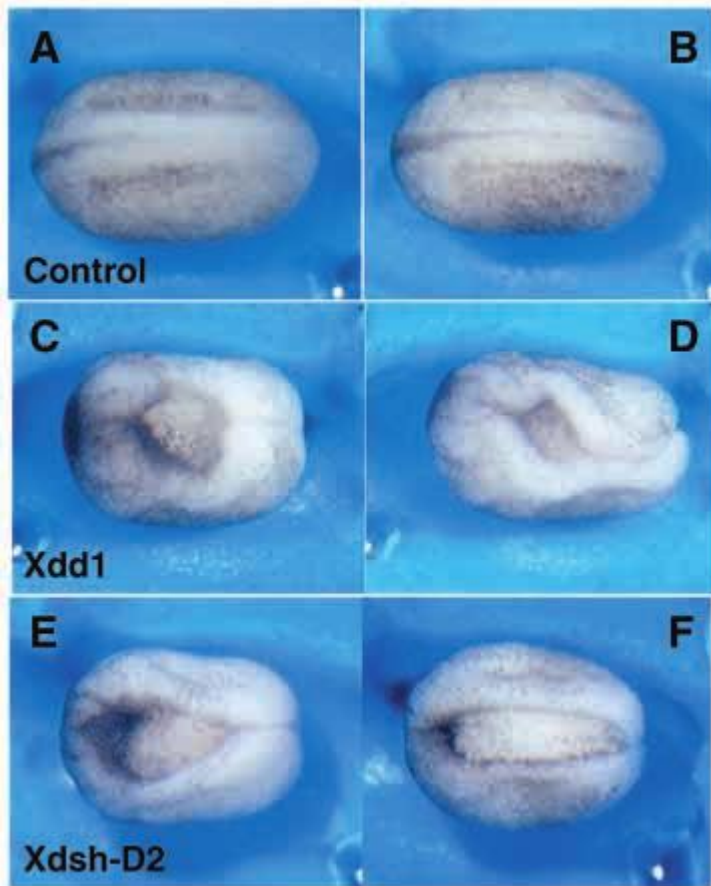
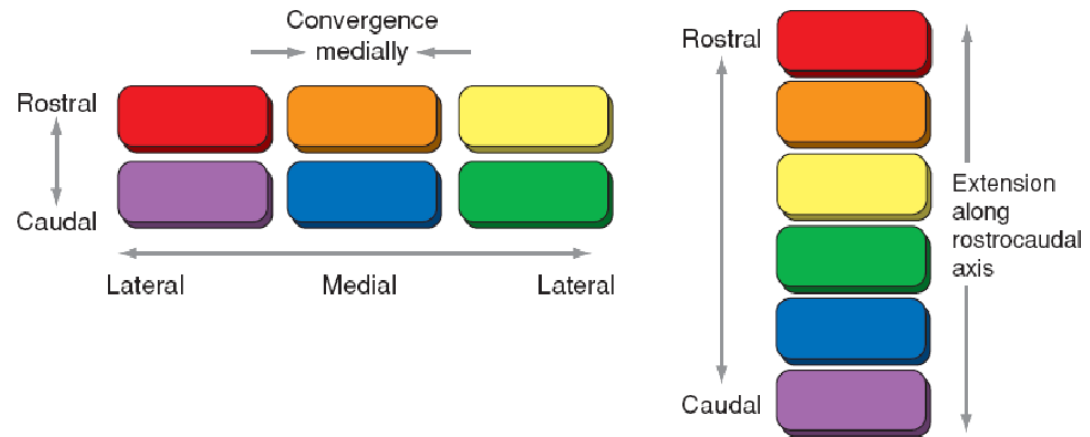


# Bone morphogenetic proteins regulate neural tube closure by interacting with the apicobasal polarity pathway

Dae Seok Eom<sup>1,2,\*</sup>, Smita Amarnath<sup>2</sup>, Jennifer L. Fogel<sup>3,†</sup> and Seema Agarwala<sup>1,2,3,‡</sup>



# Cierre del tubo neural: extensión-convergencia y polaridad planar

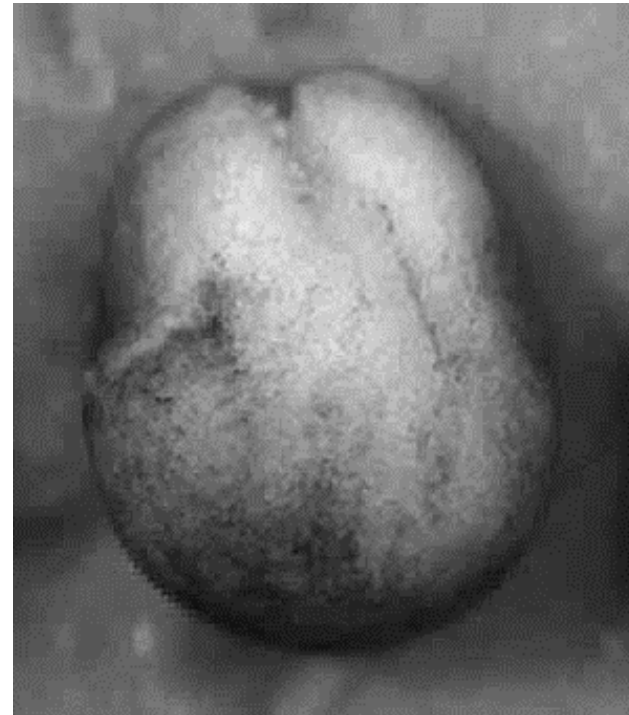


## Neural tube closure requires Dishevelled-dependent convergent extension of the midline

John B. Wallingford\* and Richard M. Harland



Control



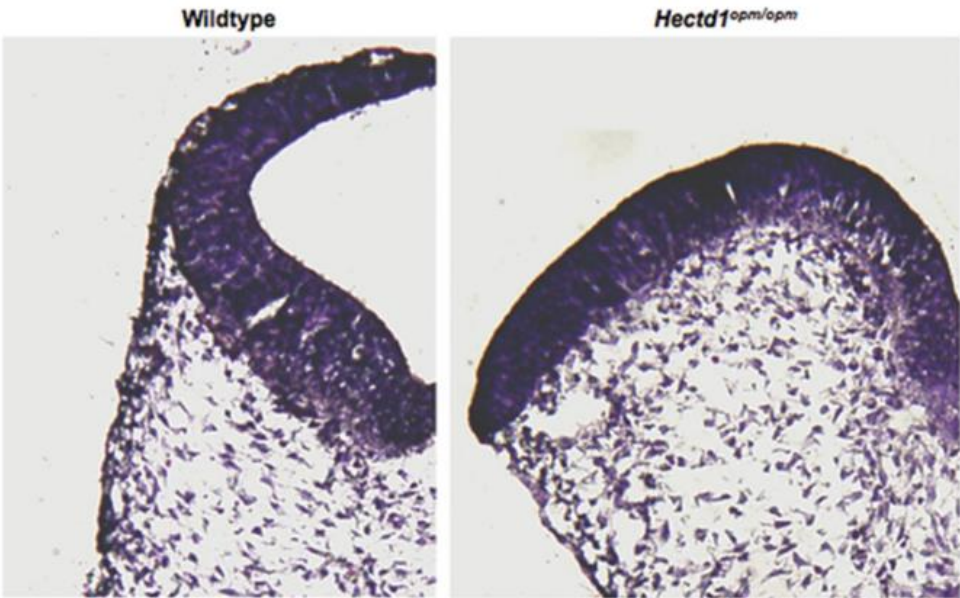
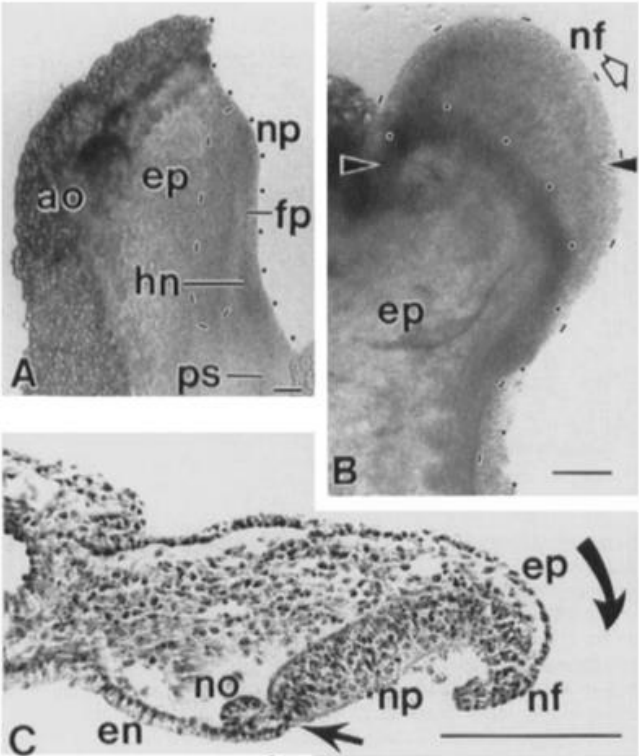
MO Xdsh

**Cooperative Model of Epithelial Shaping and Bending During Avian Neurulation: Autonomous Movements of the Neural Plate, Autonomous Movements of the Epidermis, and Interactions in the Neural Plate/Epidermis Transition Zone**

J. DAVID MOURY AND GARY C. SCHOENWOLF

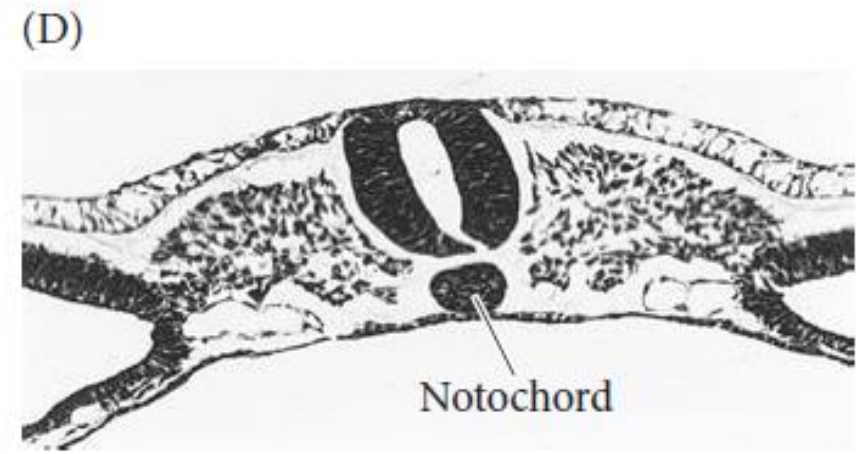
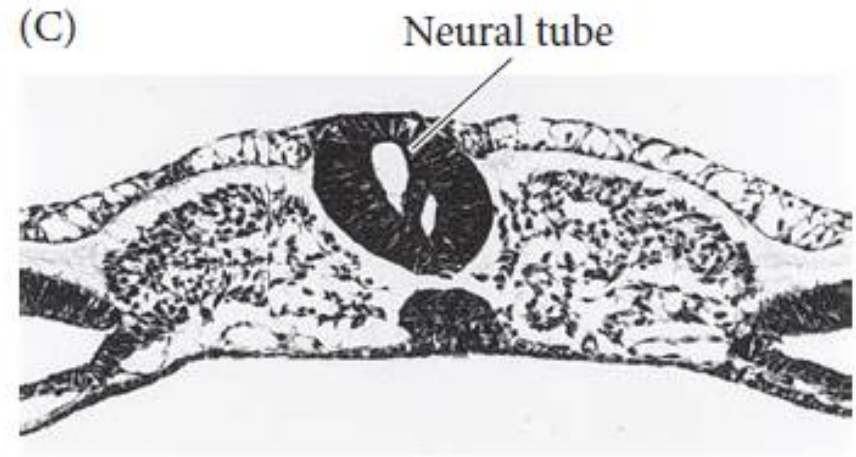
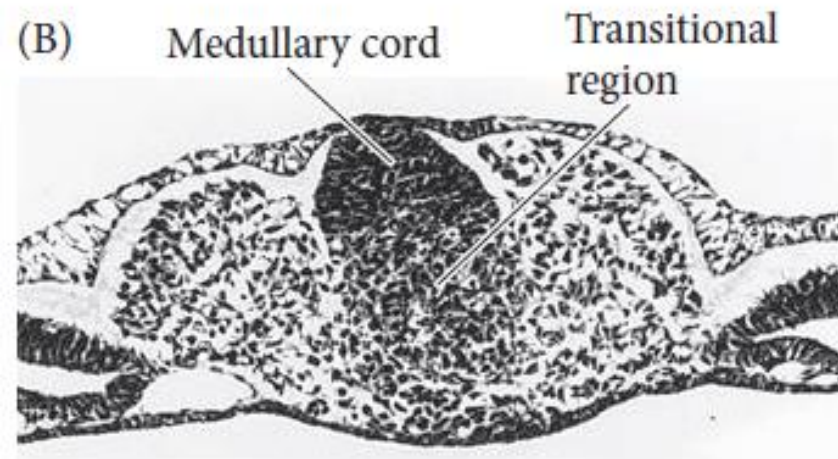
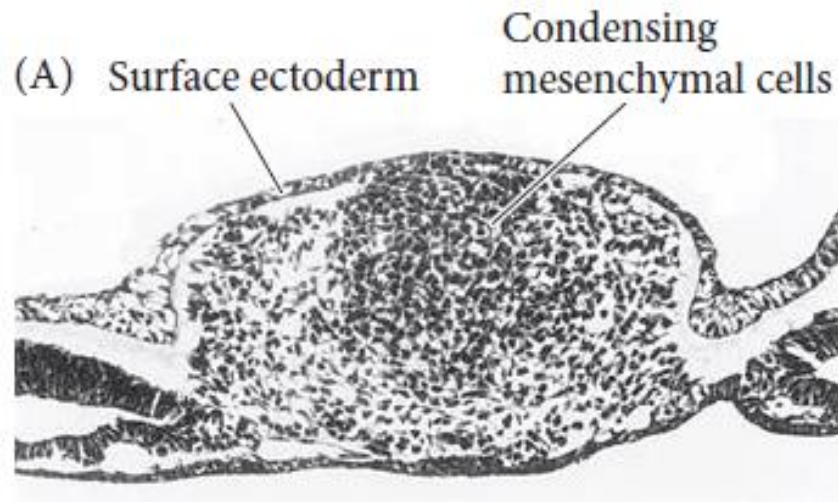
**Does the Cranial Mesenchyme Contribute to Neural Fold Elevation During Neurulation?**

Irene E. Zohn\* and Anjali A. Sarkar



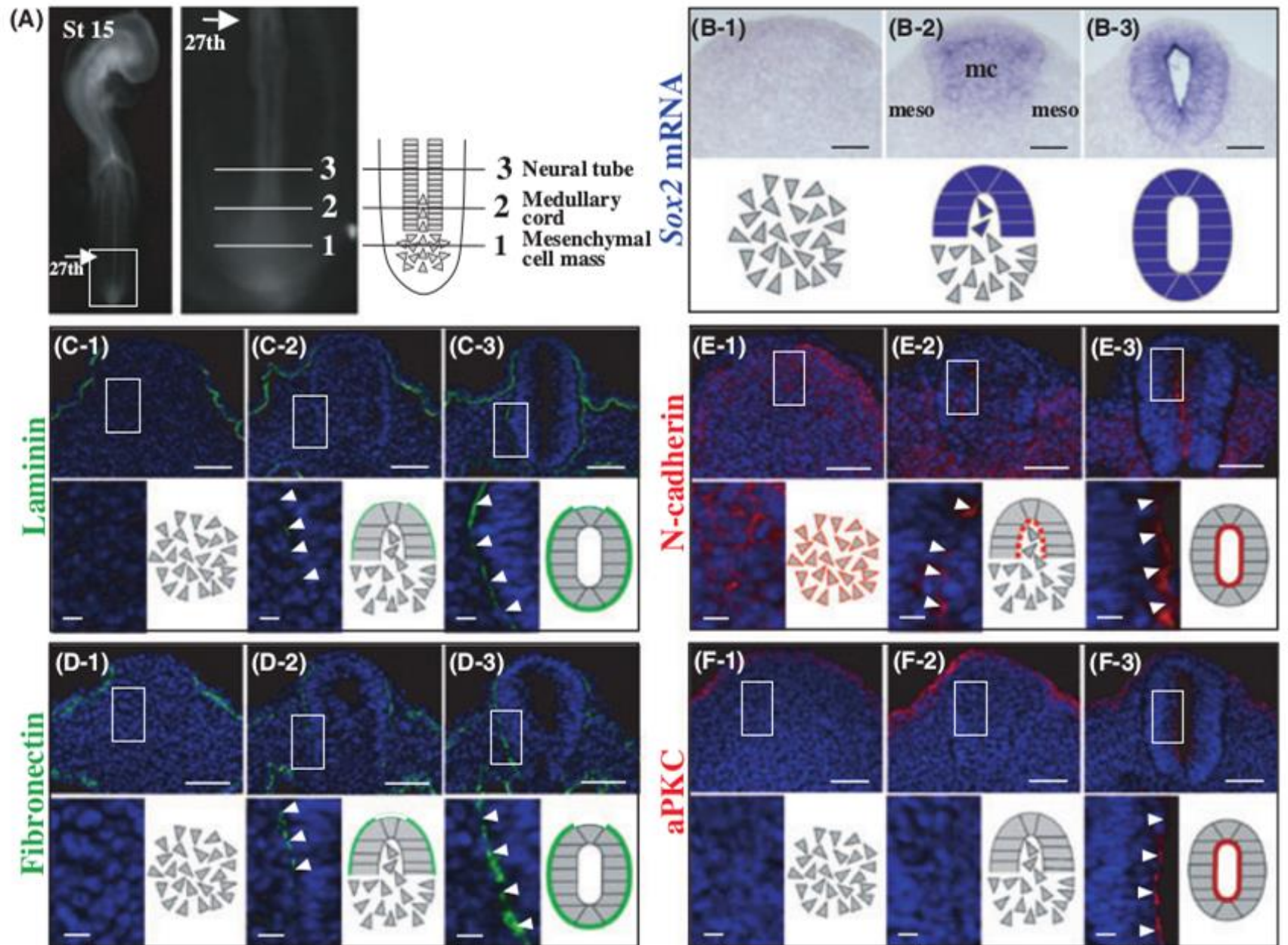
**Fuerzas extrínsecas: ectodermo no neural mesénquima de la cabeza**

# Cierre del tubo neural: Neurulación secundaria

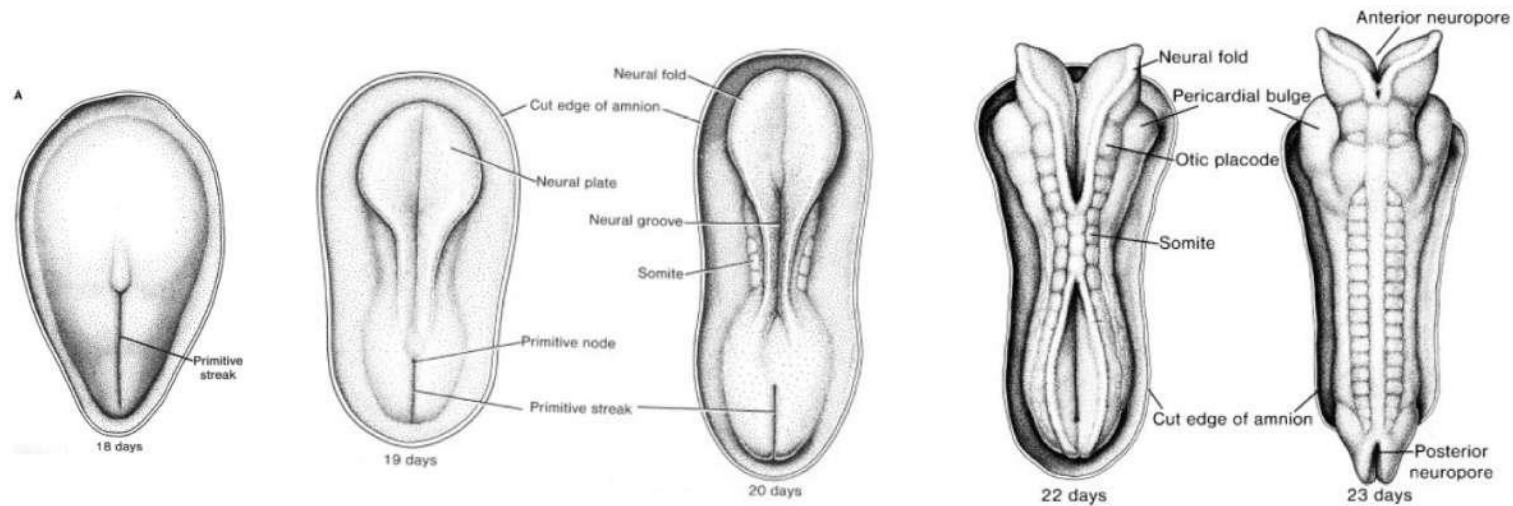


Transición mesénquima-epitelio

# Adquisición de polaridad epitelial

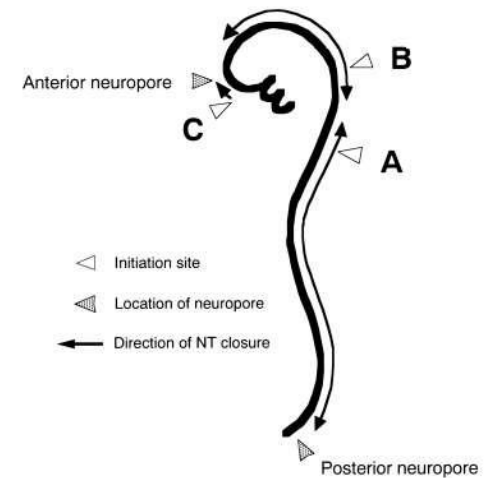
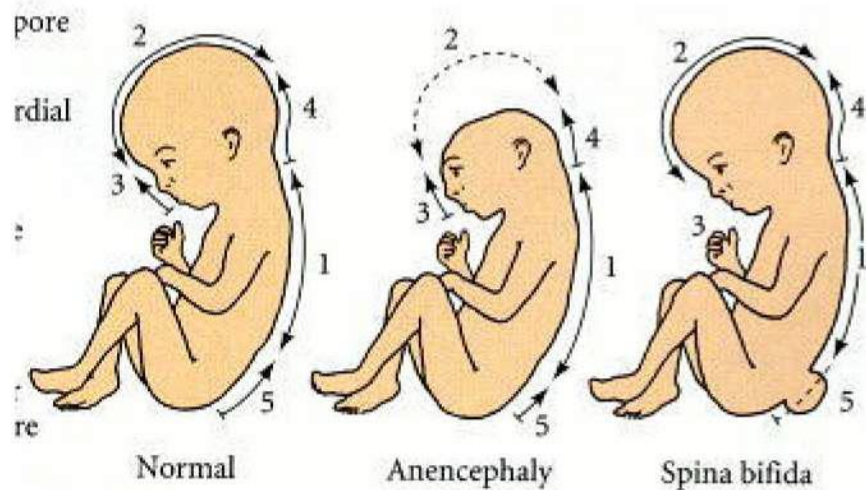


# Cierre del tubo neural en mamíferos



Tomoko Nakatsu · Chigako Uwabe · Kohei Shiota

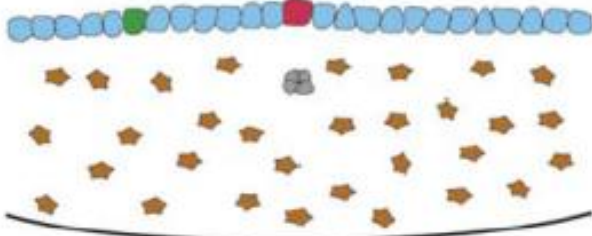
**Neural tube closure in humans initiates at multiple sites: evidence from human embryos and implications for the pathogenesis of neural tube defects**



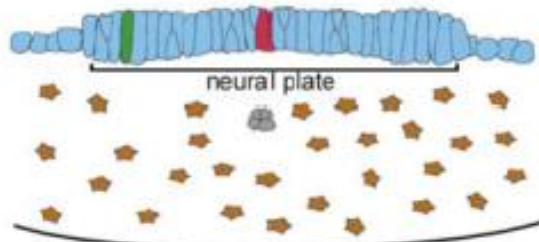


# Neurulación en peces

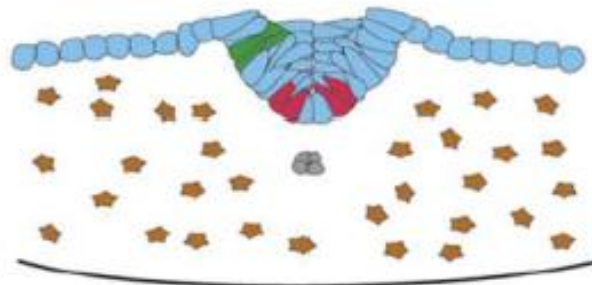
1. Initial epithelium



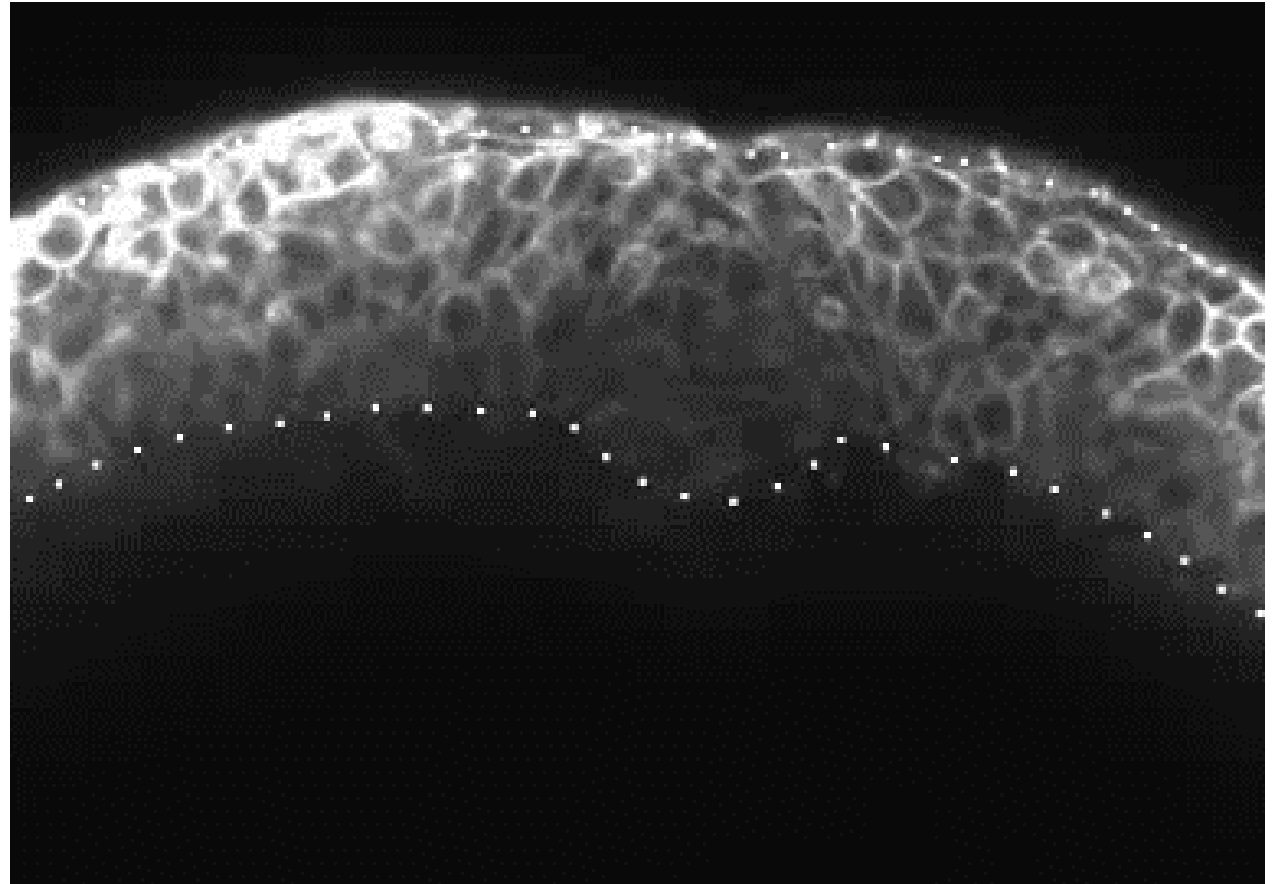
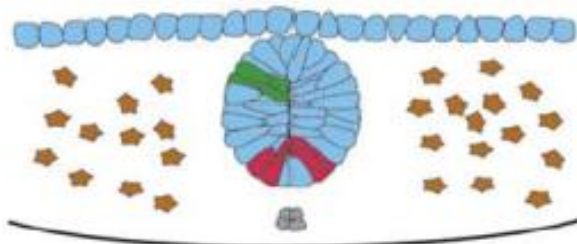
2. Columnarization



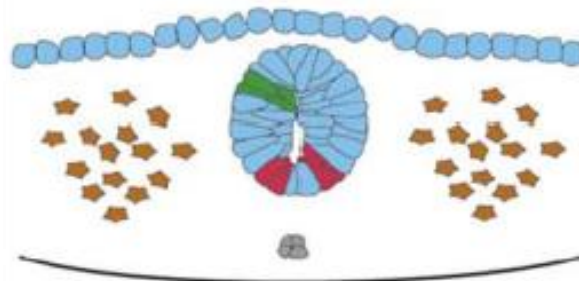
3. Neural keel formation



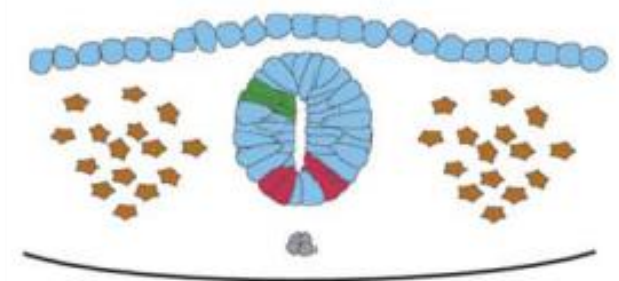
4. Neural rod formation



5. Lumen opening

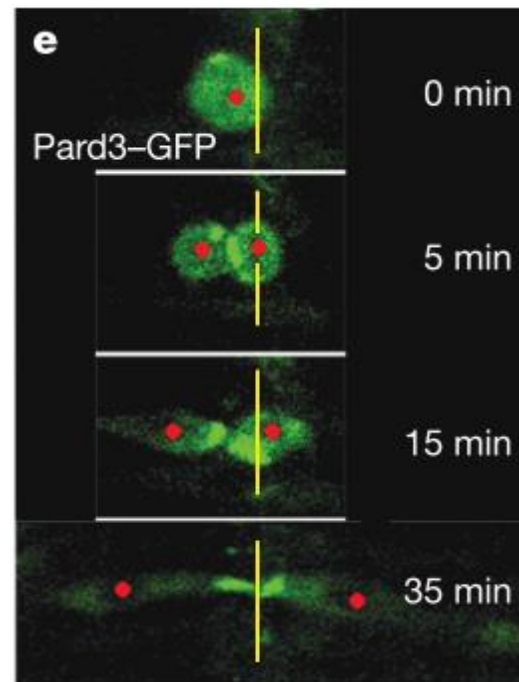
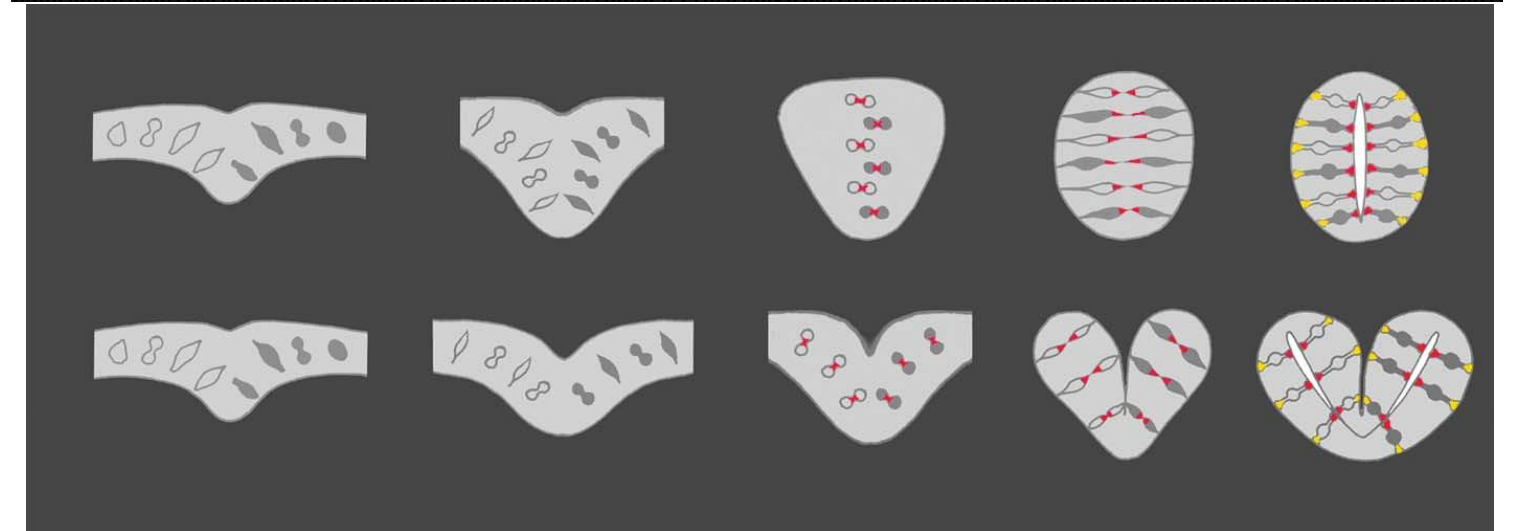
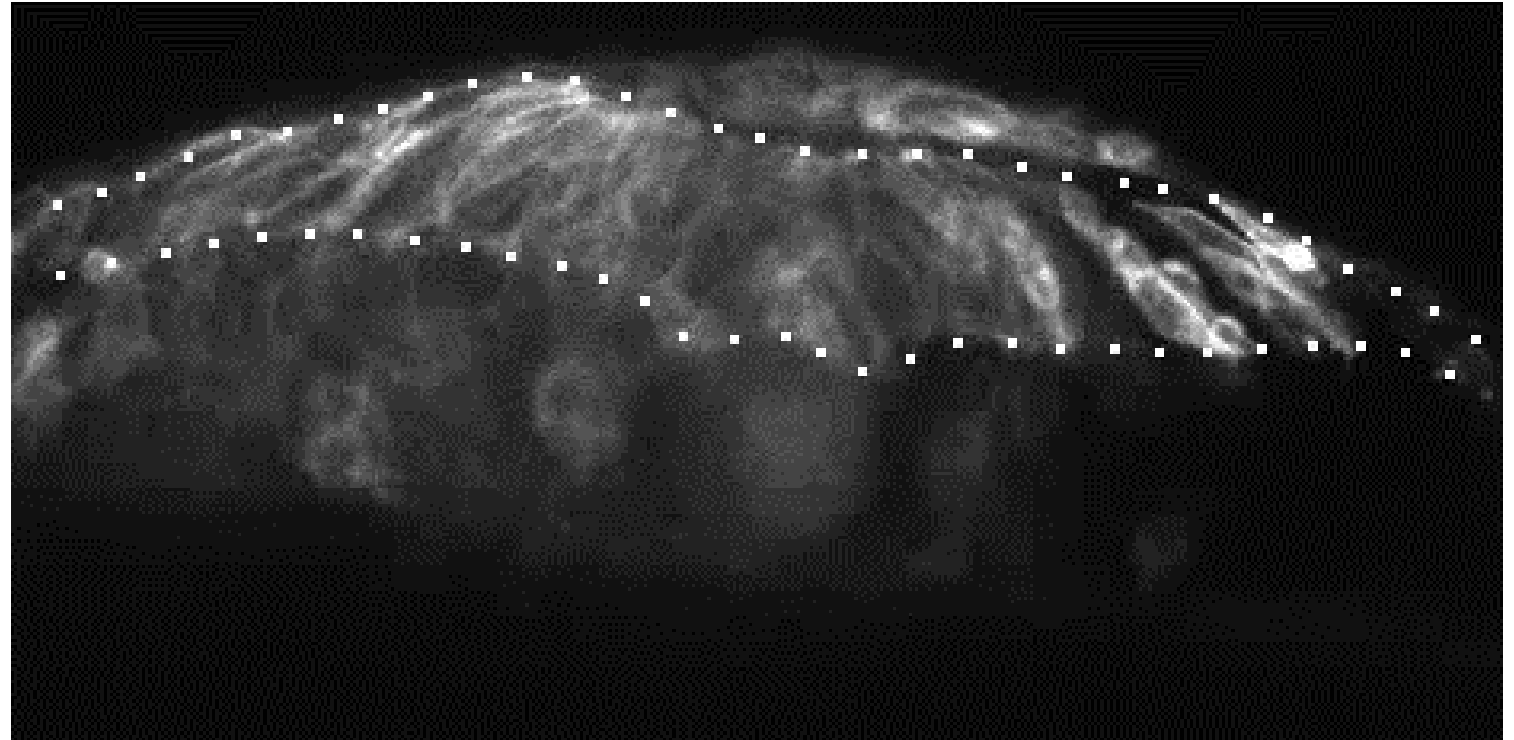


6. Neural tube complete



# A mirror-symmetric cell division that orchestrates neuroepithelial morphogenesis

Marcel Tawk<sup>1</sup>, Claudio Araya<sup>1</sup>, Dave A. Lyons<sup>1†</sup>, Alexander M. Reugels<sup>2</sup>, Gemma C. Girdler<sup>1</sup>, Philippa R. Bayley<sup>1†</sup>, David R. Hyde<sup>3</sup>, Masazumi Tada<sup>1</sup> & Jonathan D. W. Clarke<sup>1</sup>

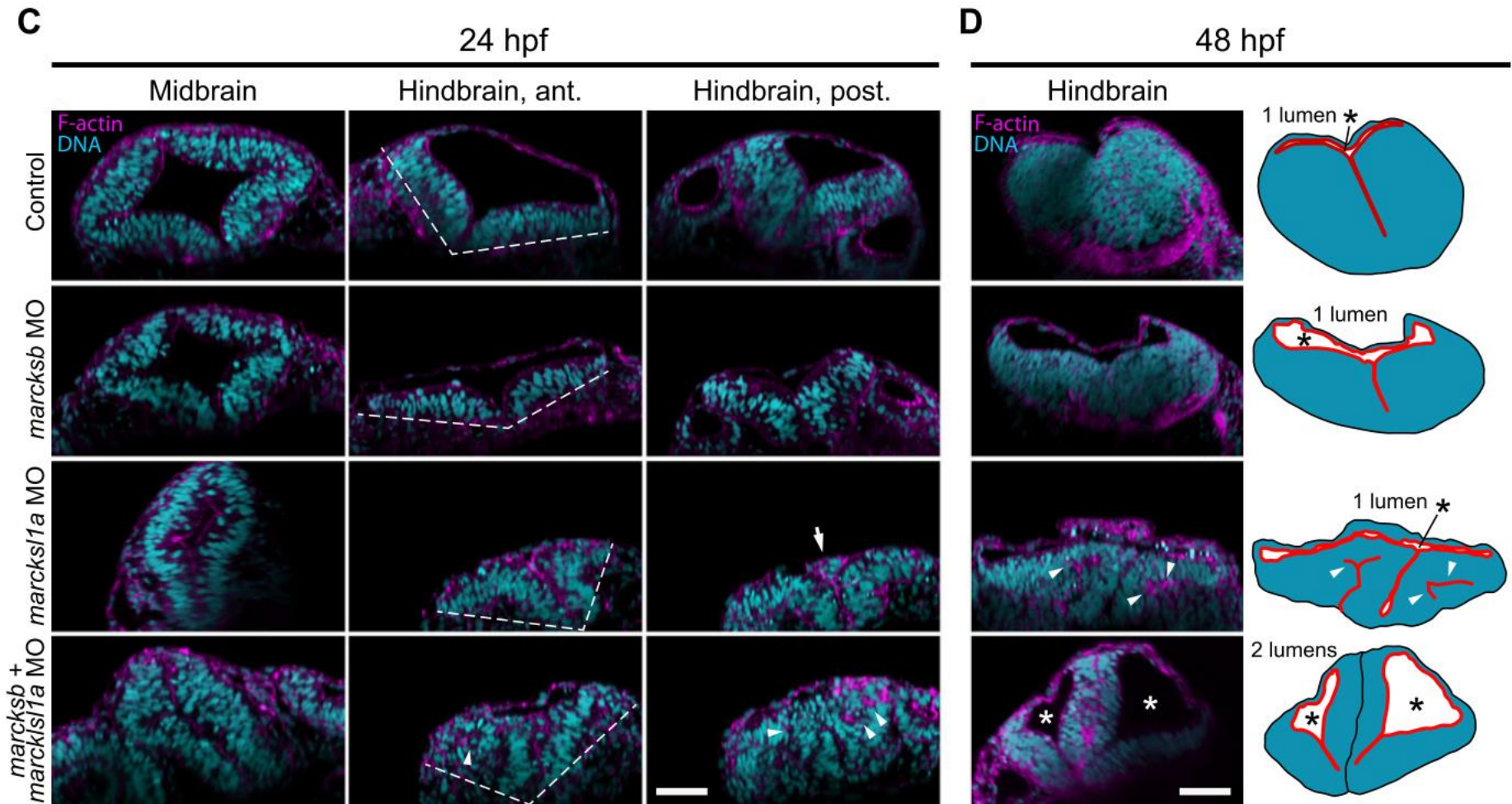


# Functional Diversification of the Four MARCKS Family Members in Zebrafish Neural Development

DANIEL PRIETO<sup>1</sup> AND FLAVIO R. ZOLESSI<sup>1,2\*</sup>

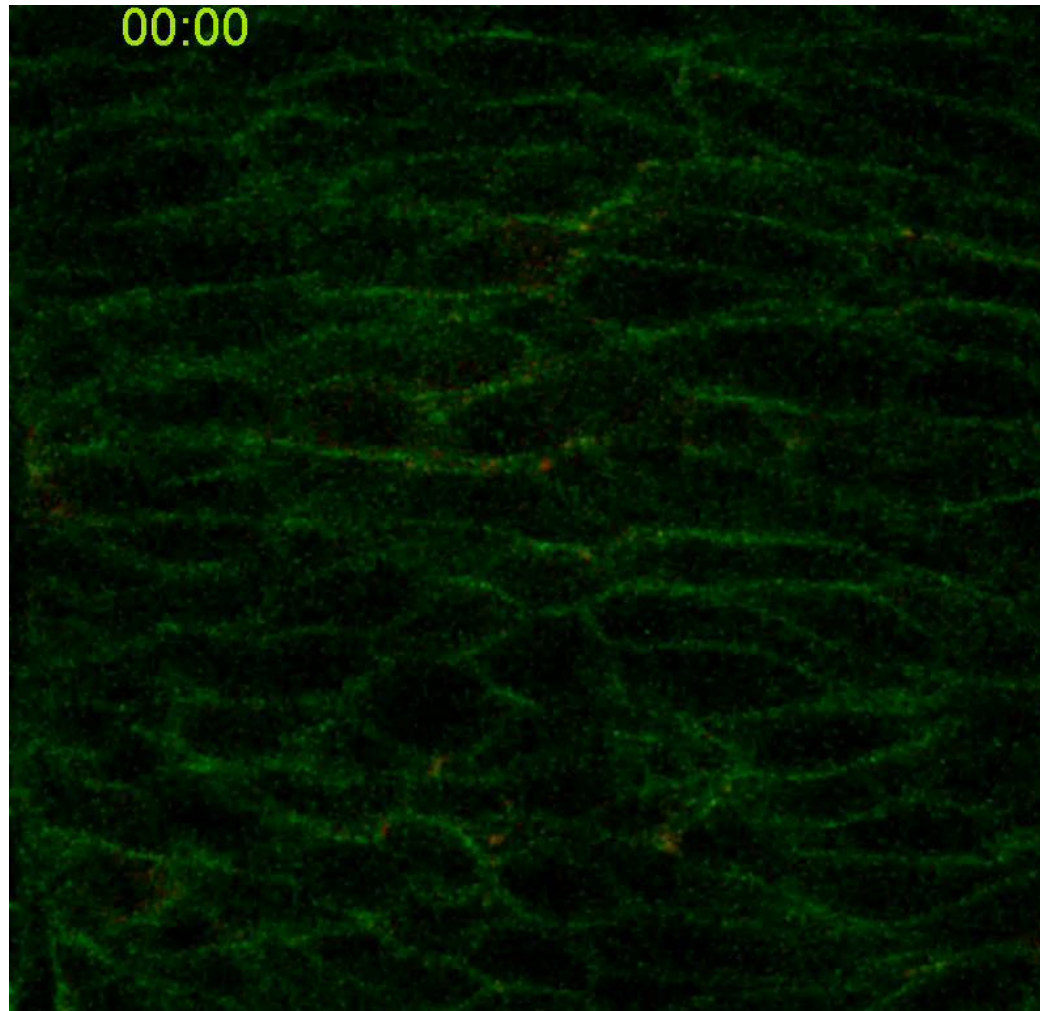
<sup>1</sup>Facultad de Ciencias, Sección Biología Celular, Universidad de la República, Montevideo, Uruguay

<sup>2</sup>Cell Biology of Neural Development Lab, Institut Pasteur de Montevideo, Montevideo, Uruguay



# Apical Cell-Cell Adhesions Reconcile Symmetry and Asymmetry in Zebrafish Neurulation

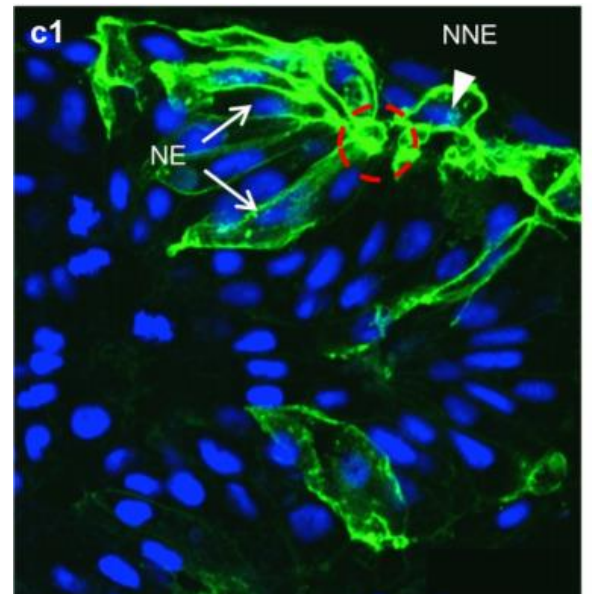
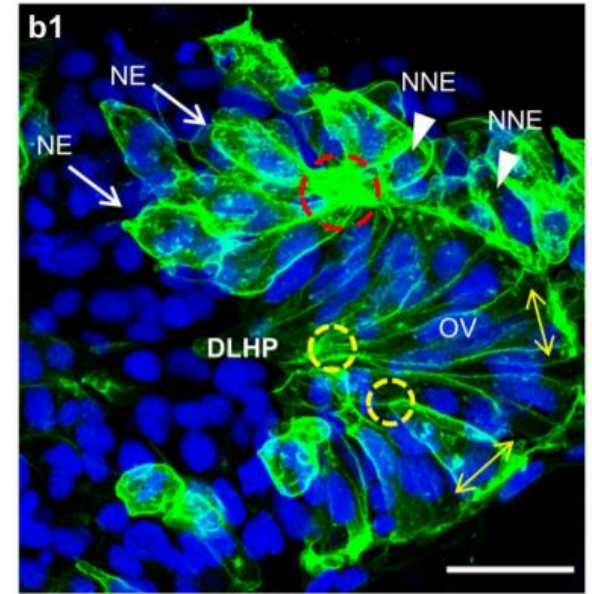
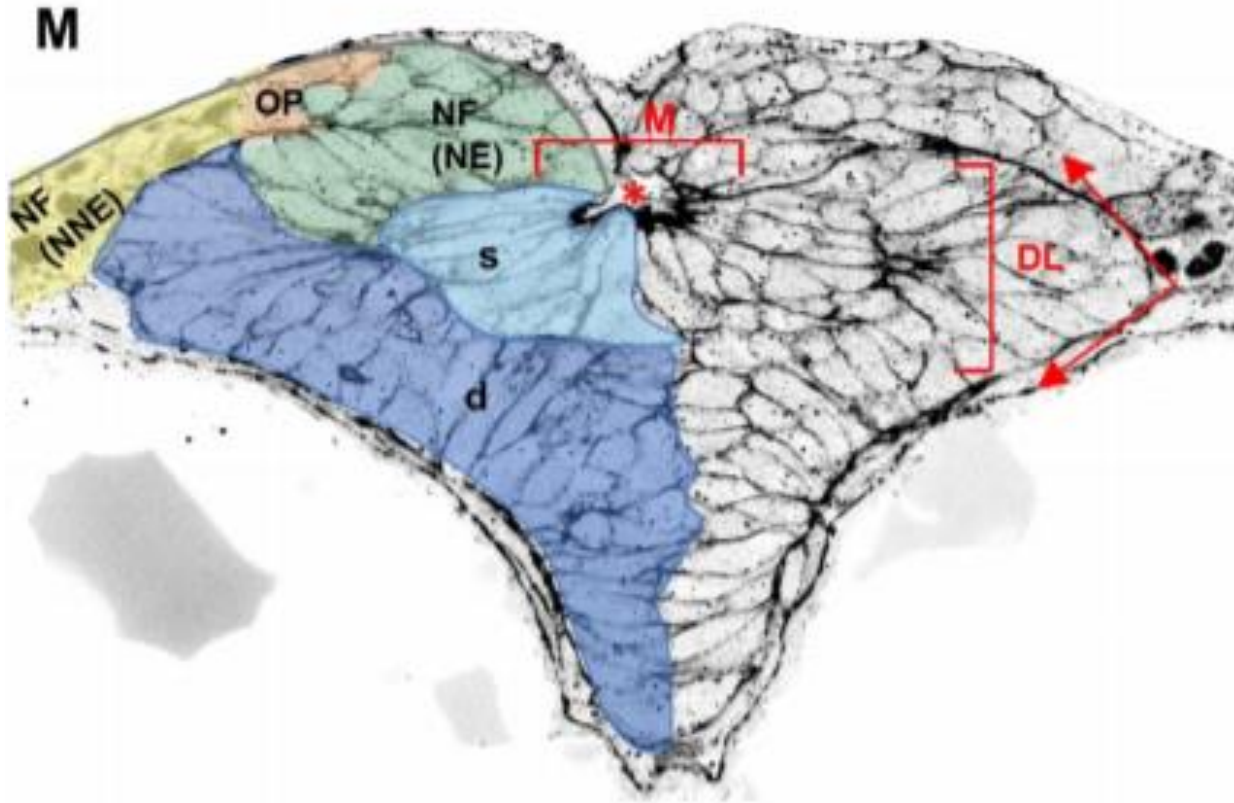
Chuanyu Guo,<sup>1</sup> Jian Zou,<sup>1</sup> Yi Wen,<sup>1</sup> Wei Fang,<sup>1</sup> Donna Beer Stolz,<sup>2</sup> Ming Sun,<sup>2</sup> and Xiangyun Wei<sup>1,3,4,5,\*</sup>



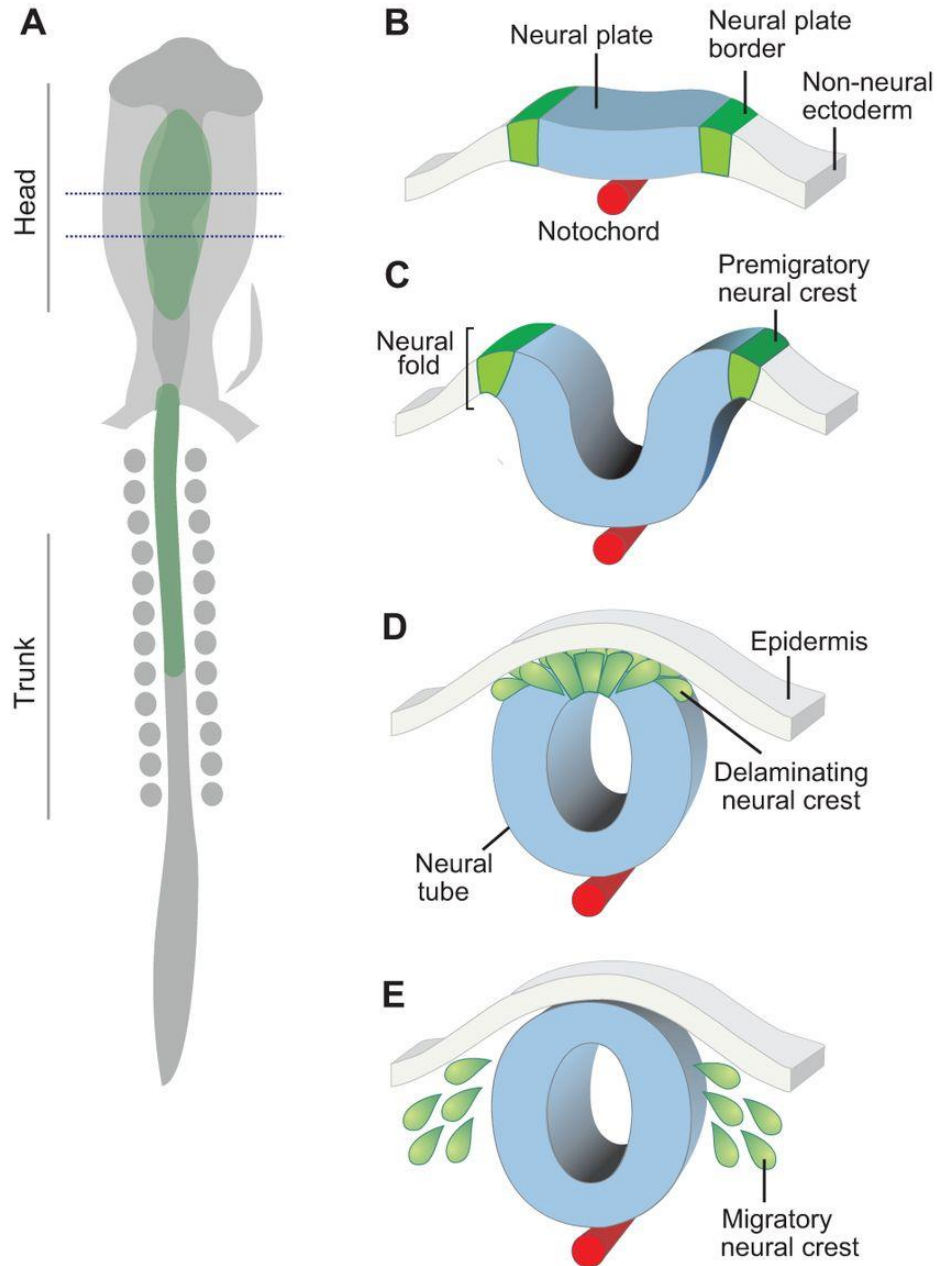
N-Cad-GFP  
ZO-1-mCherry

**Hingepoints and neural folds reveal conserved  
features of primary neurulation in the zebrafish forebrain**

Jonathan M. Werner<sup>1\*</sup>, Maraki Y. Negesse<sup>1\*</sup>, Dominique L. Brooks<sup>1</sup>, Allyson R. Caldwell<sup>1</sup>,  
Jafira M. Johnson<sup>1</sup> and Rachel M. Brewster<sup>1</sup>



# La cuarta hoja embrionaria: la cresta neural



## F Neural crest derivatives

### Mesenchymal cells

- Chondroblasts/chondrocytes
- Osteoblasts/osteocytes
- Fibroblasts
- Odontoblasts
- Cardiac mesenchyme
- Myoblasts
- Adipocytes

### Neuronal cells

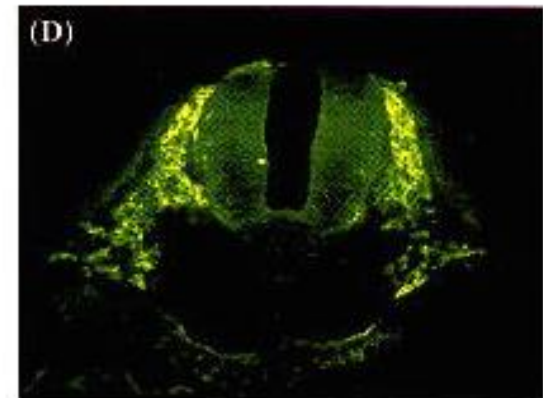
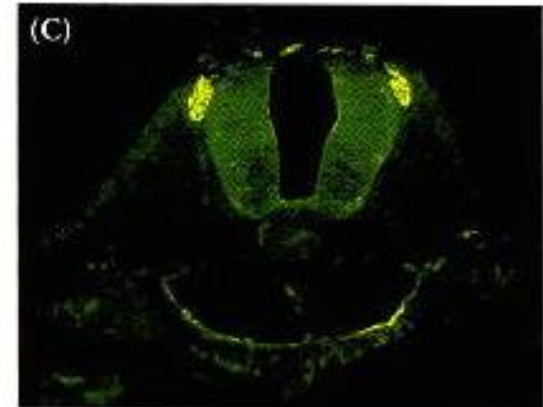
- Sensory neurons
- Cholinergic neurons
- Adrenergic neurons
- Satellite cells
- Schwann cells
- Glia cells

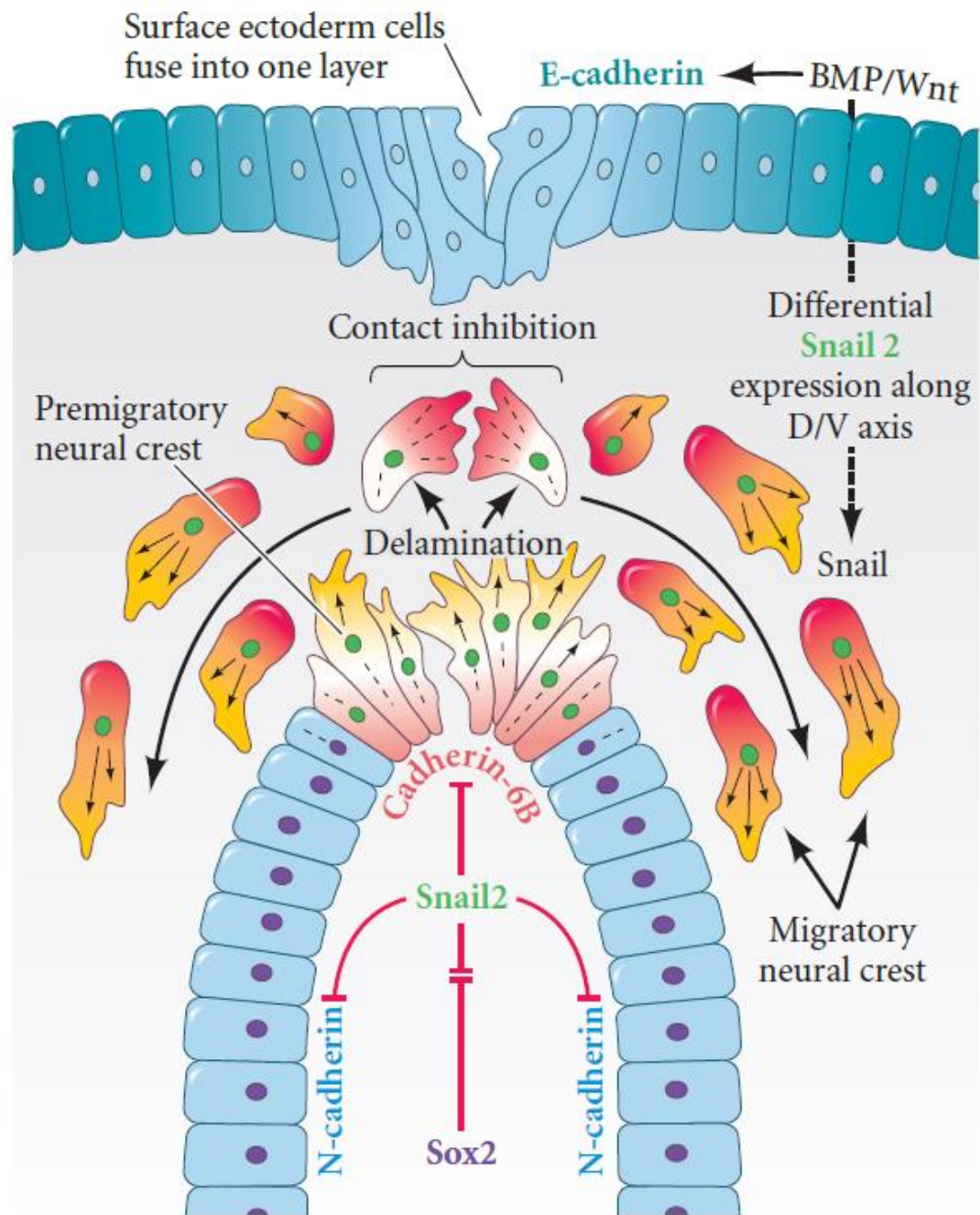
### Secretory cells

- Chromaffin cells
- Parafollicular cells
- Calcitonin-producing cells

### Pigmented cells

- Melanocytes





**Retraction**

Actomyosin stress fibers

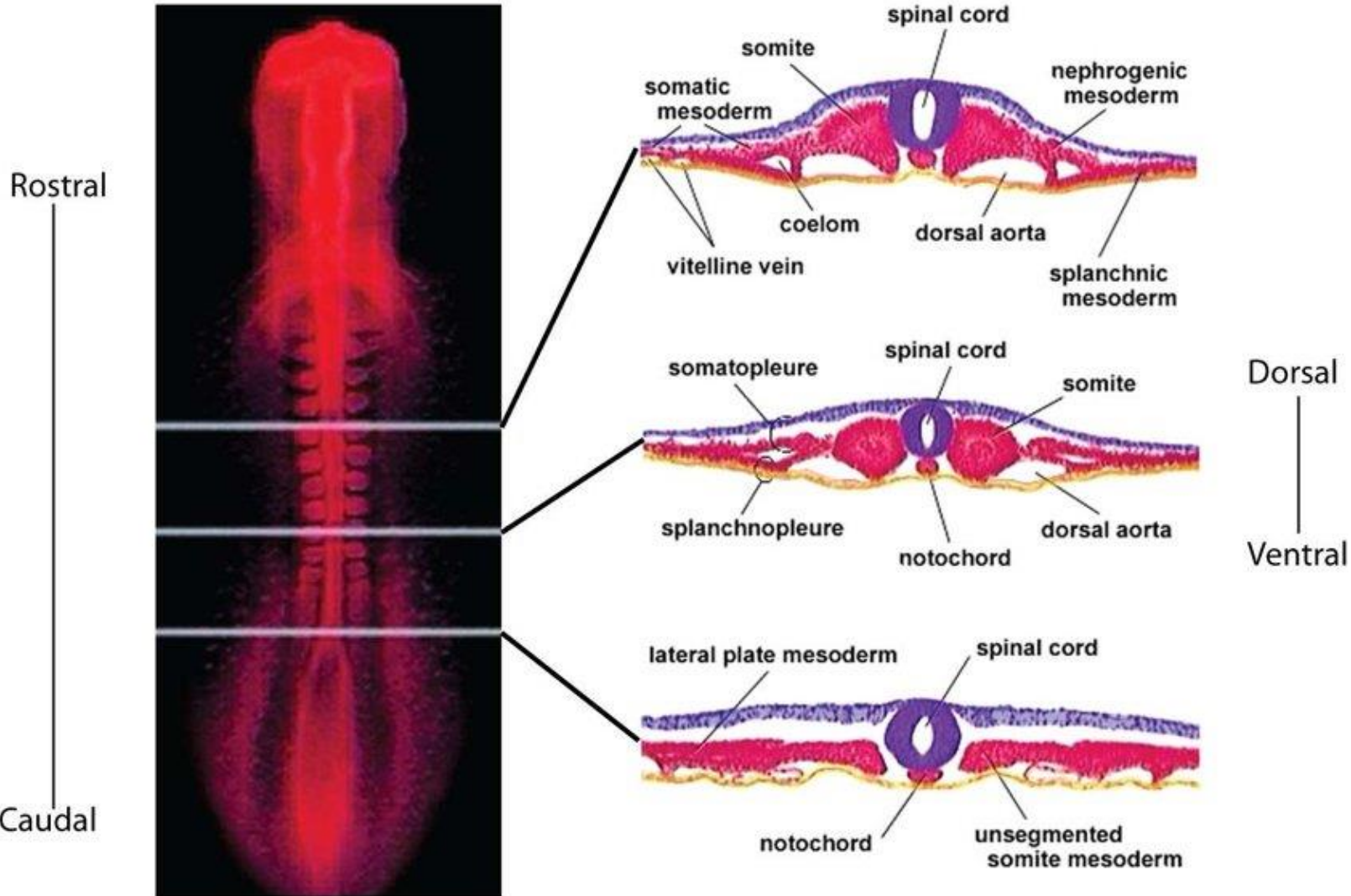
RhoA

Rac1

**Directed growth**

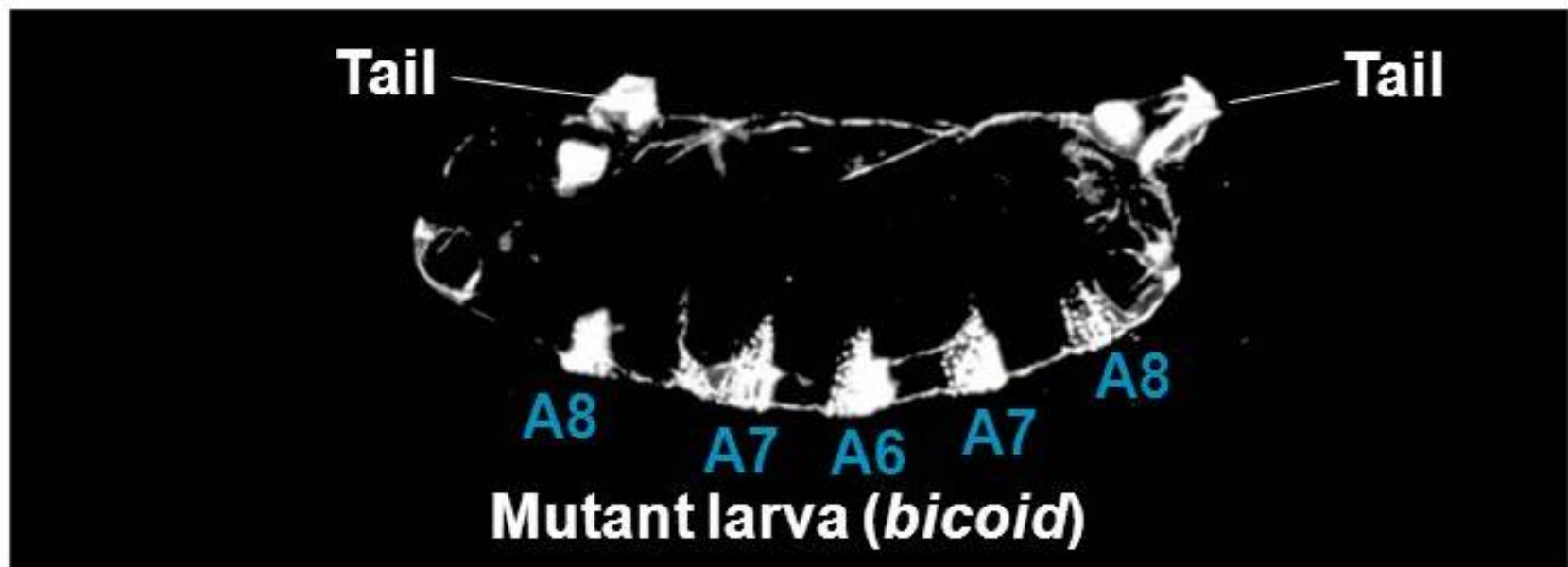
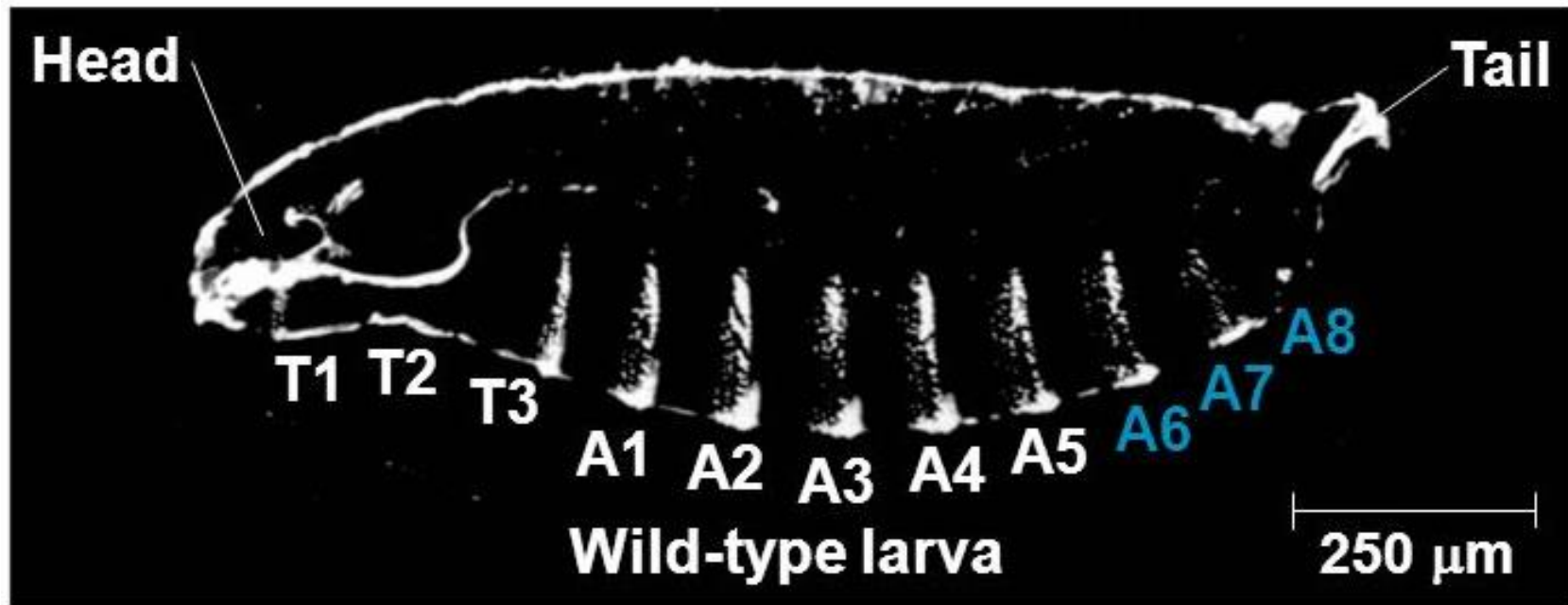
Lamellipodia/filopodia focal adhesions

# Las capas germinales en el embrión





# Problema:



# The Nobel Prize in Physiology or Medicine 1995



Edward B. Lewis  
Prize share: 1/3



Christiane Nüsslein-  
Volhard  
Prize share: 1/3



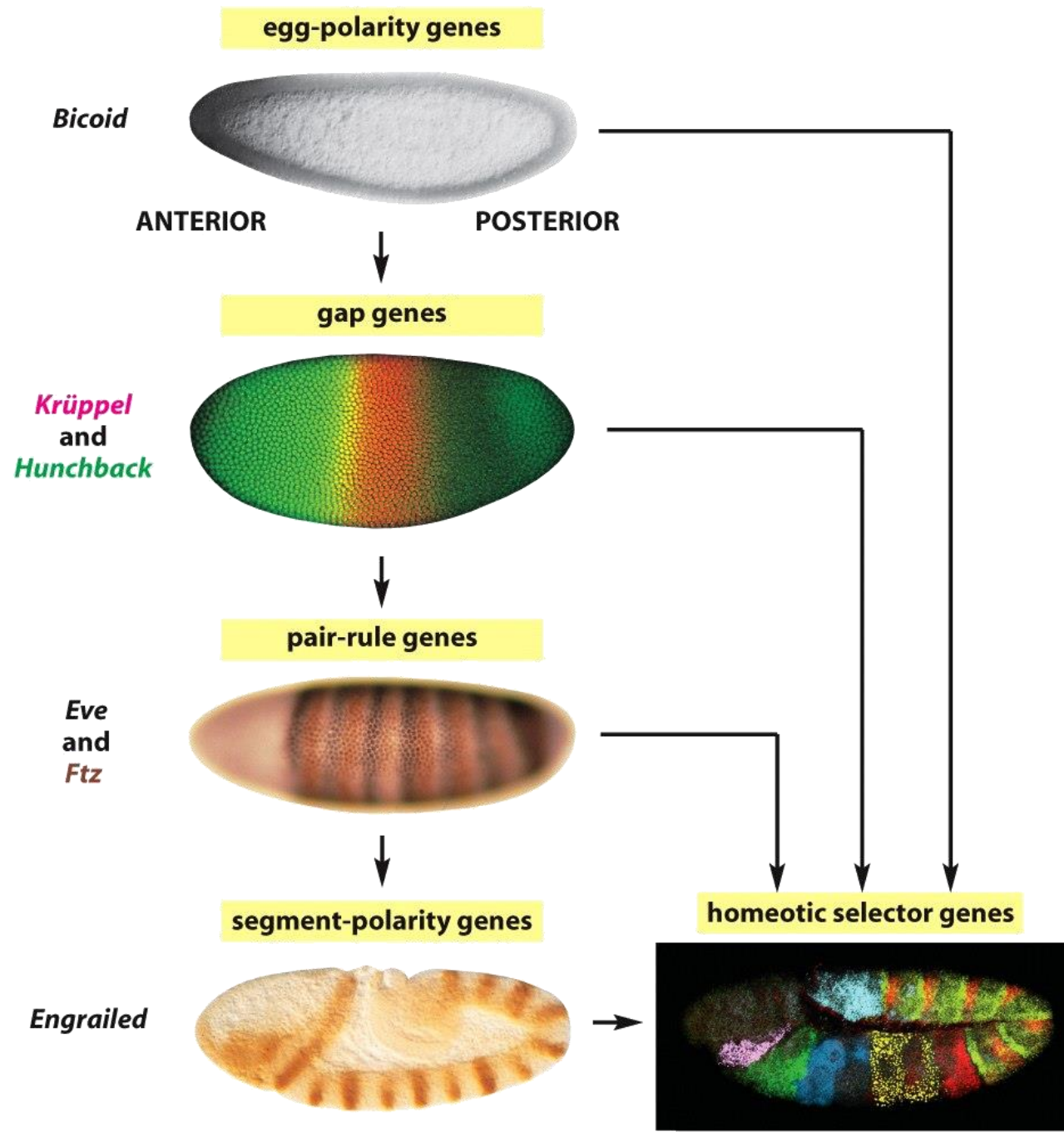
Eric F. Wieschaus  
Prize share: 1/3

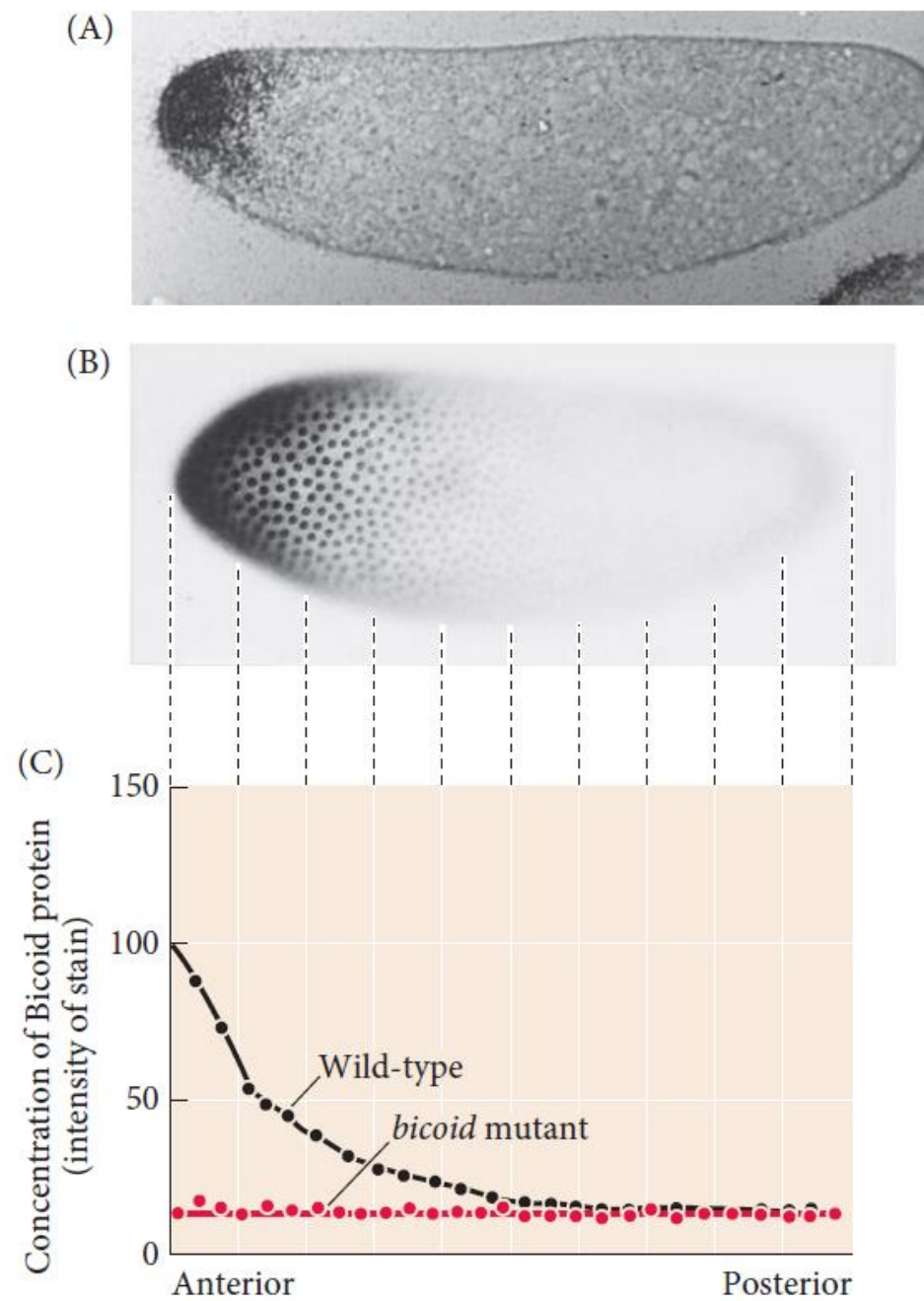
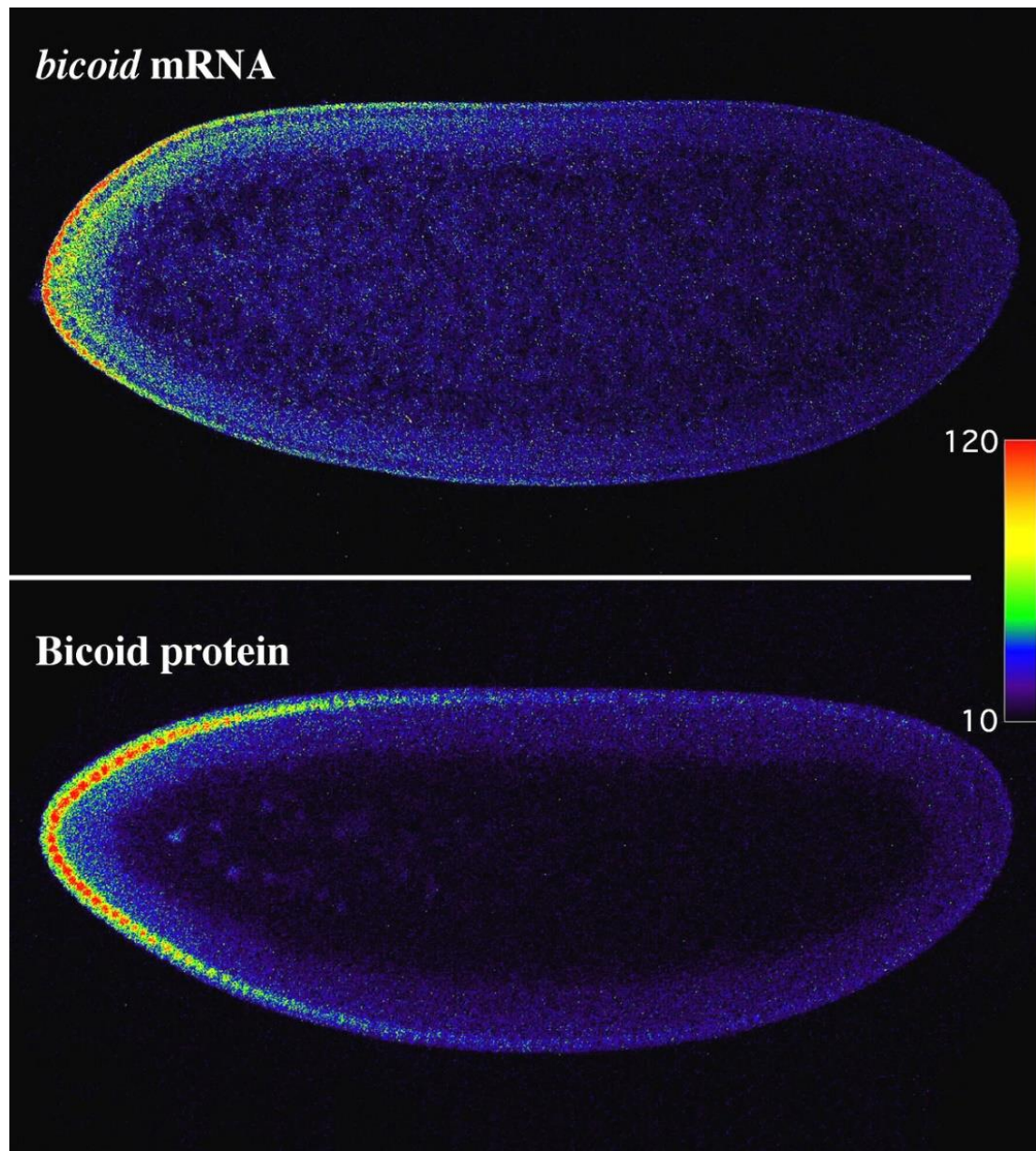
The Nobel Prize in Physiology or Medicine 1995 was awarded jointly to Edward B. Lewis, Christiane Nüsslein-Volhard and Eric F. Wieschaus *"for their discoveries concerning the genetic control of early embryonic development"*.

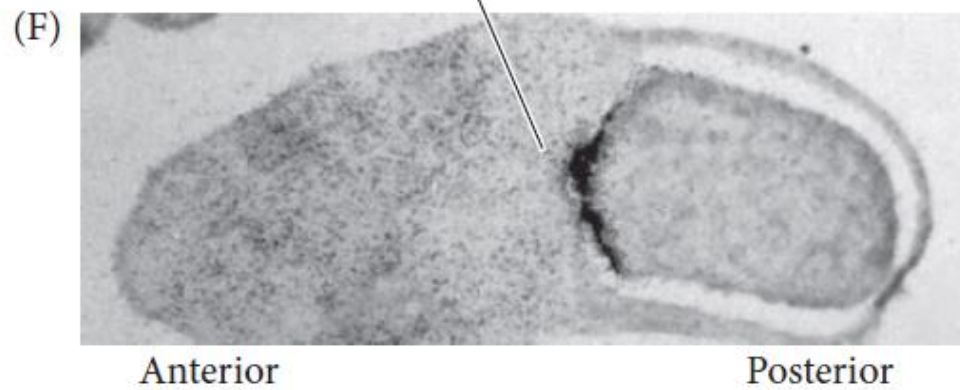
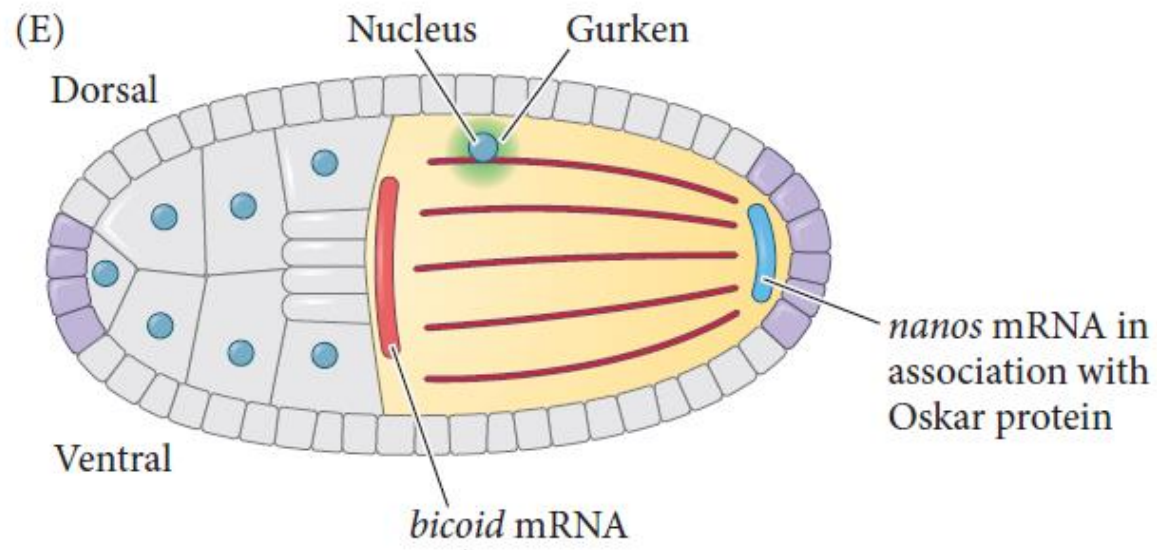
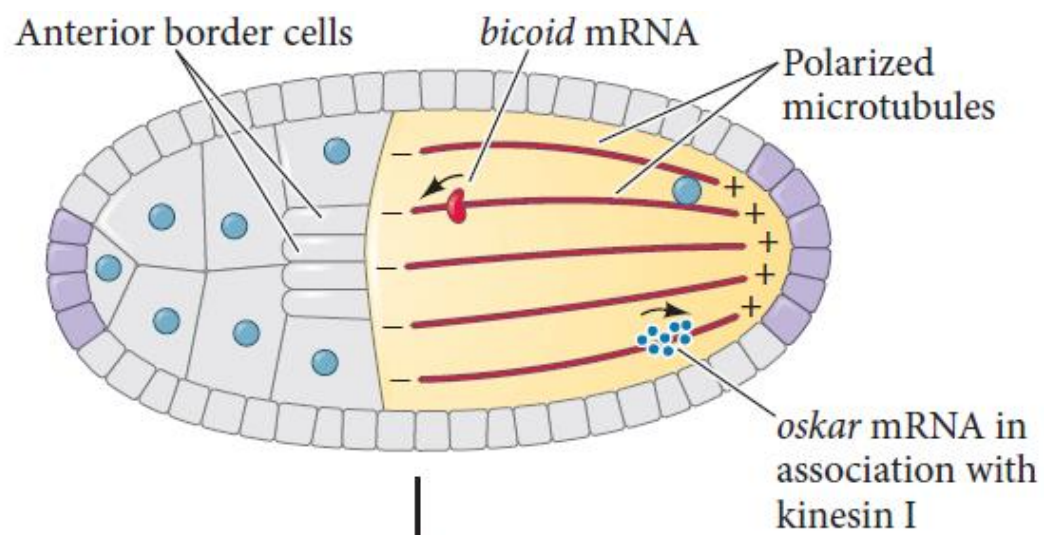
# Clivaje superficial

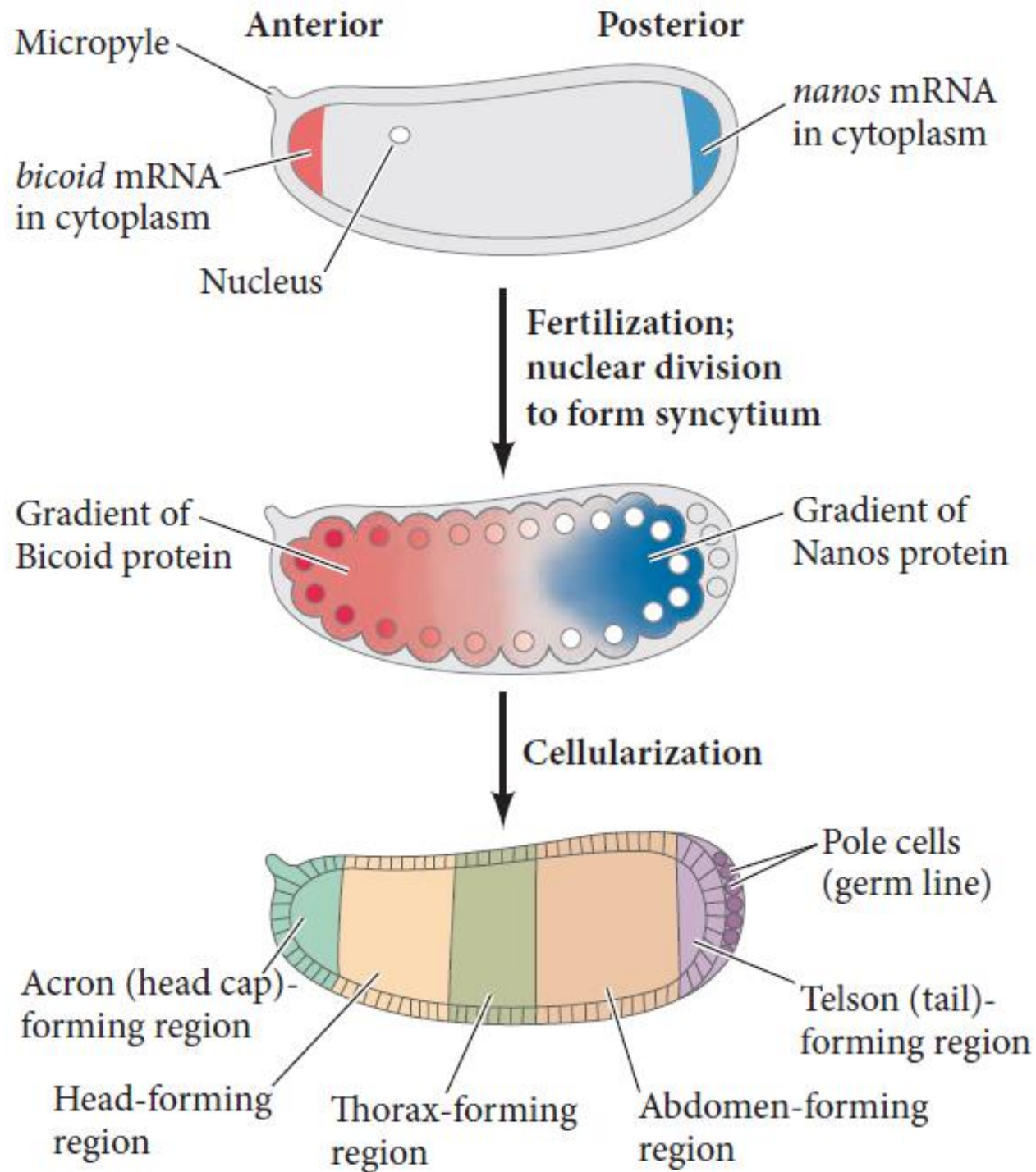


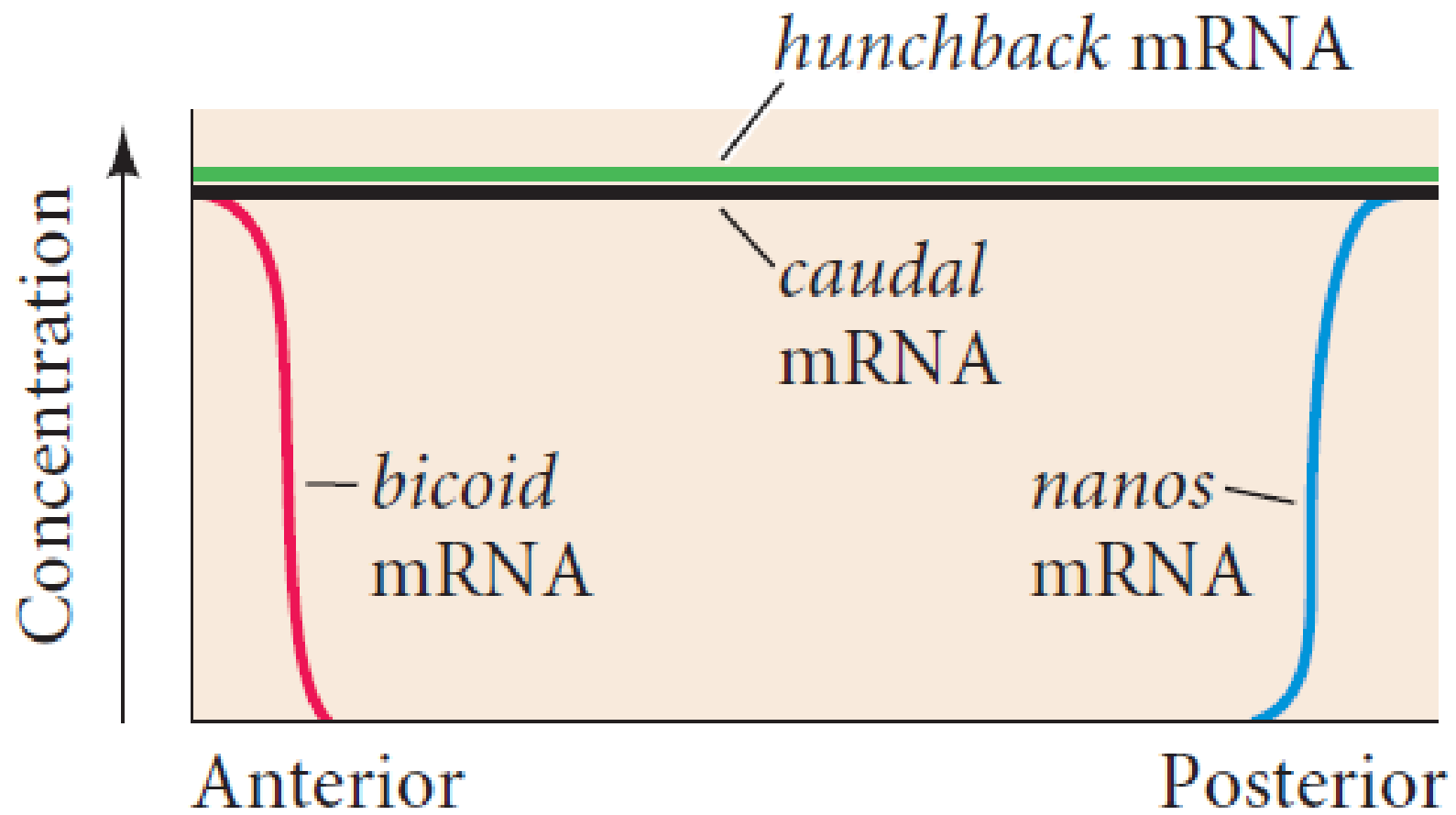
# Definición del eje céfalo-caudal en *Drosophila*



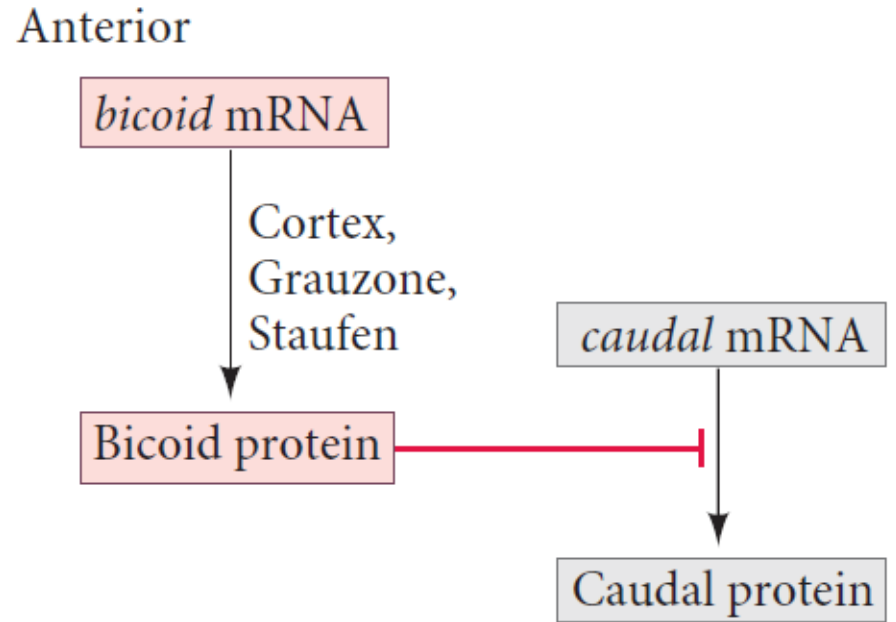
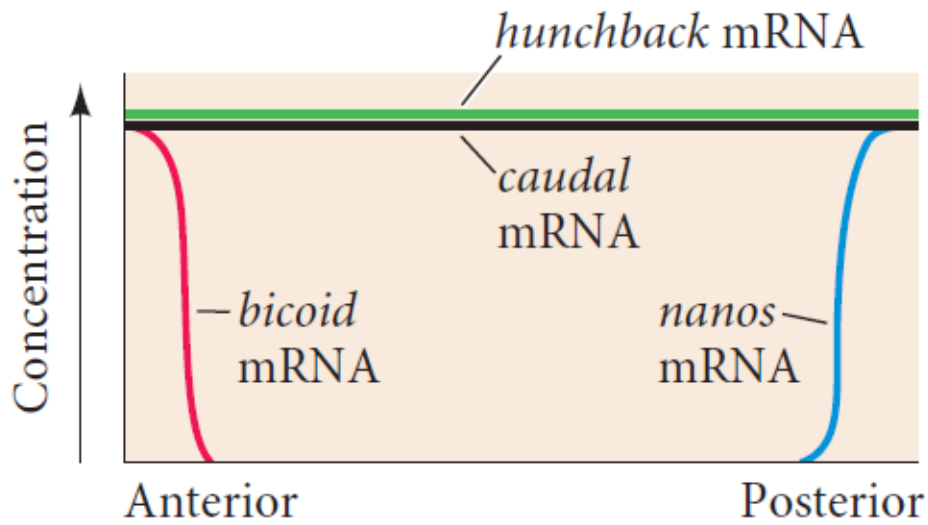












(B) Early cleavage embryo proteins

