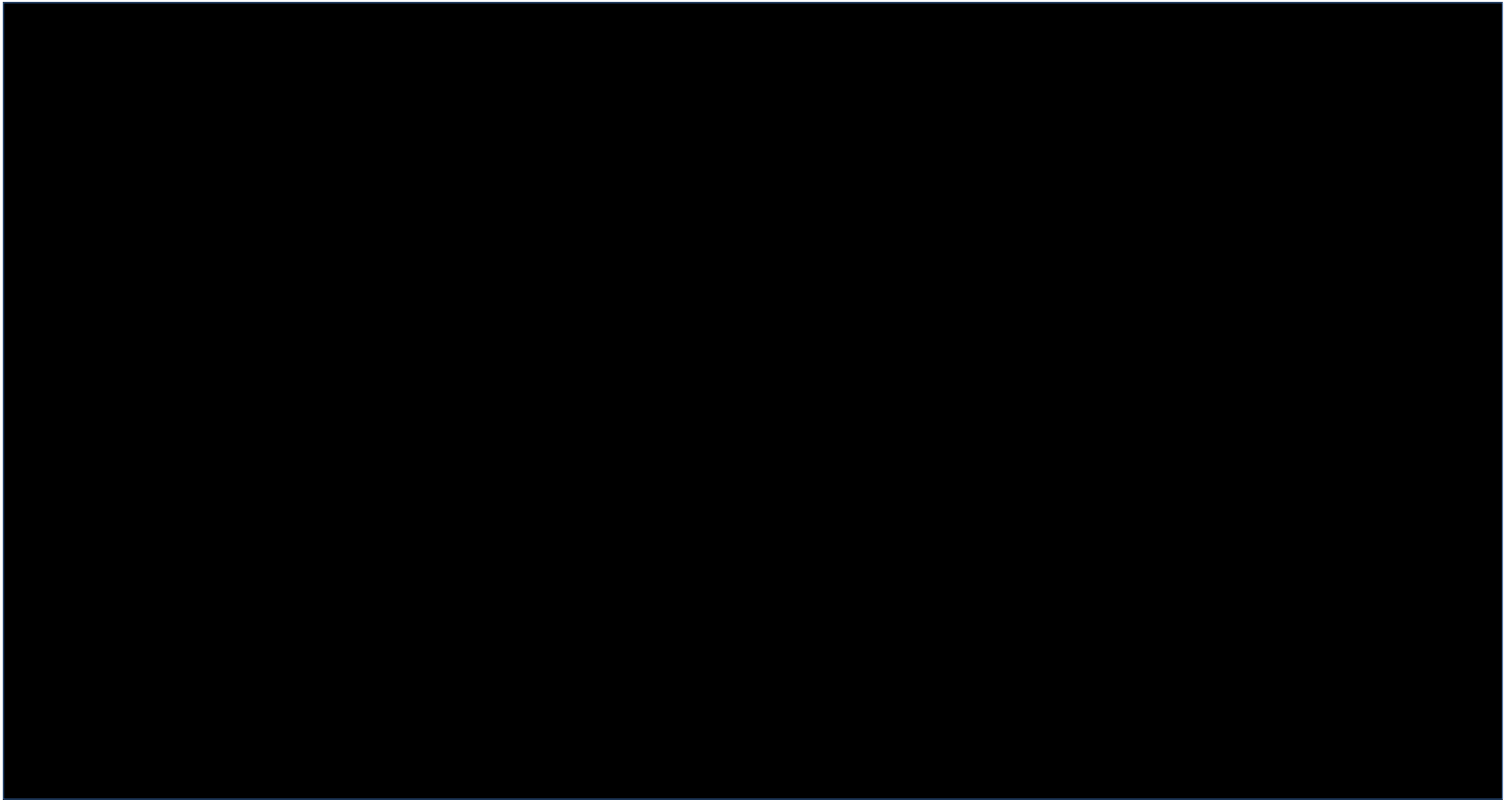


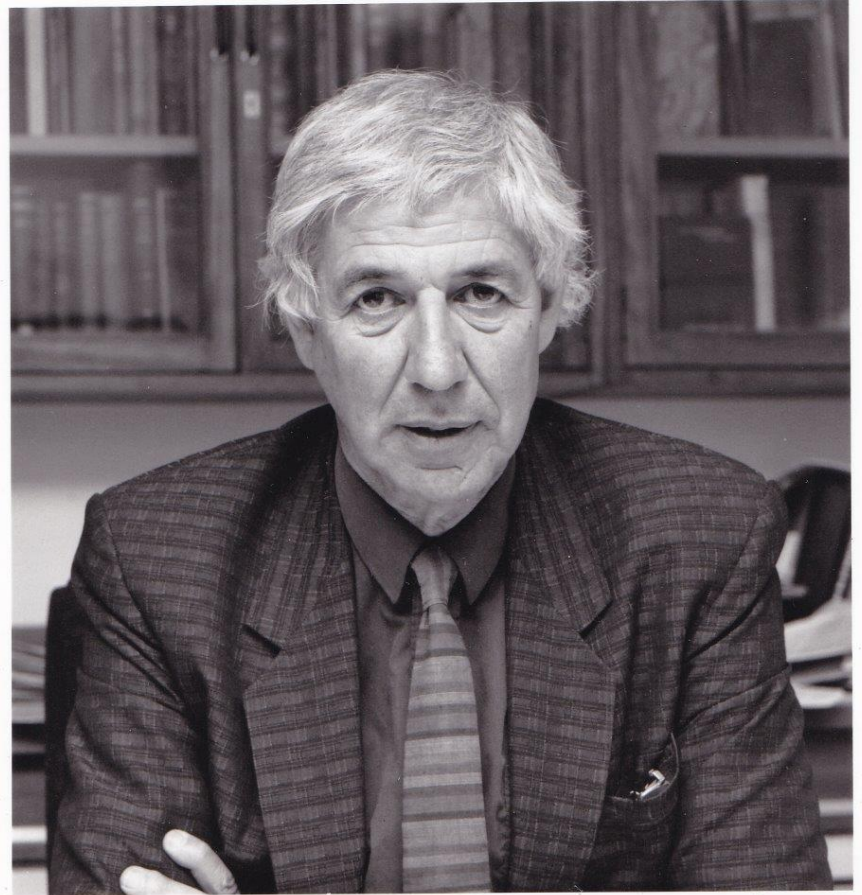
Desarrollo temprano en metazoarios II



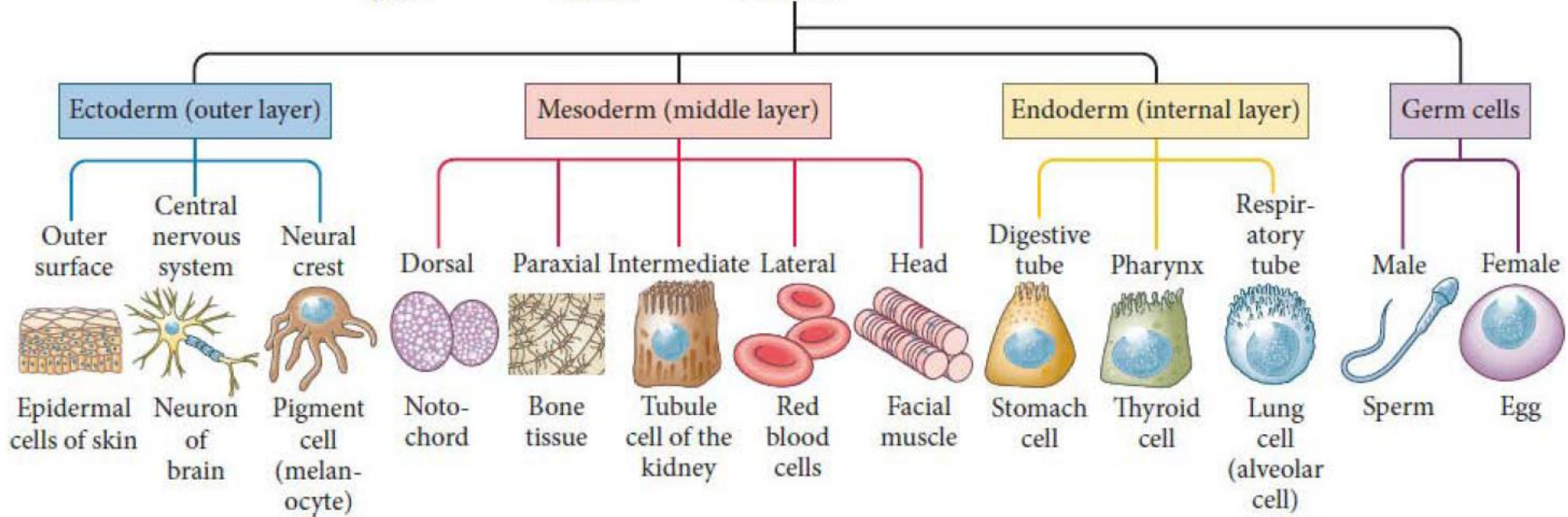
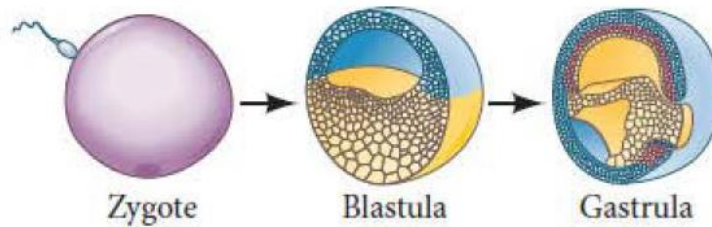
<https://www.youtube.com/watch?v=wJNRIDWjX-o>

Gonzalo Aparicio

“It is not birth, marriage, or death,
but **gastrulation** which is truly the
most important time in your life.”



Lewis Wolpert
(1929-2021)



Ectodermo epidermis, sistema nervioso

Mesodermo corazón, sangre, huesos, músculos, gónadas, riñón

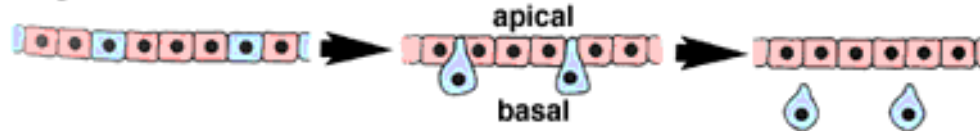
Endodermo epitelio del sistema digestivo y órganos asociados, pulmones

Movimientos morfogénéticos

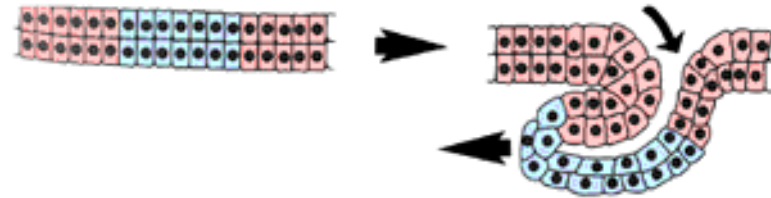
Invagination



Ingression



Involution



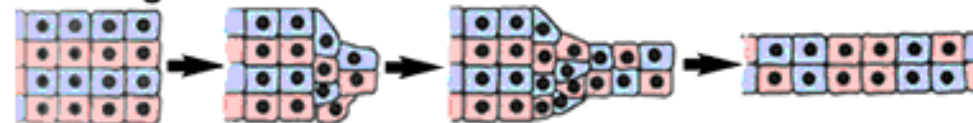
Epiboly



Intercalation

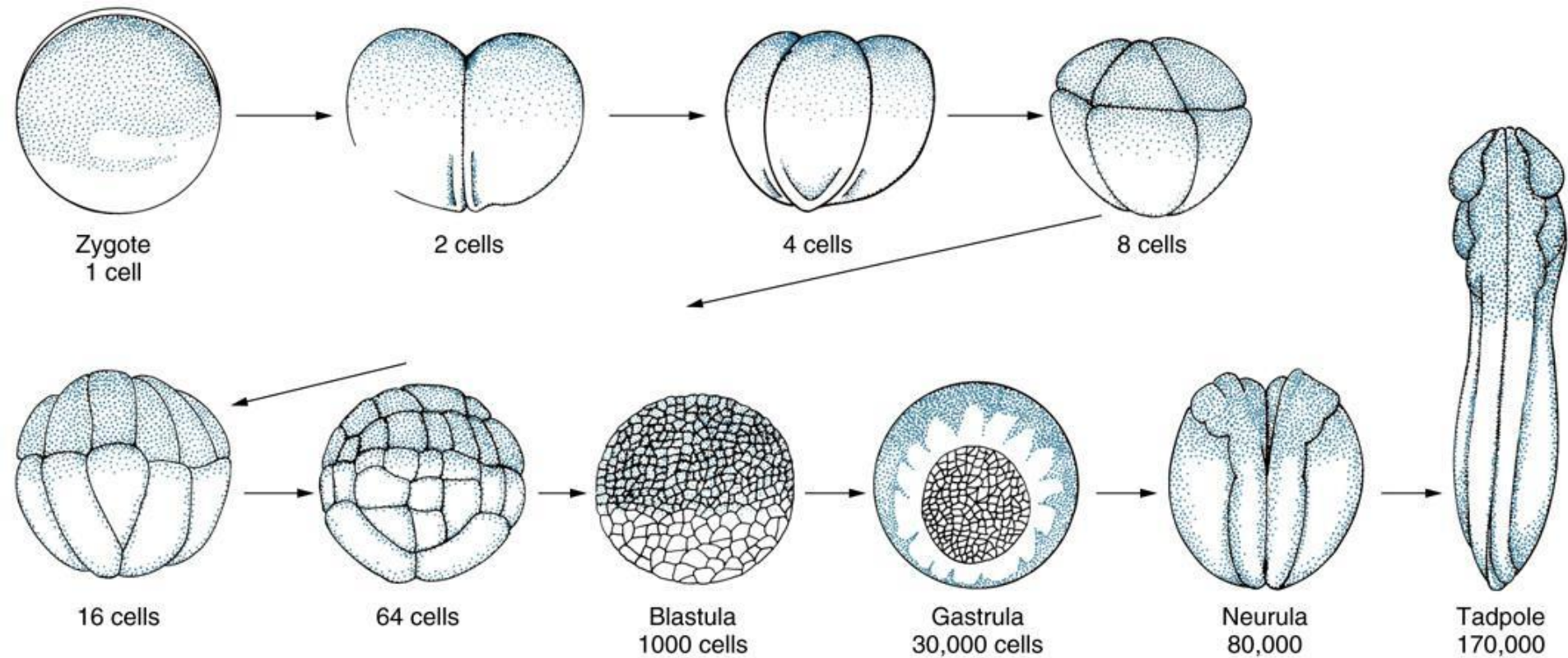


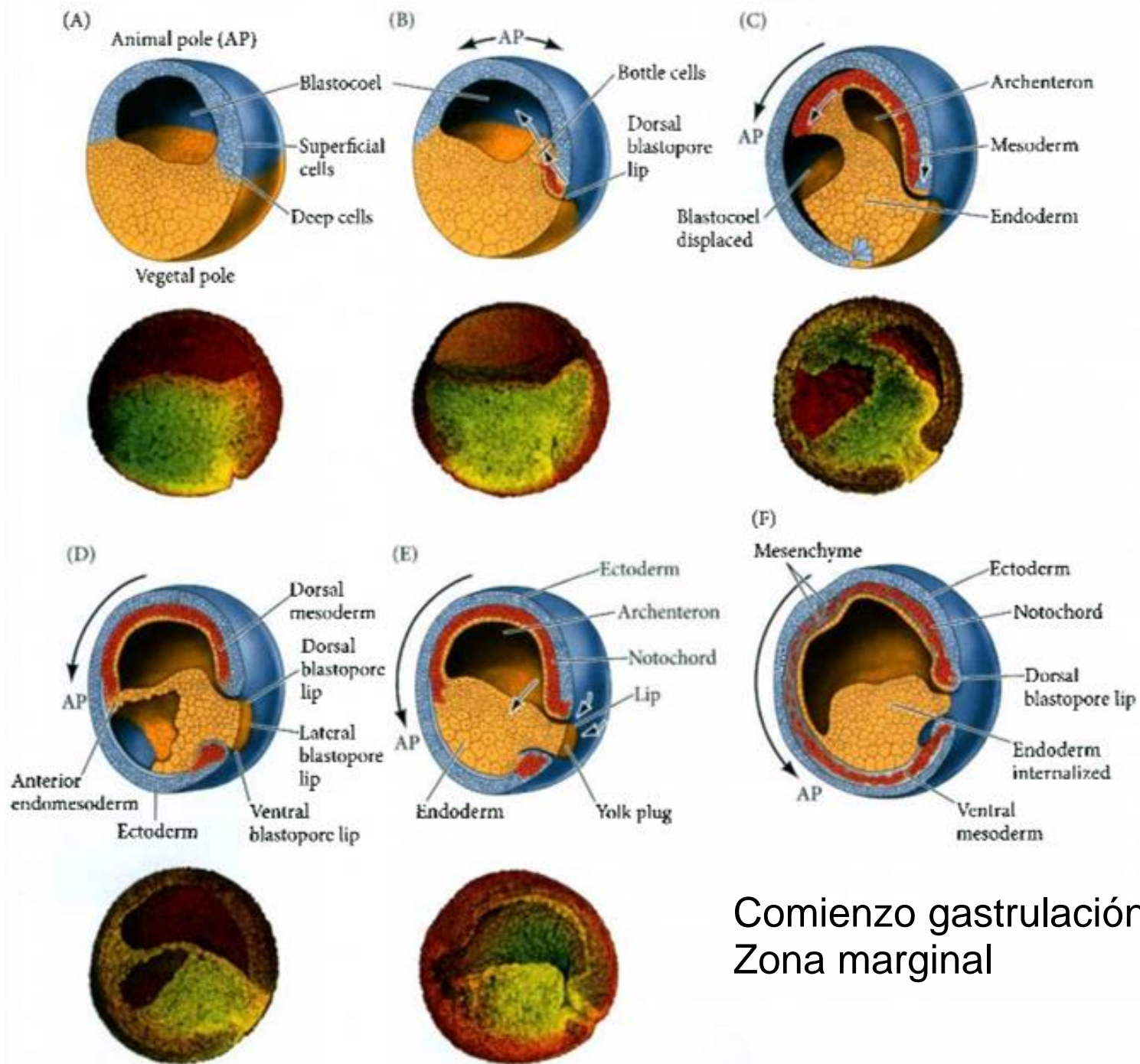
Convergent extension



Gastrulación

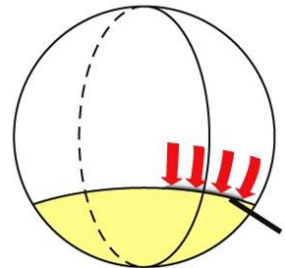
Embriones con clivaje holoblástico: Anfibios



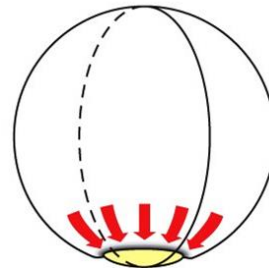
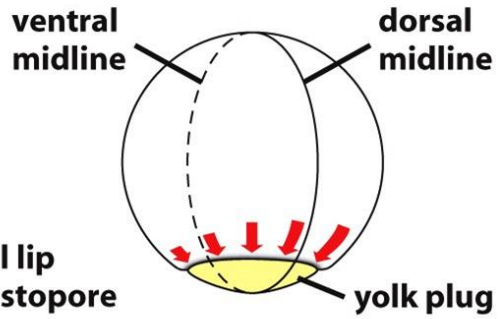


Comienzo gastrulación:
Zona marginal

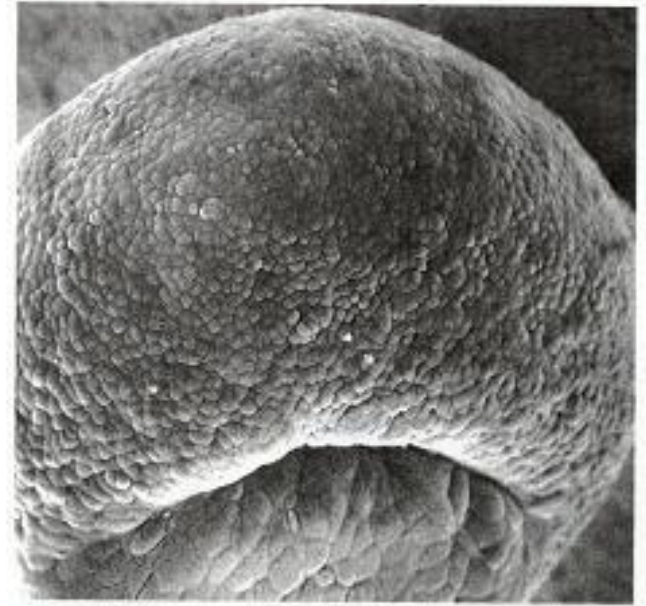
ANIMAL POLE



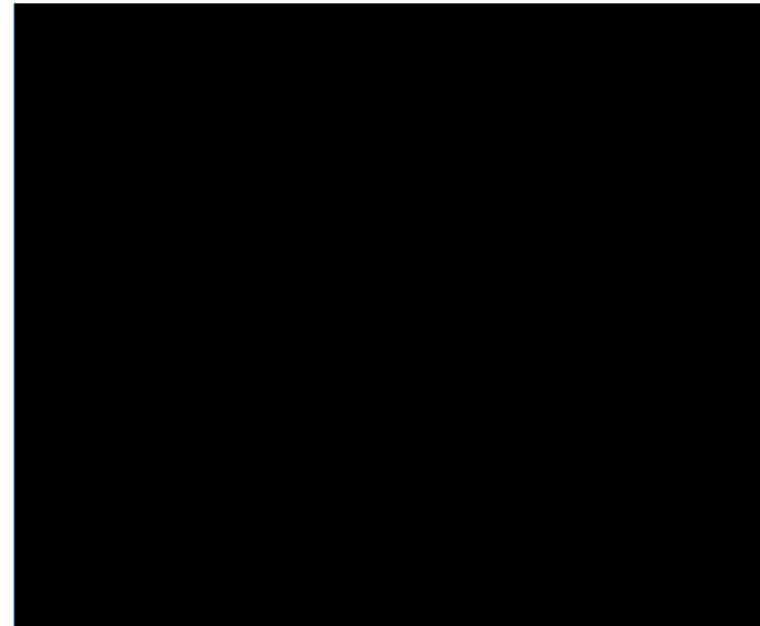
VEGETAL POLE



external views

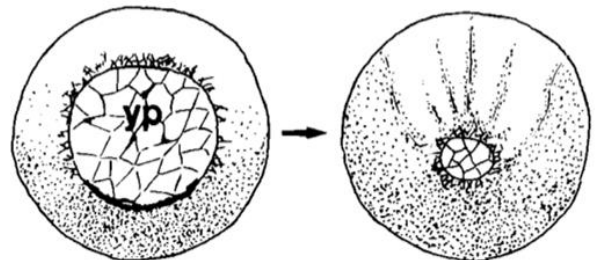
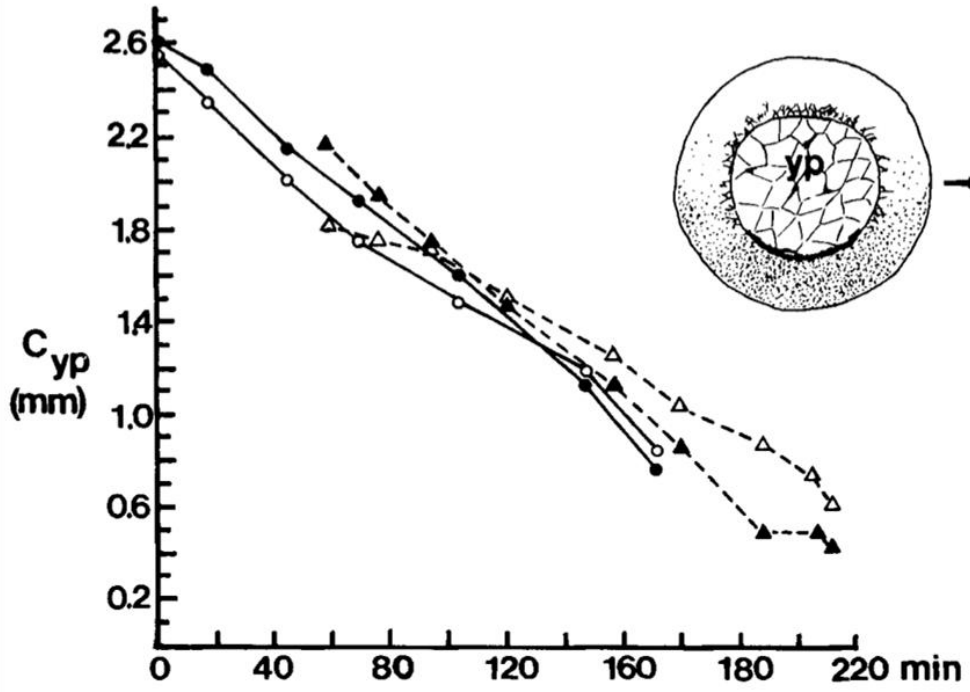
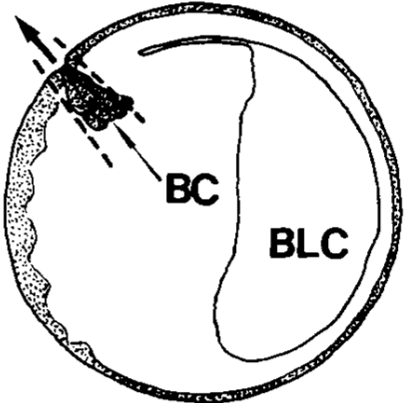


<https://youtu.be/6IJDpdChQK4>

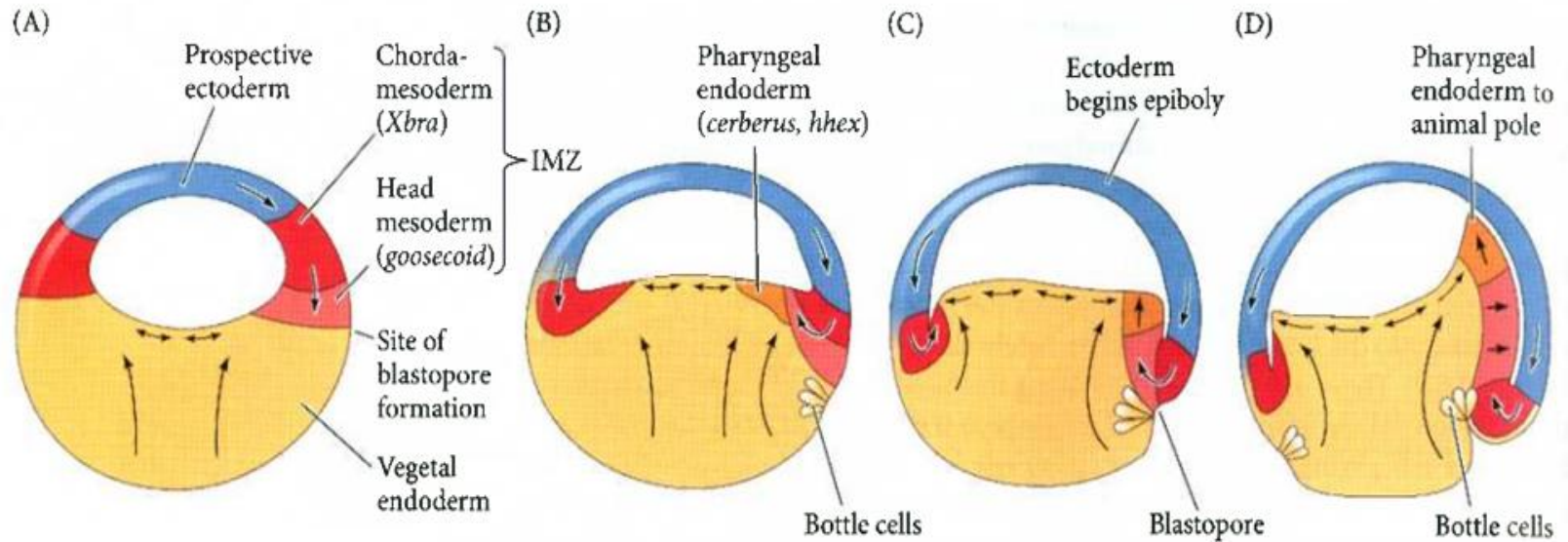


An Experimental Analysis of the Role of Bottle Cells and the Deep Marginal Zone in Gastrulation of *Xenopus laevis*

R.E. KELLER
Department of Biology, Indiana University, Bloomington, Indiana 47401
and Department of Biology, Yale University, New Haven, Connecticut 06520

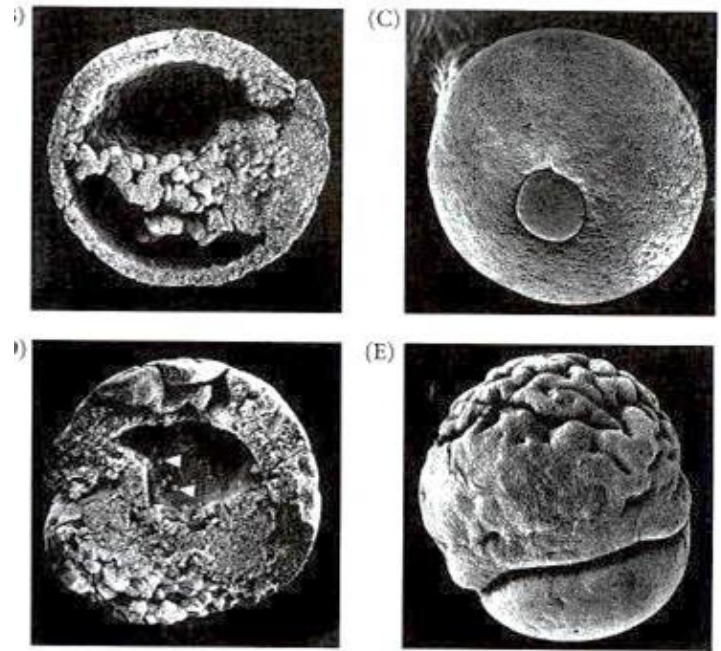


Rotación vegetal

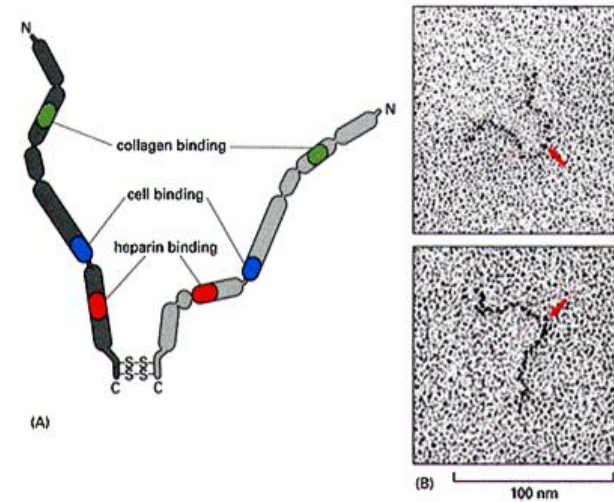
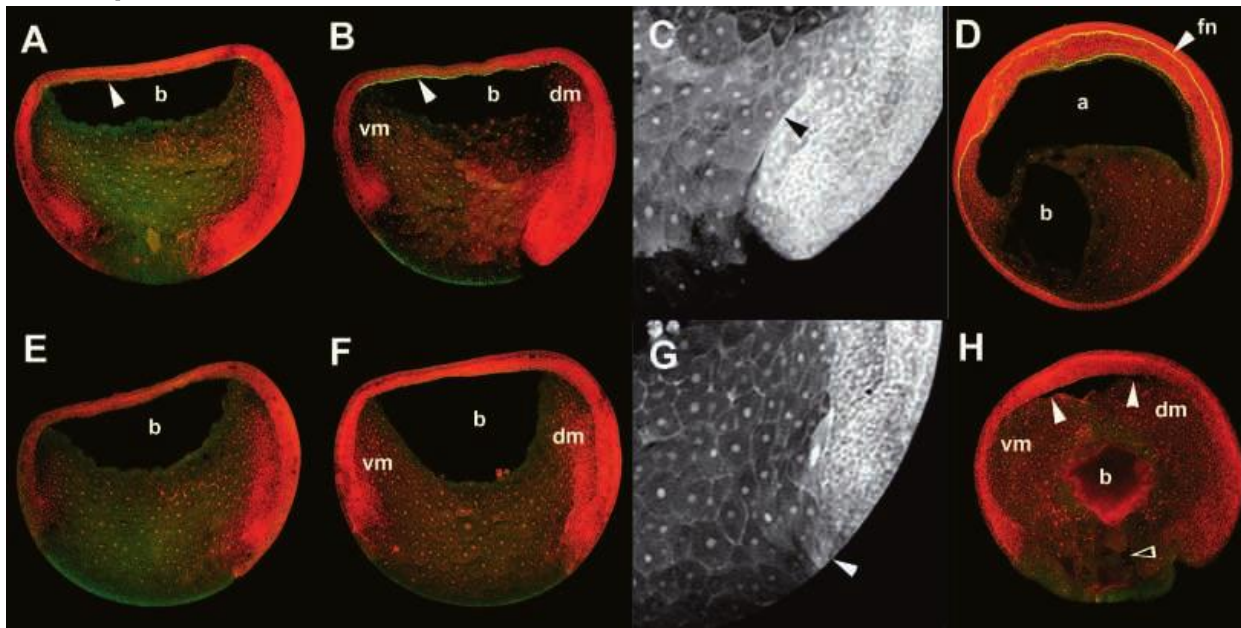


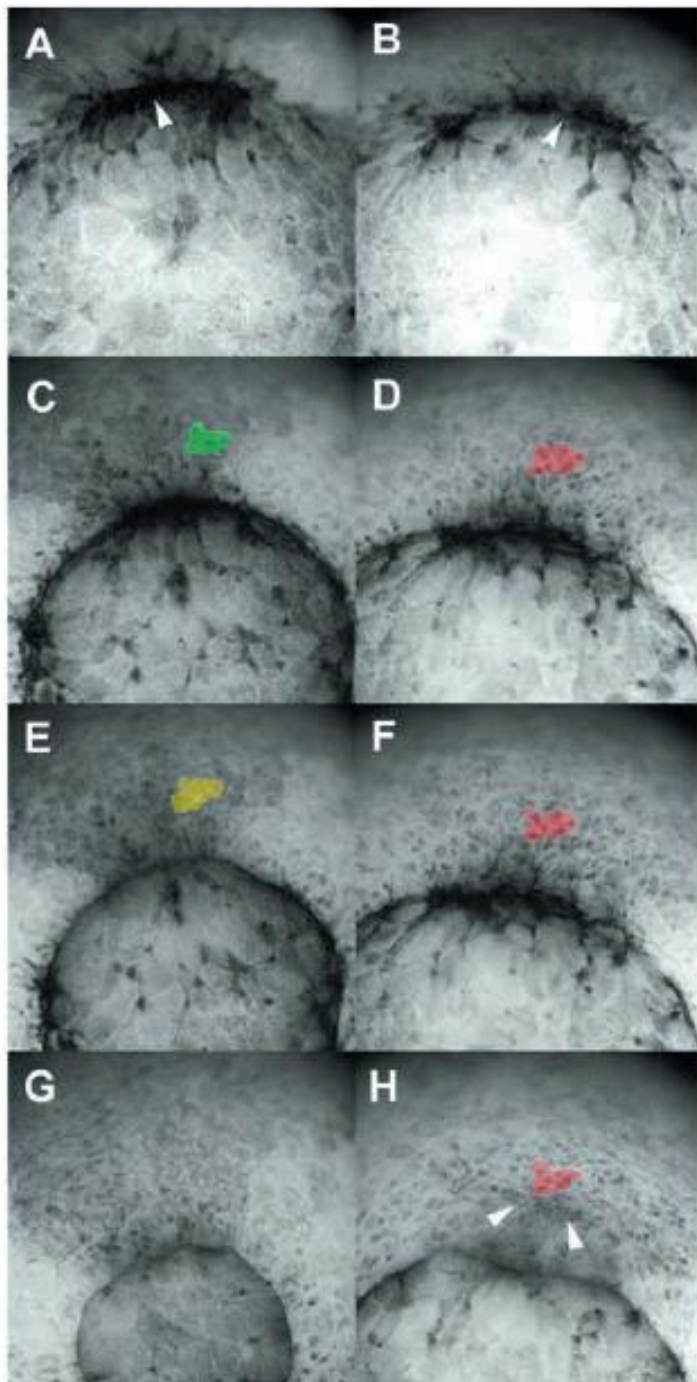
Coloca al endodermo faríngeo adyacente al blastocele, migrando hacia la futura región anterior del embrión

Rol de la fibronectina en la gastrulación de anfibios

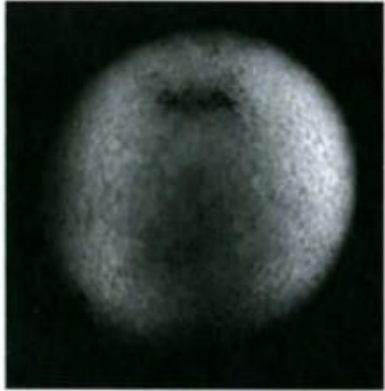


Bloqueo funcional con mAb

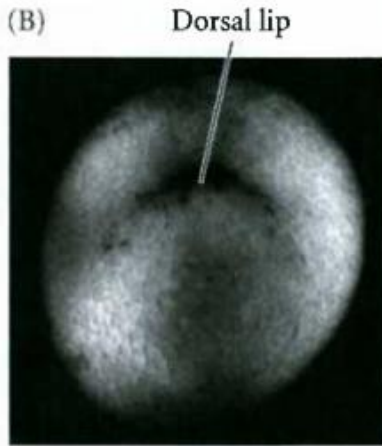




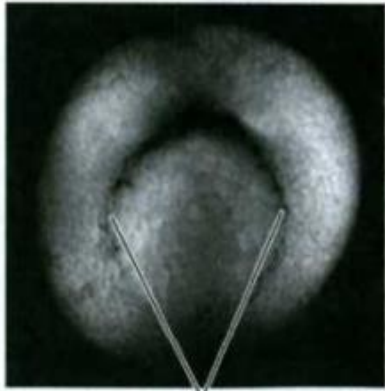
(A)



(B)

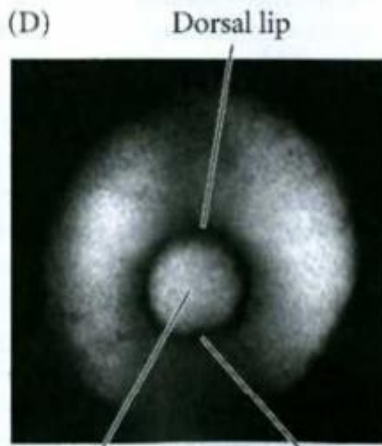


(C)



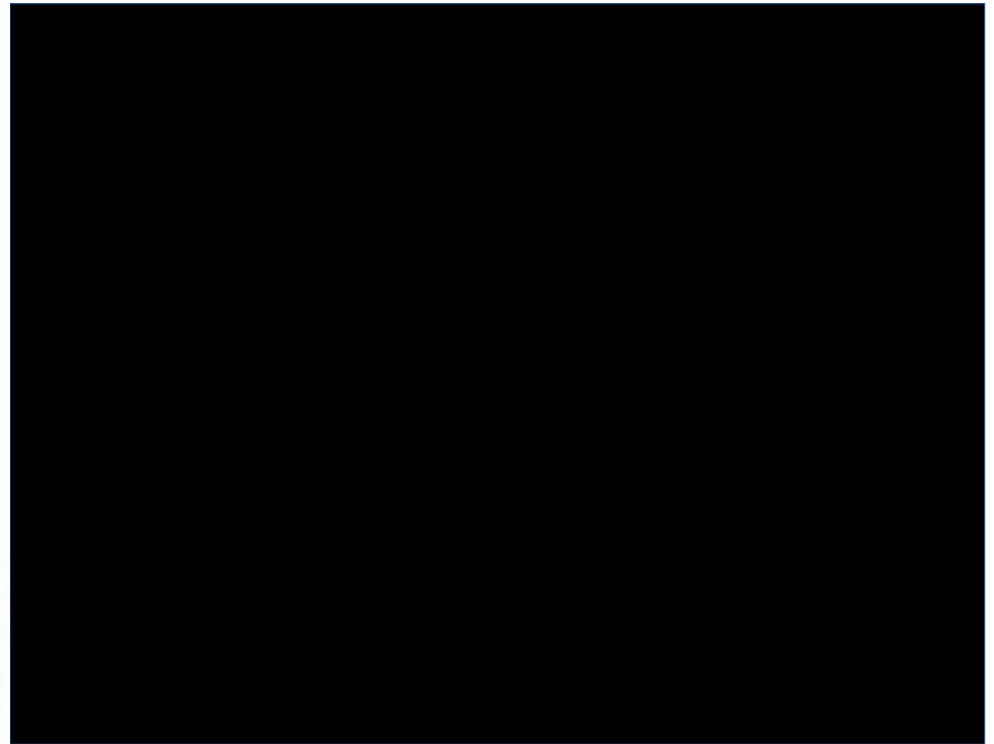
Bilateral lips

(D)



Yolk plug

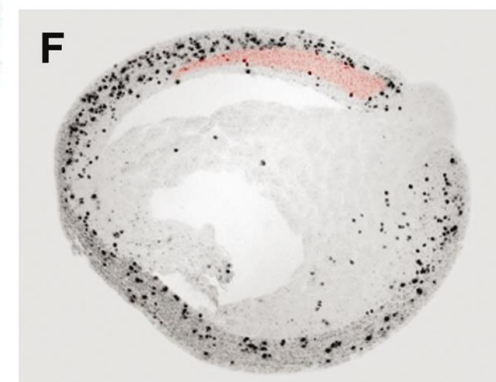
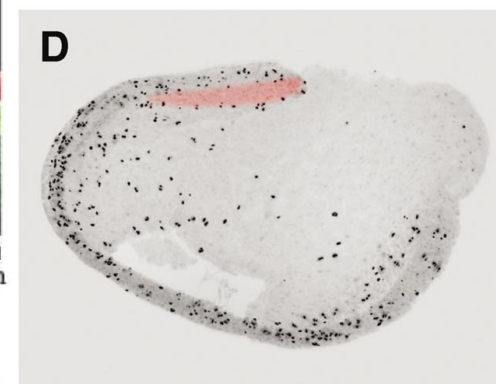
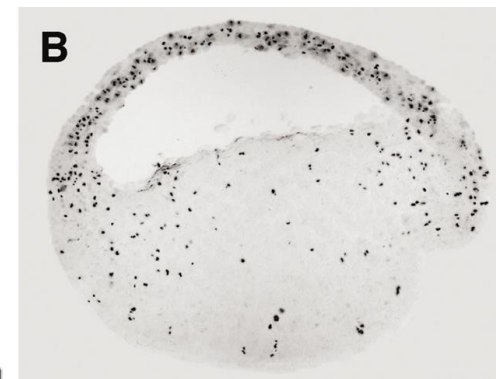
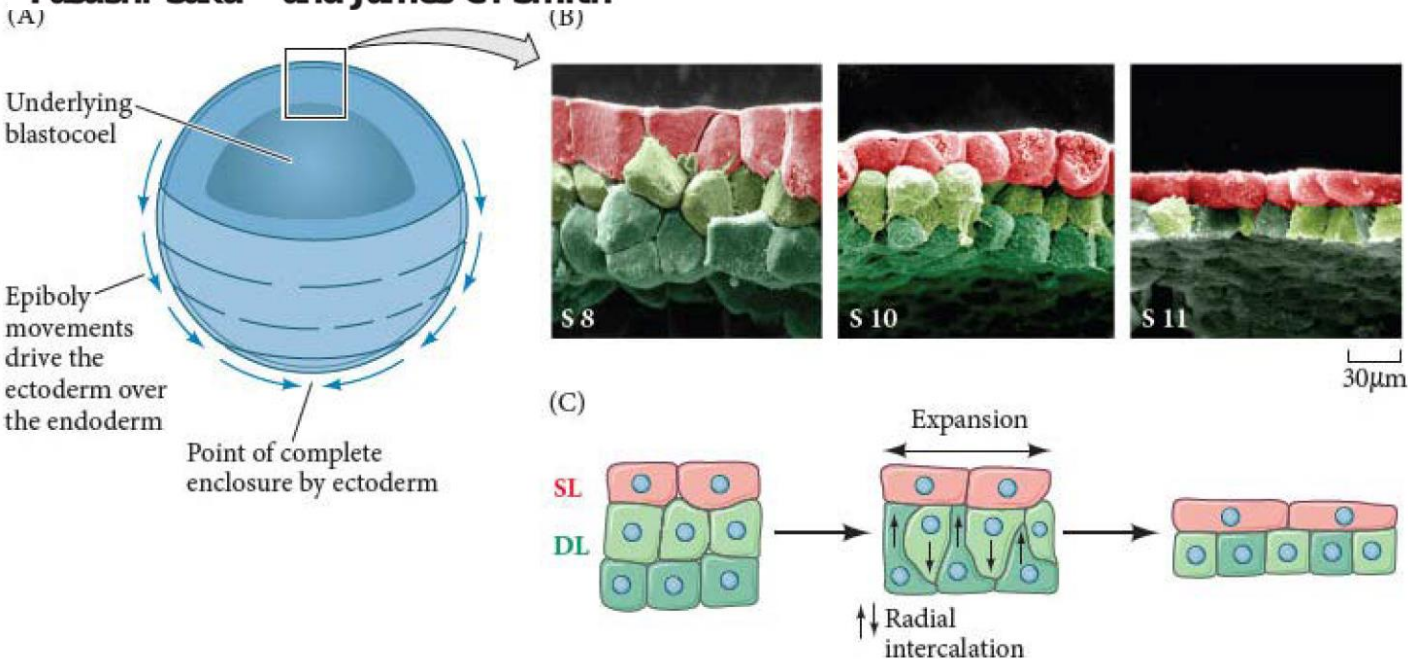
Ventral lip



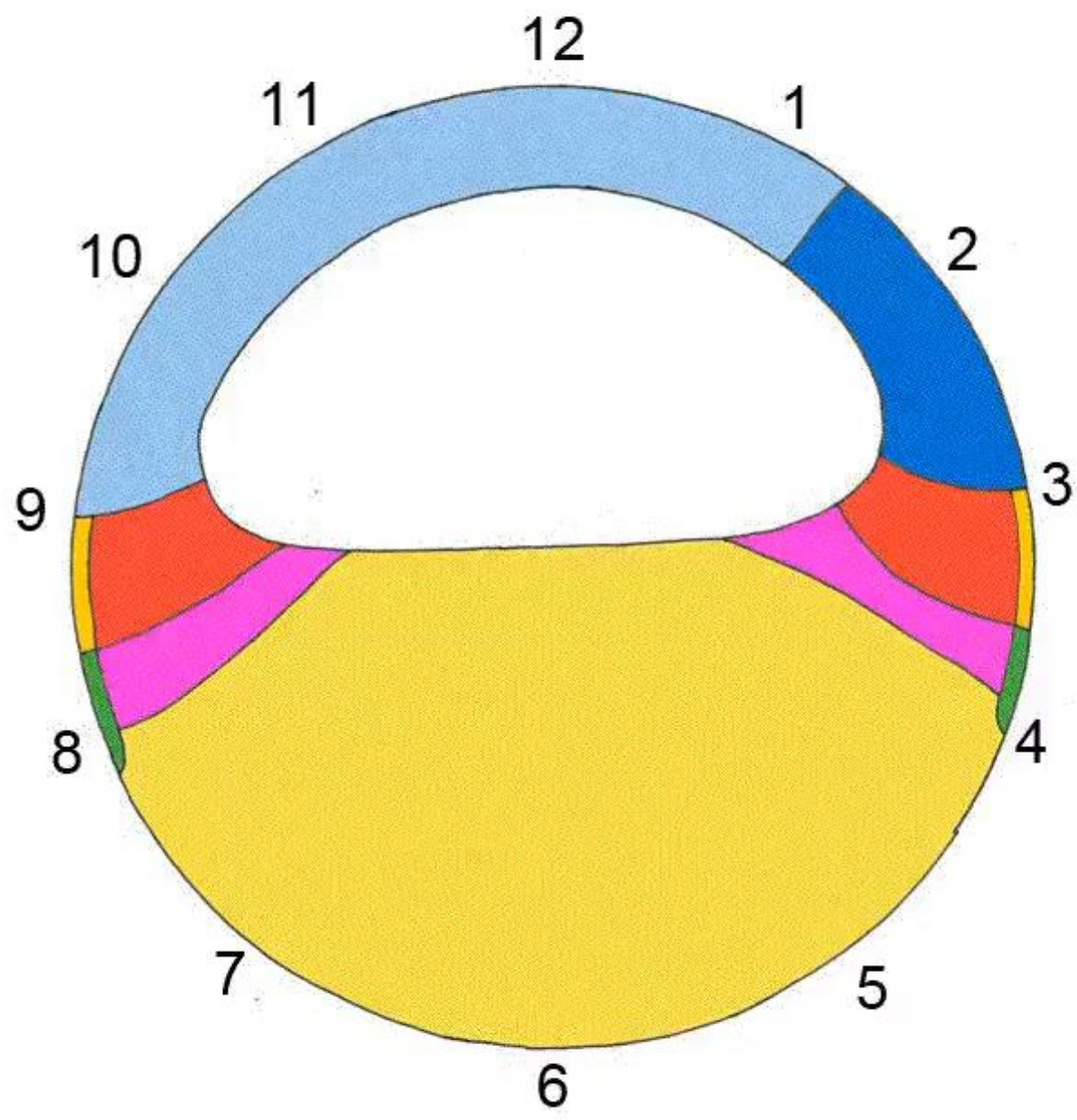
https://www.youtube.com/watch?v=ZEGvhkoVu_g

Spatial and Temporal Patterns of Cell Division during Early Xenopus Embryogenesis

Yasushi Saka^{1,2} and James C. Smith²



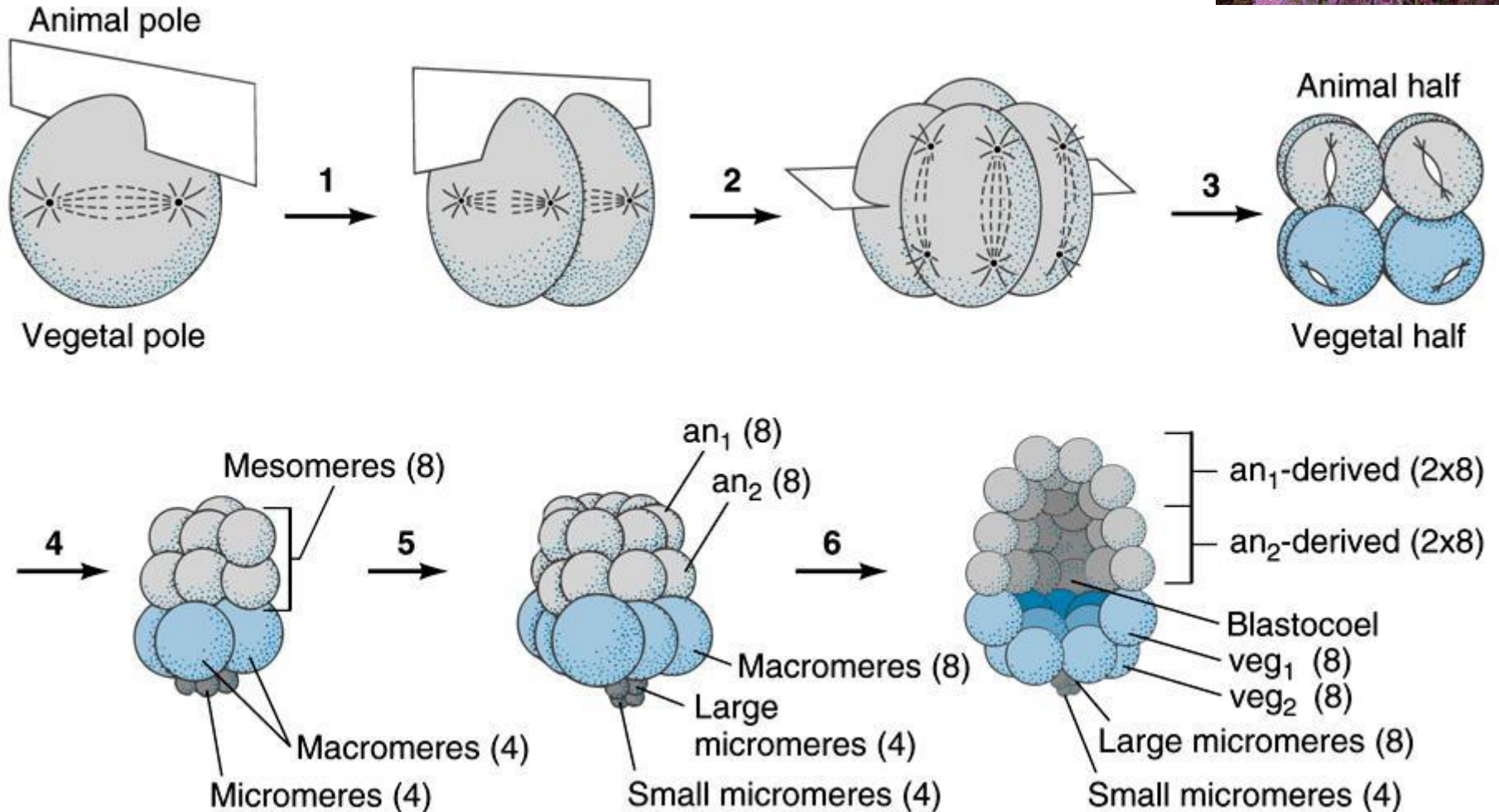
La epibolia del ectodermo es acompañada por aumento de la divisiones e intercalamientos celulares

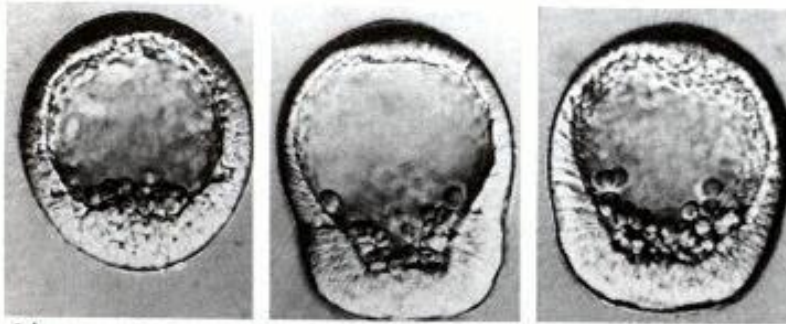


Gastrulación

Embriones con clivaje holoblástico:

Equinodermos

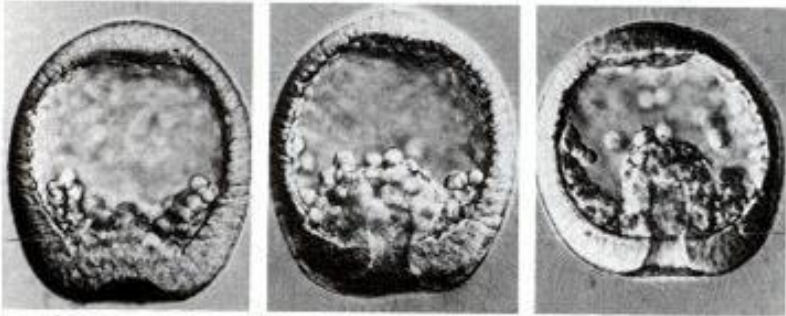




9 hrs.

9.5 hrs.

10 hrs.



10.5 hrs.

11 hrs.

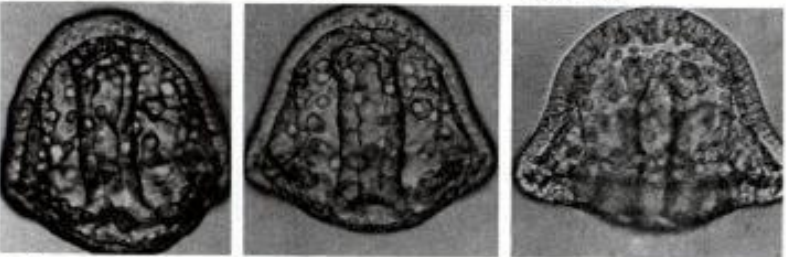
11.5 hrs.



12 hrs.

13 hrs.

13.5 hrs.



15 hrs.

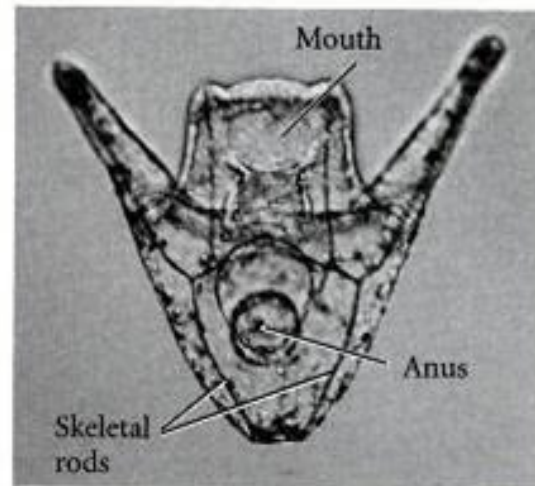
17 hrs.

18 hrs.



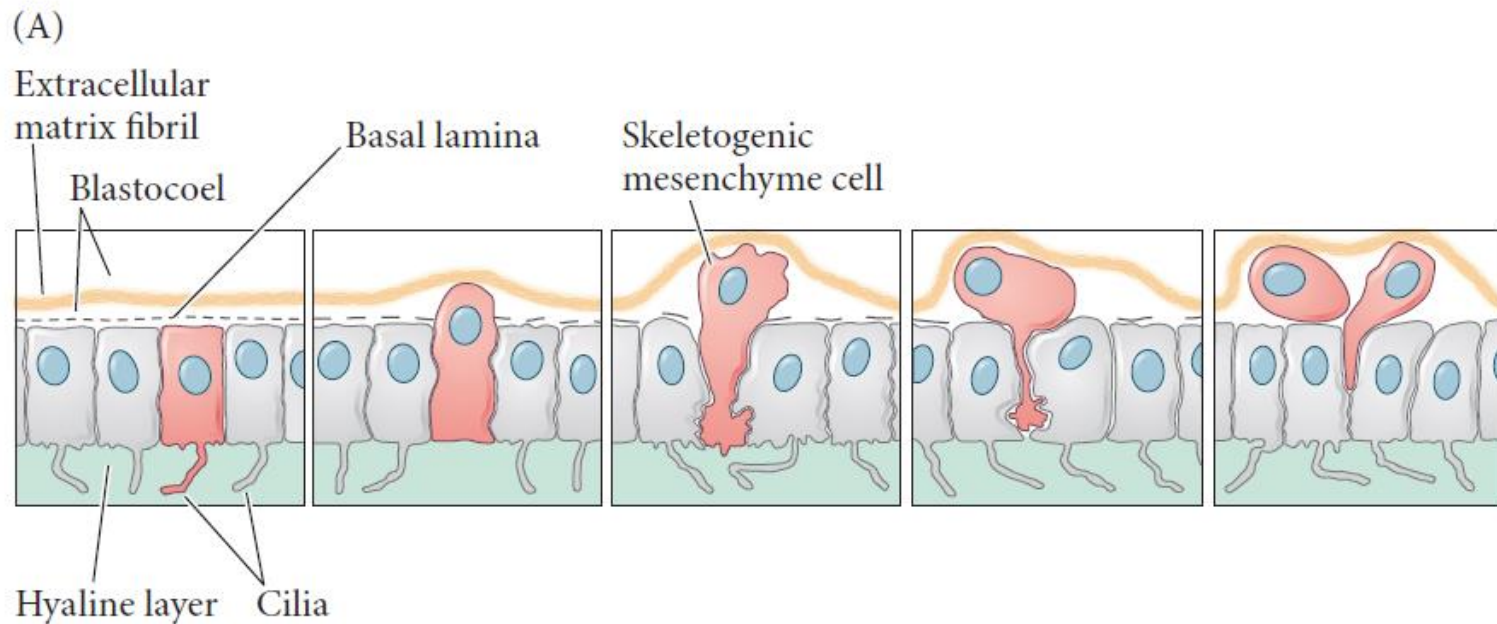
<https://www.youtube.com/watch?v=Lgb4wMsZwZA>

Comienzo gastrulación:
Polo vegetal

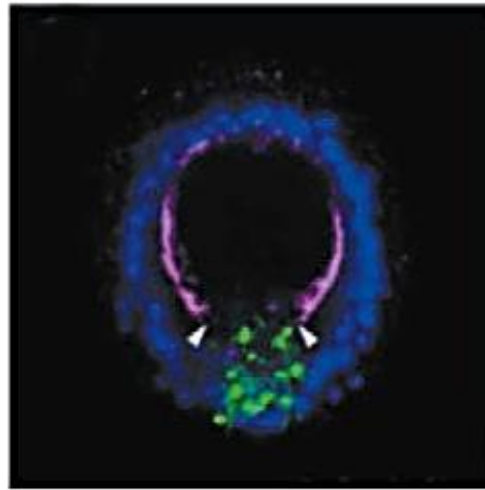
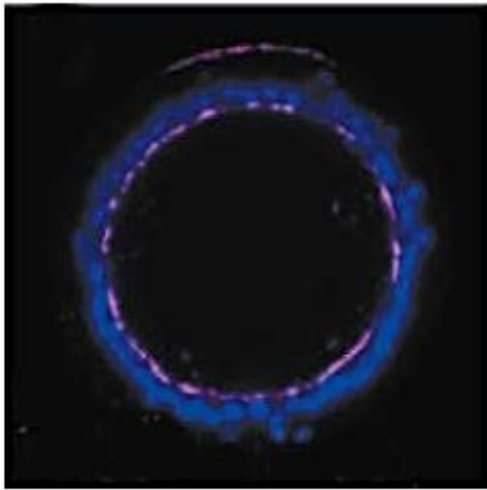


Transición epitelio-mesénquima

- 1 Polaridad ápico-basal
- 2 Constricción apical
- 3 Remodelación de la lámina basal
- 4 Pérdida de adhesión celular
- 5 Movilidad celular



Transición epitelio-mesénquima: degradación de la matriz extracelular

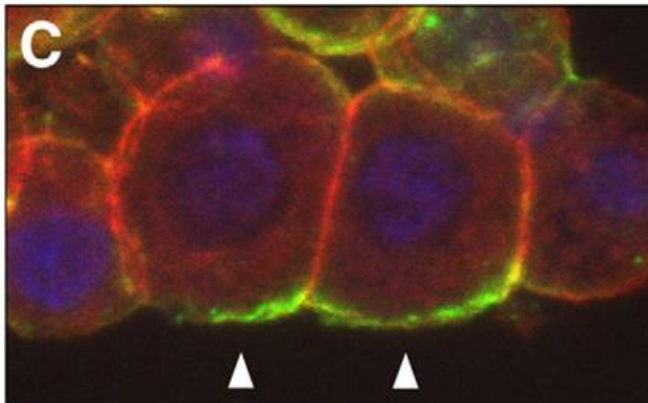
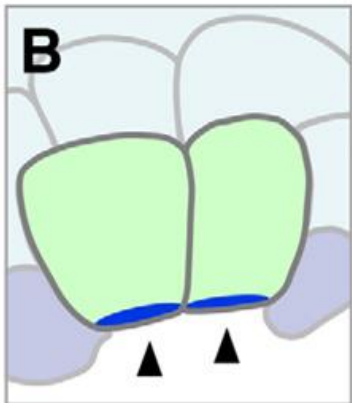
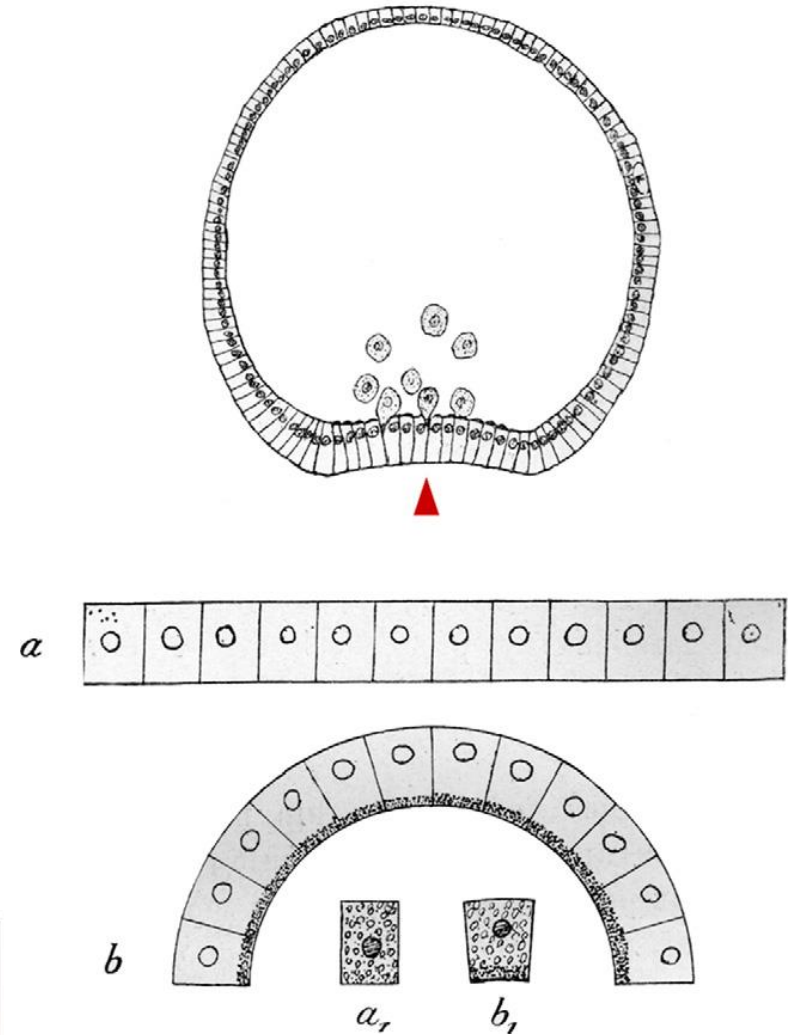
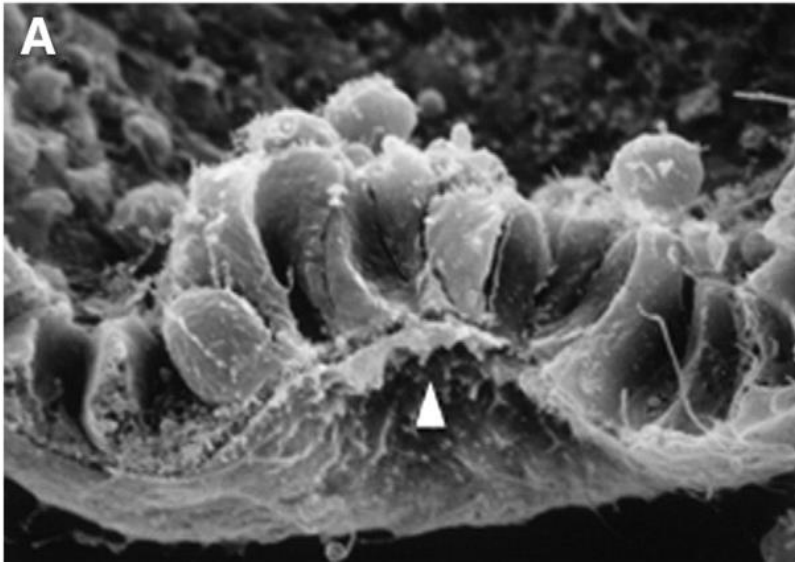


Azul - ADN

Magenta - Matriz extracelular

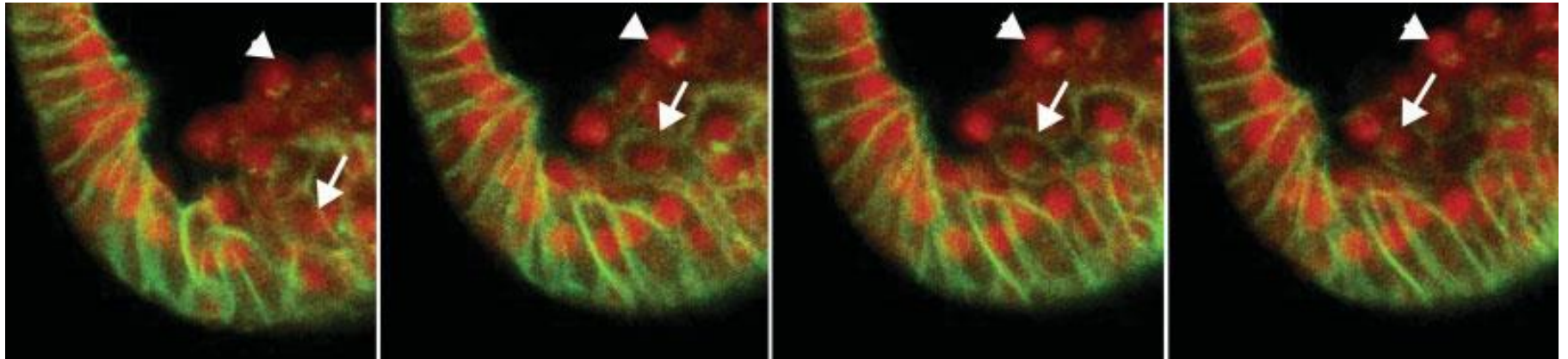
Verde - células mesenquimales

Constricción apical



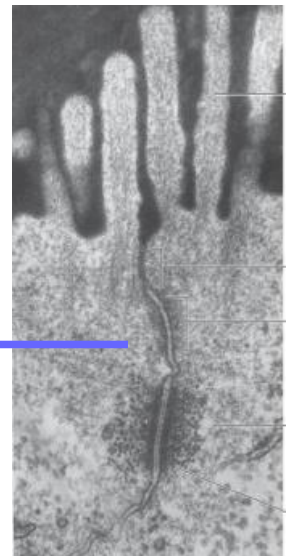
Ingression of Primary Mesenchyme Cells of the Sea Urchin Embryo: A Precisely Timed Epithelial Mesenchymal Transition

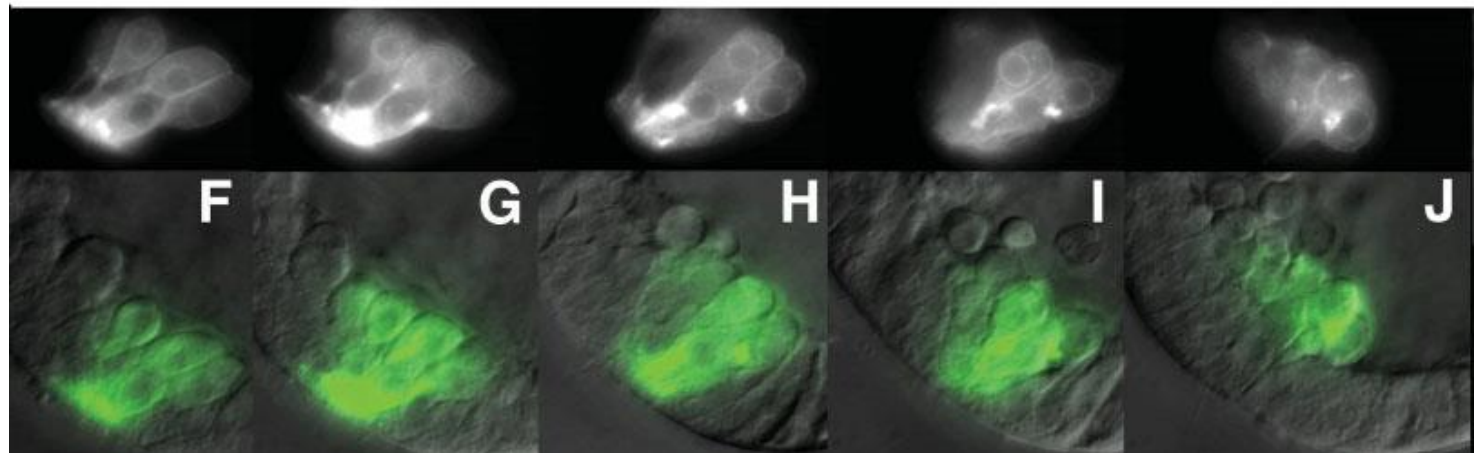
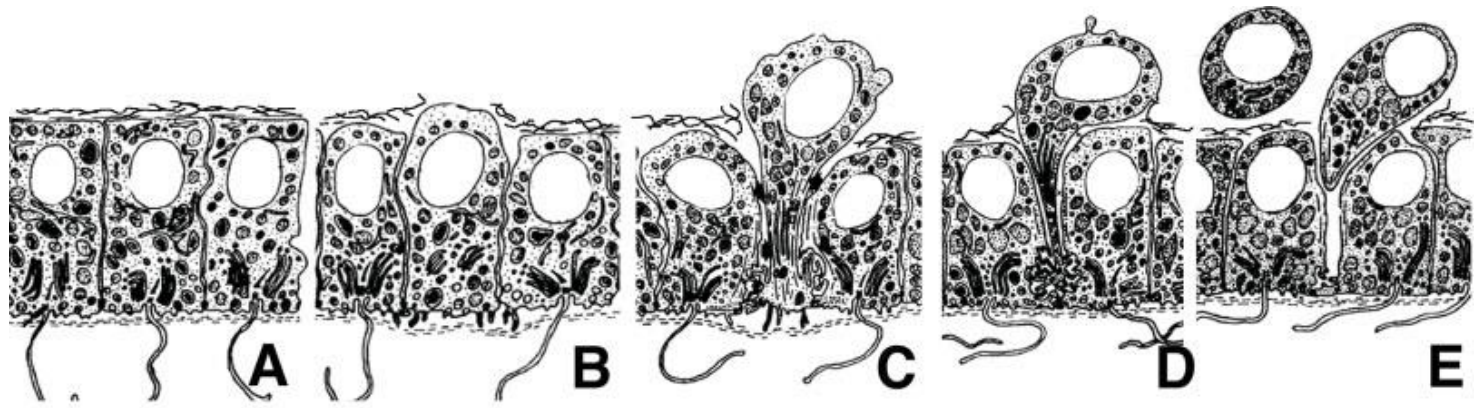
Shu-Yu Wu, Michael Ferkowicz and David R. McClay*



Cadherina-GFP

Cinturón de adhesión

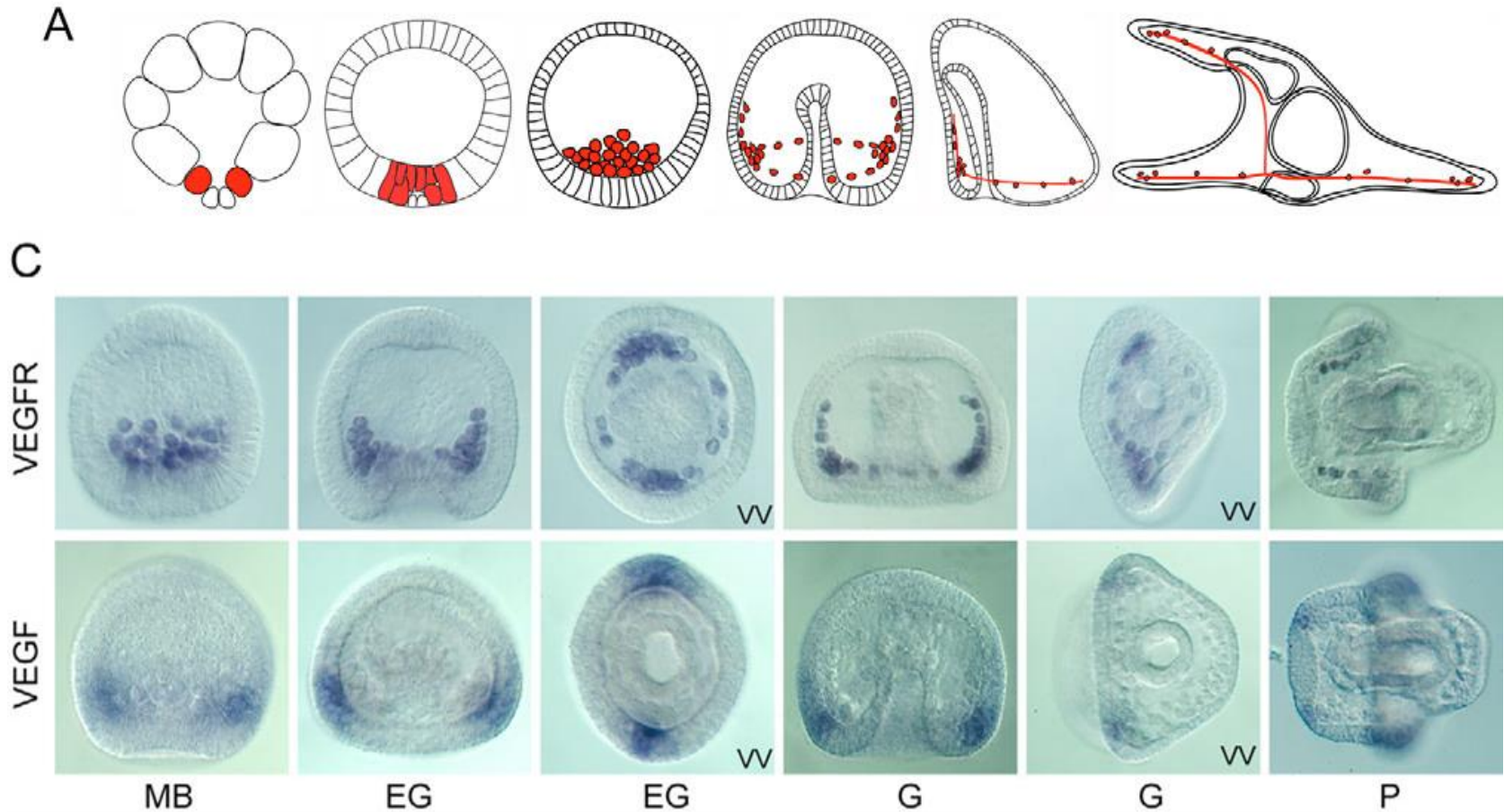


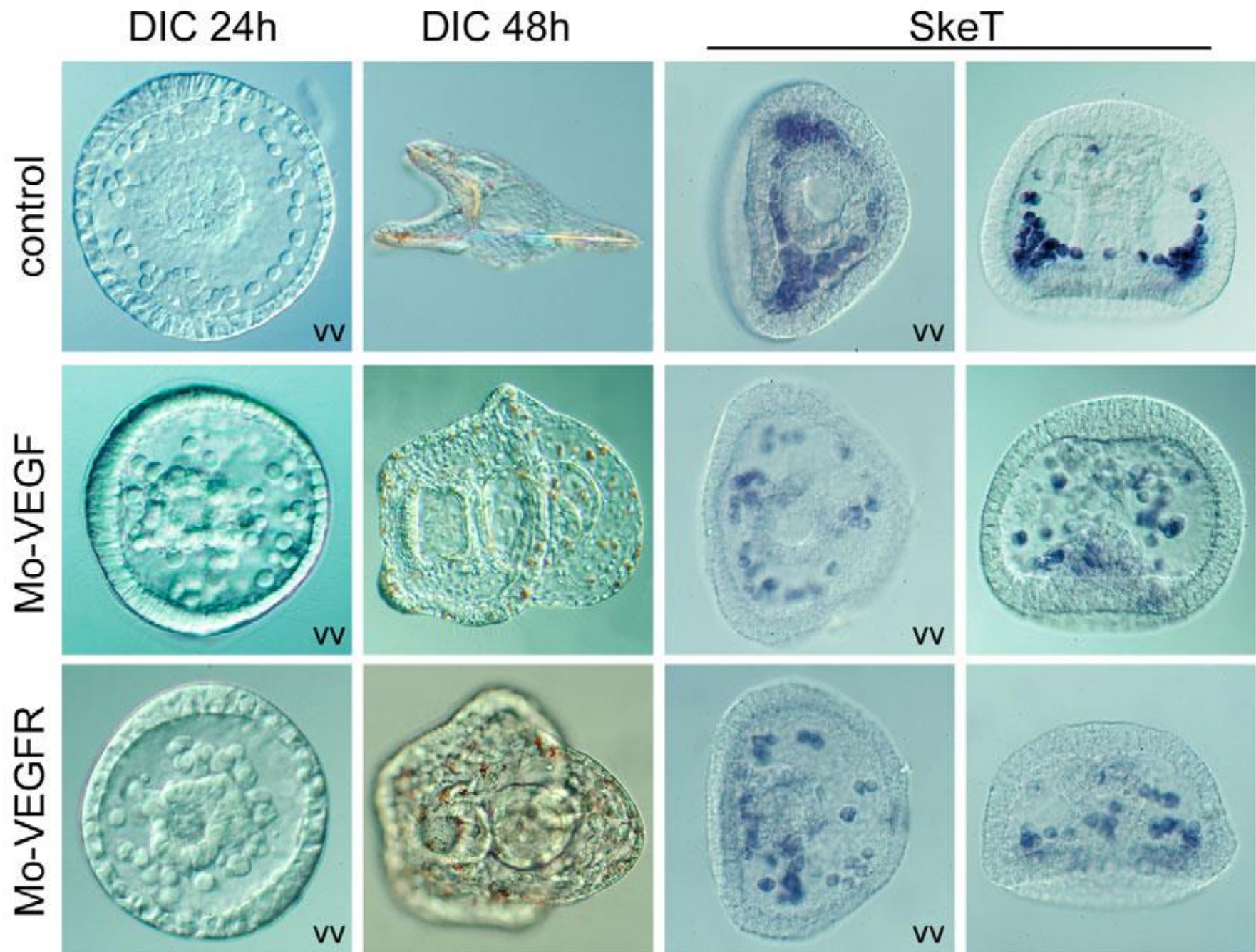


← Cinturón de adhesión

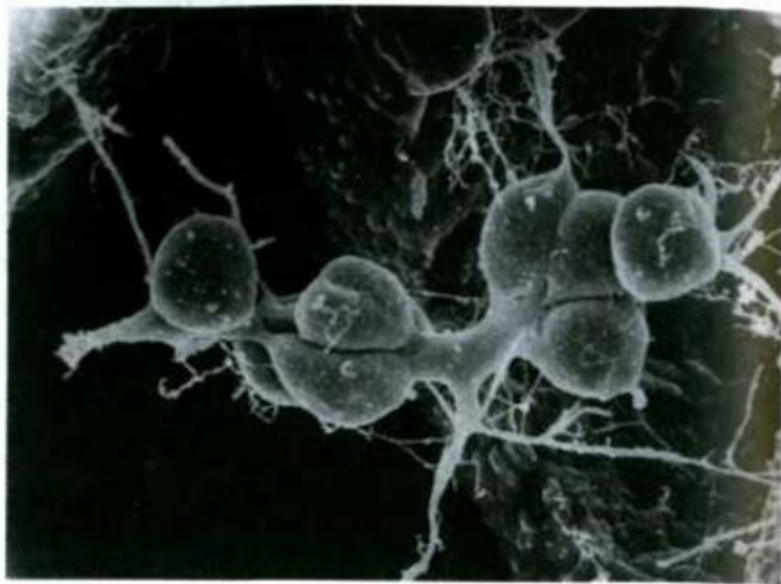
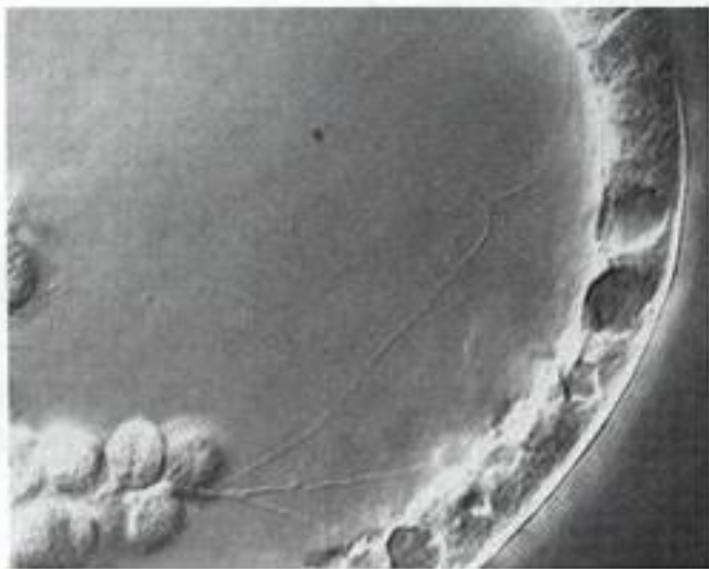
Localized VEGF signaling from ectoderm to mesenchyme cells controls morphogenesis of the sea urchin embryo skeleton

Louise Duloquin, Guy Lhomond and Christian Gache*



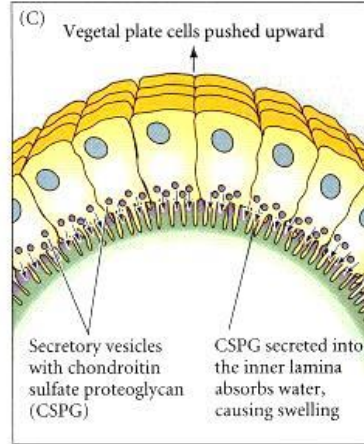
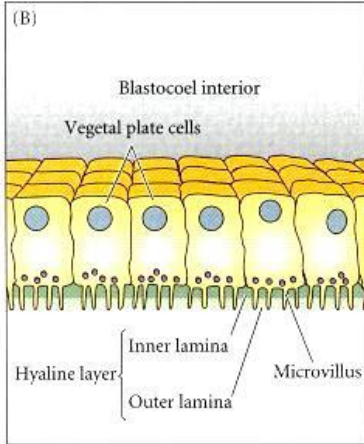
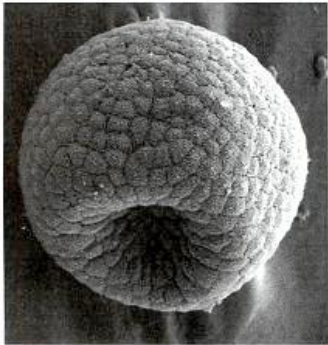


(A)

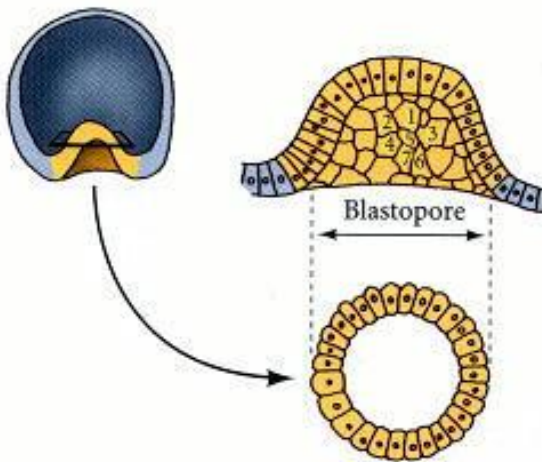


<https://www.youtube.com/watch?v=w611XMbUCIs>

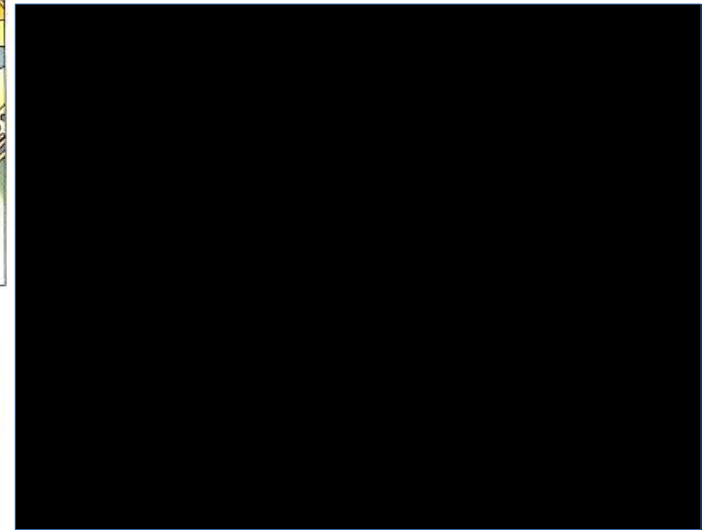
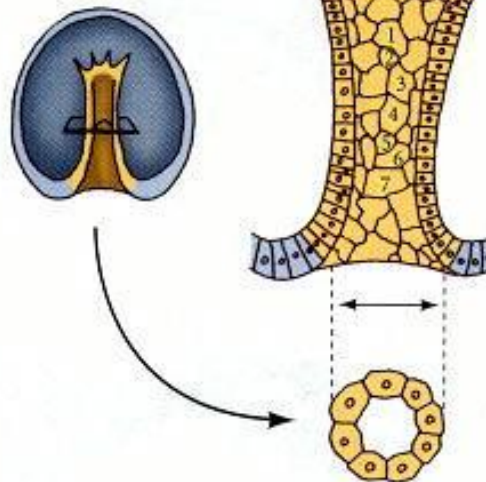
(A)



EARLY GASTRULATION

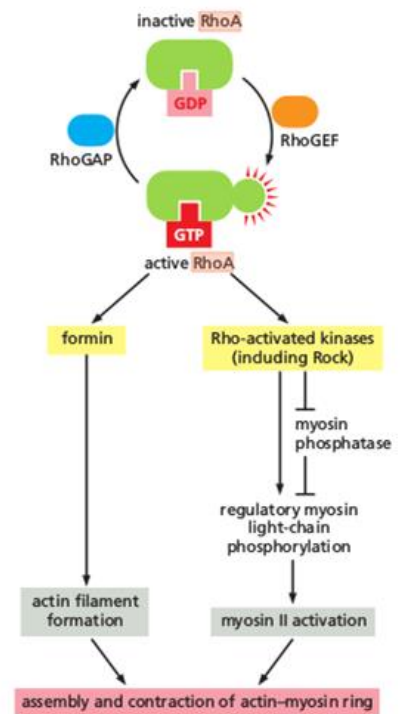
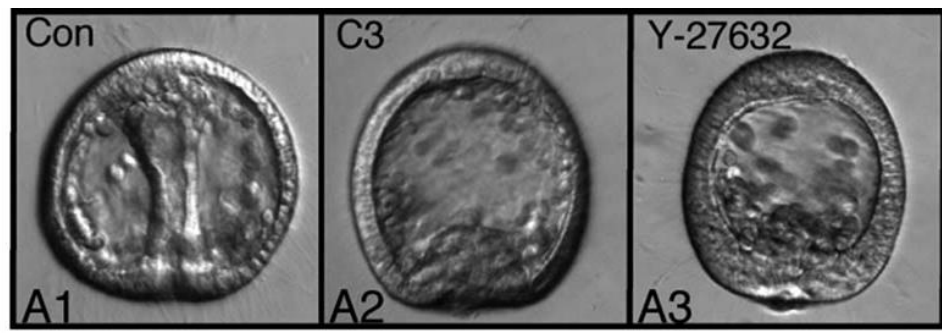
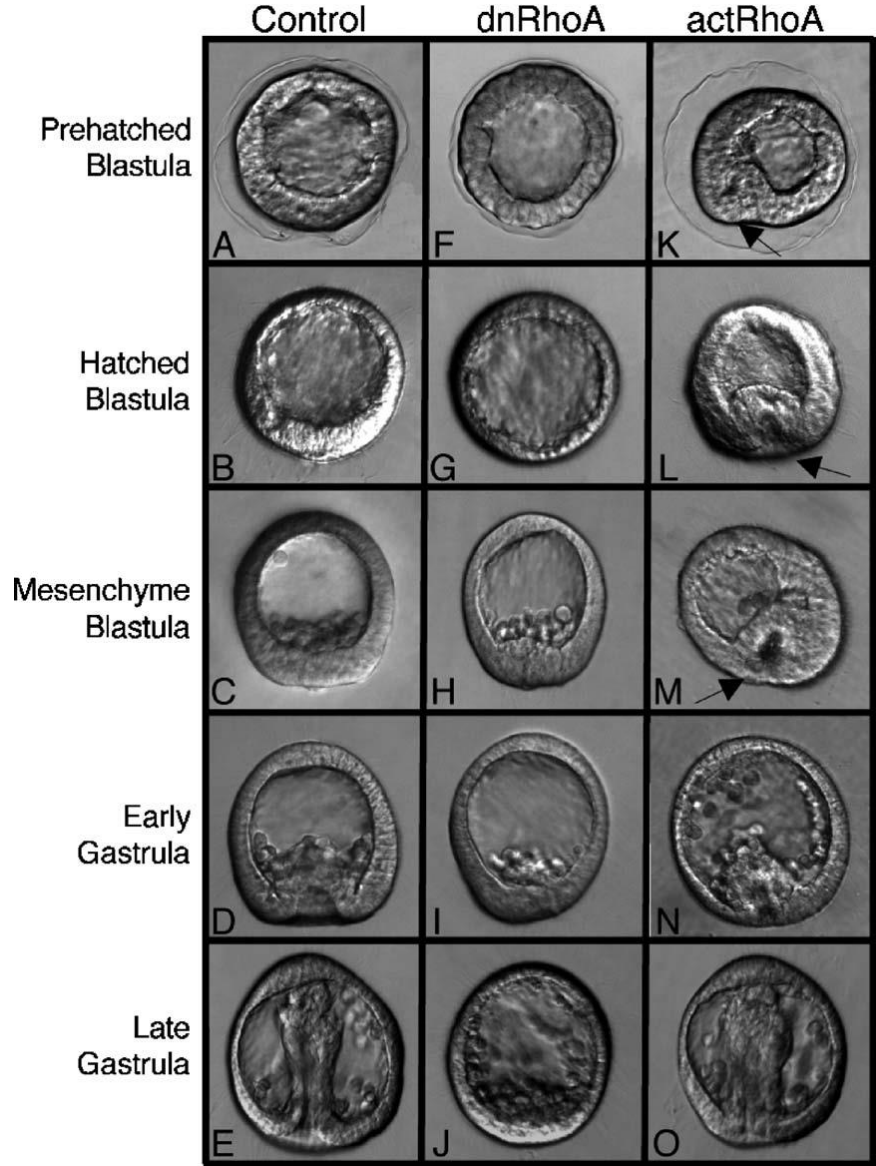


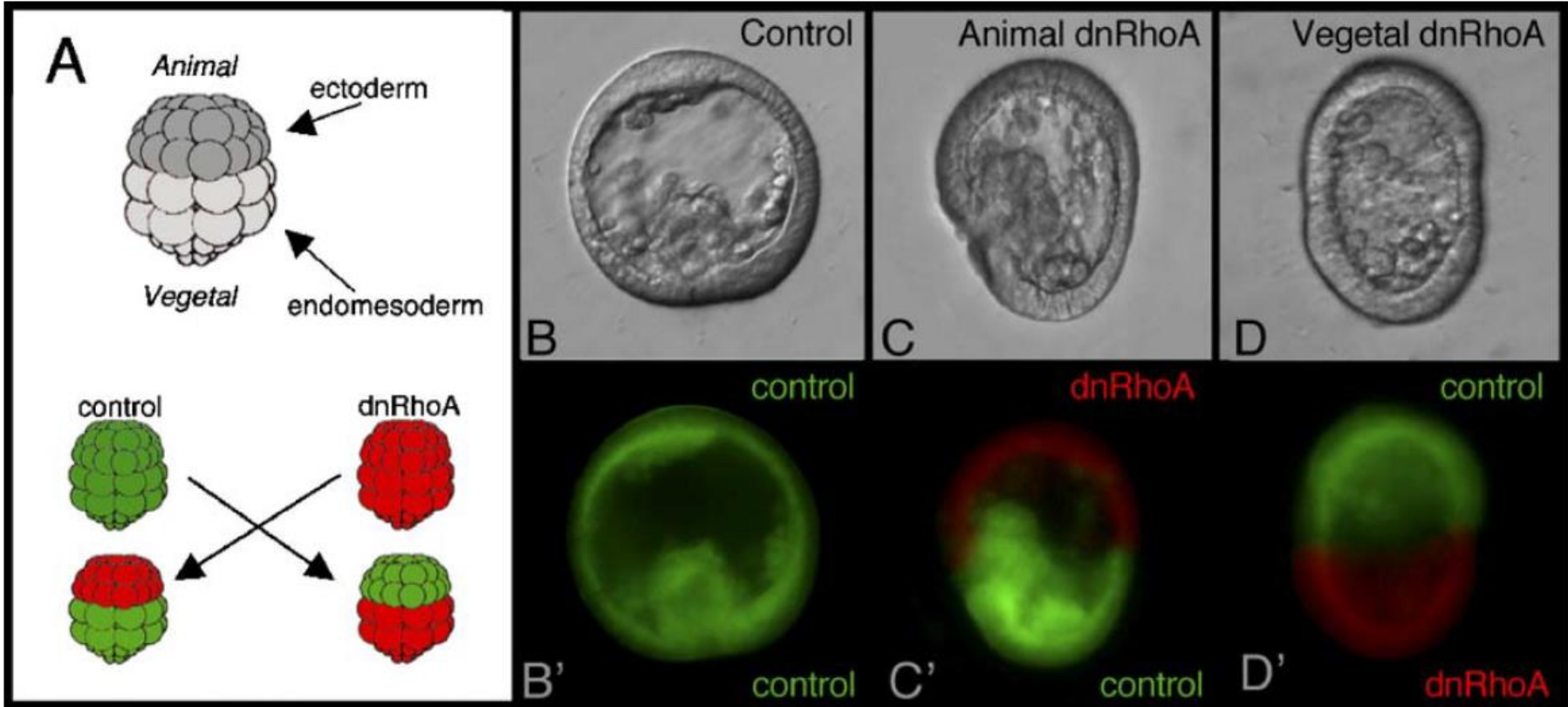
LATER GASTRULATION



RhoA regulates initiation of invagination, but not convergent extension, during sea urchin gastrulation

Wendy S. Beane ^{a,*}, Jeffrey M. Gross ^b, David R. McClay ^a

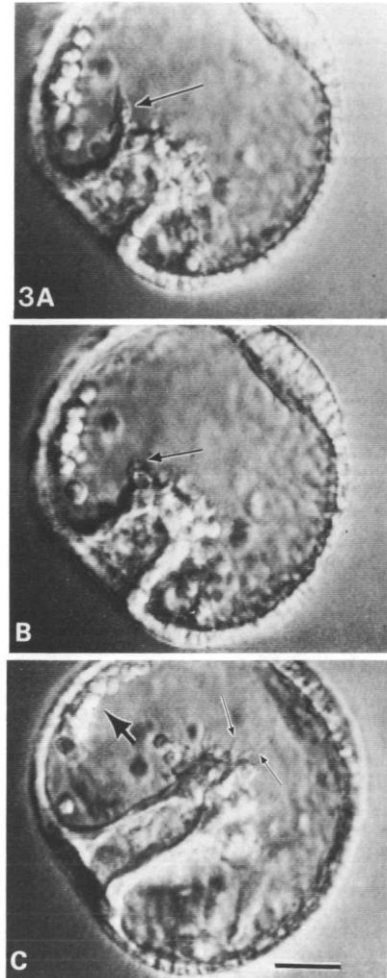
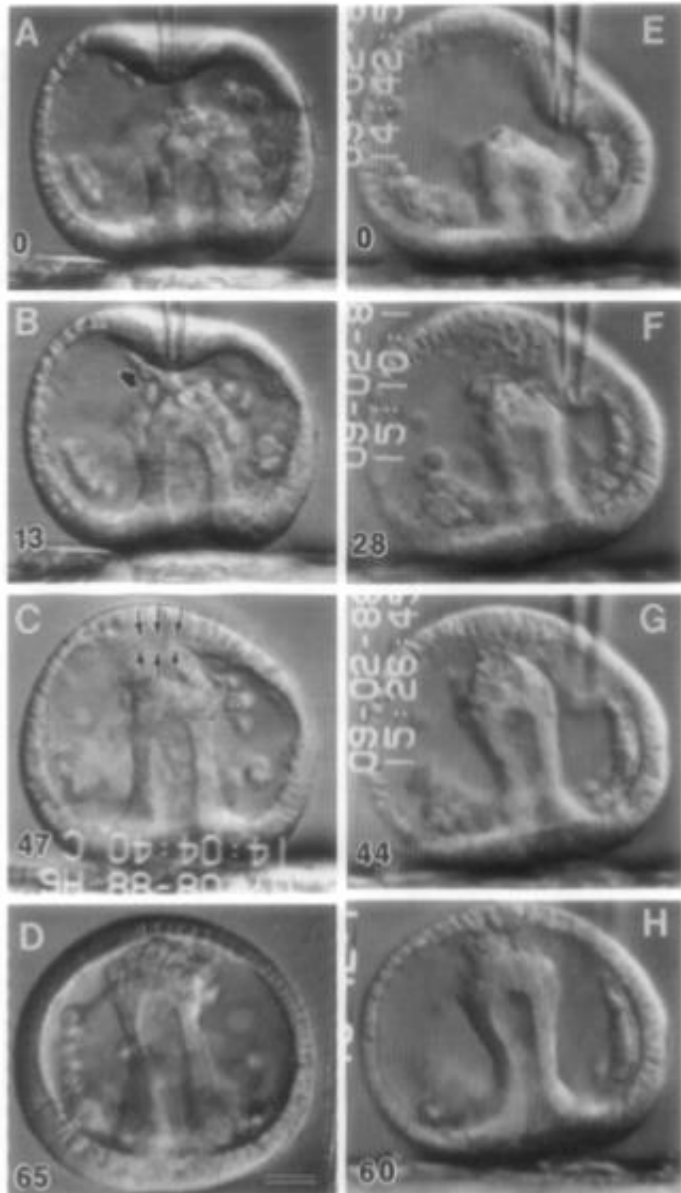




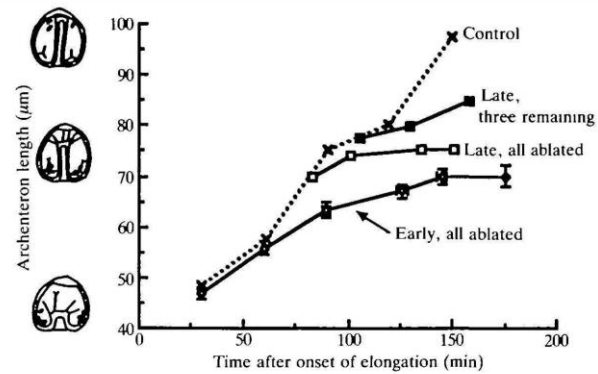
Target Recognition by the Archenteron during Sea Urchin Gastrulation*¹

JEFF HARDIN² AND DAVID R. McCLAY

Department of Zoology, Duke University, Durham, North Carolina 27706



Ablación por láser

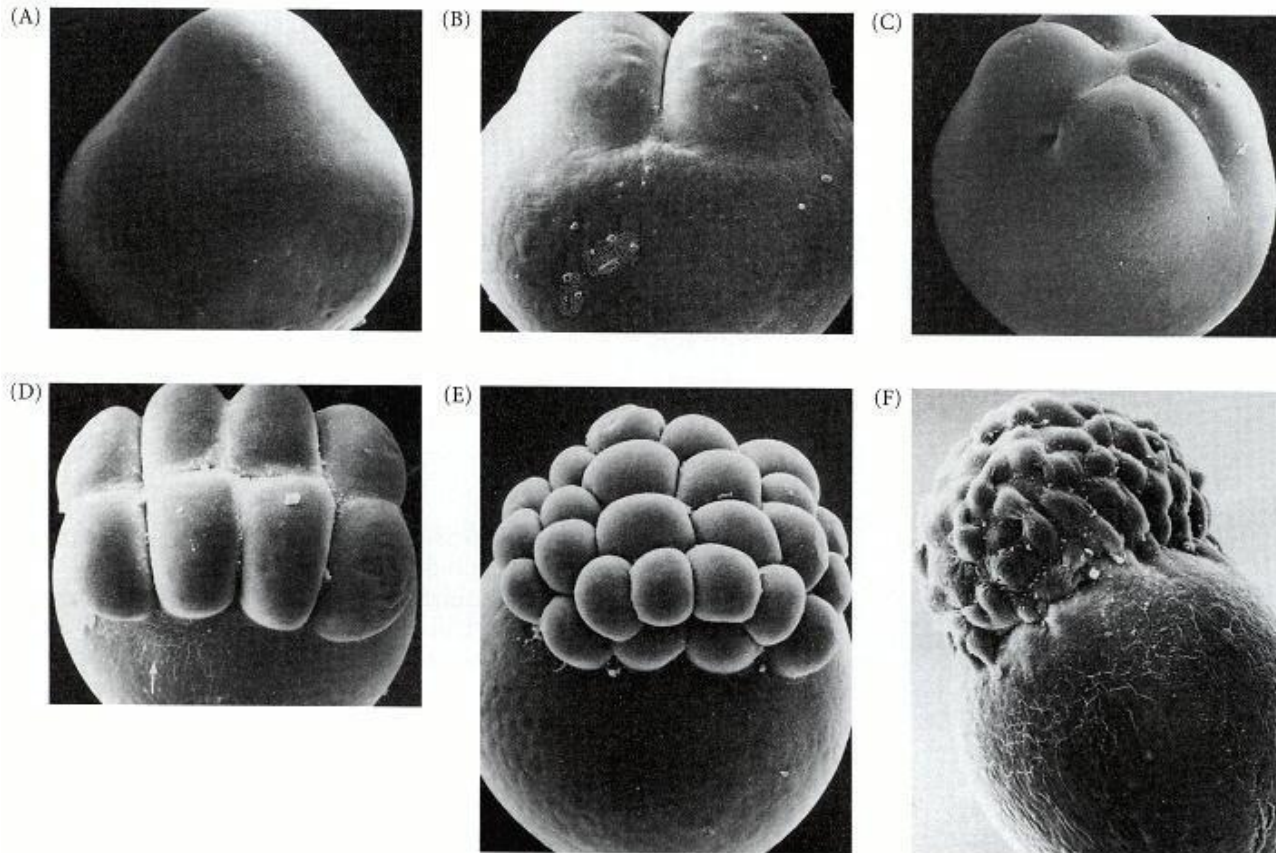


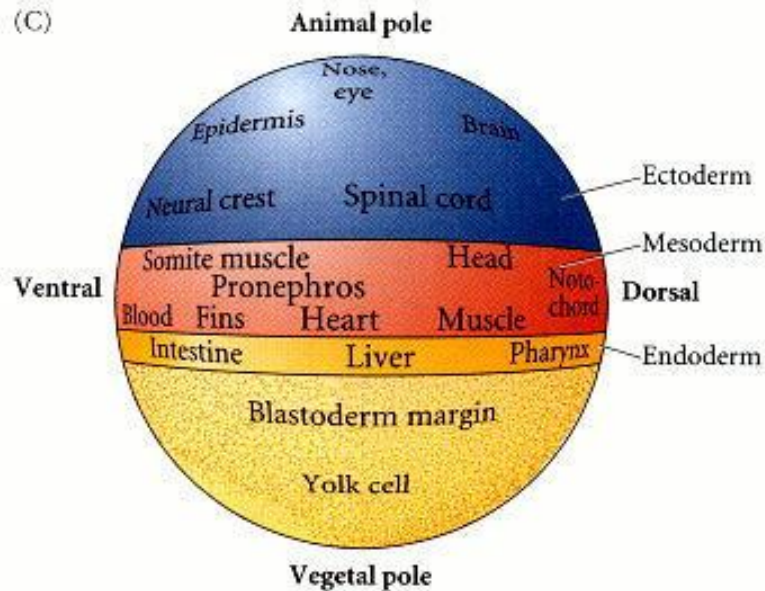
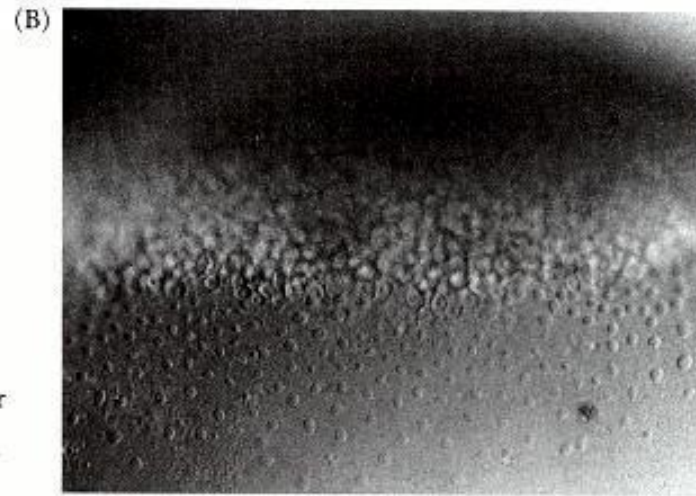
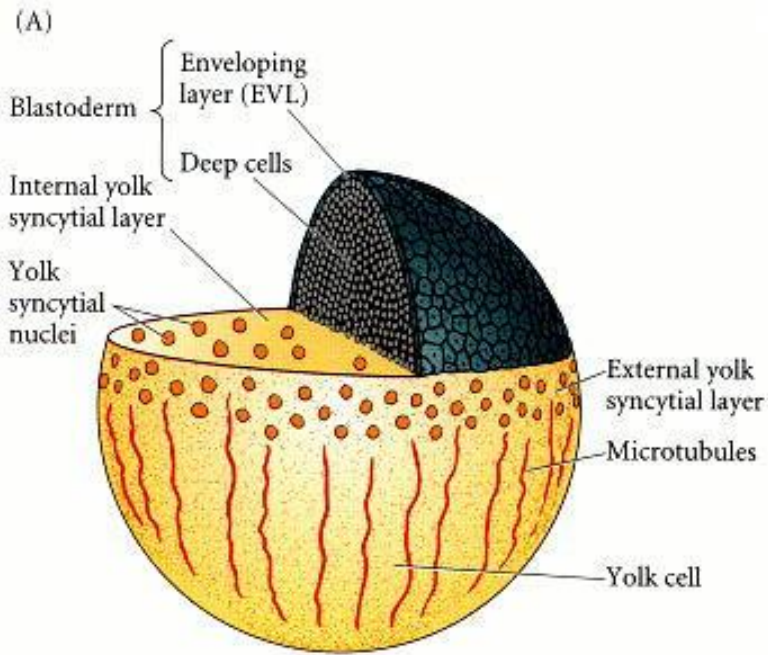
The role of secondary mesenchyme cells during sea urchin gastrulation studied by laser ablation

JEFF HARDIN*

Gastrulación

Embriones con clivaje meroblástico: peces



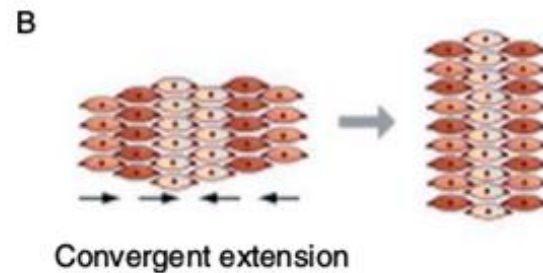
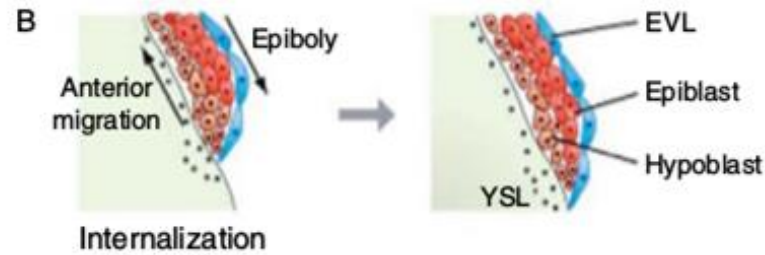
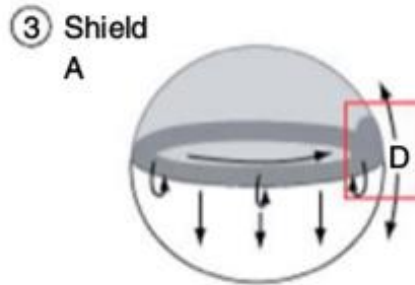
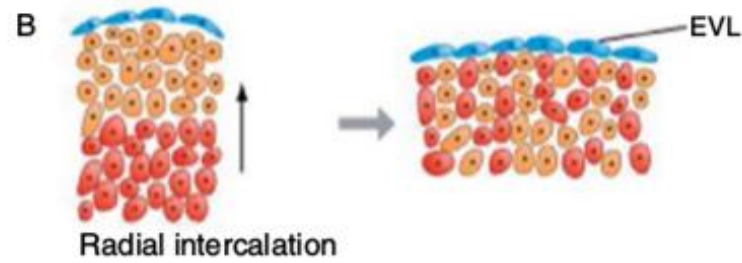
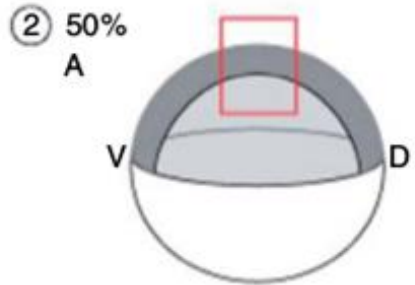
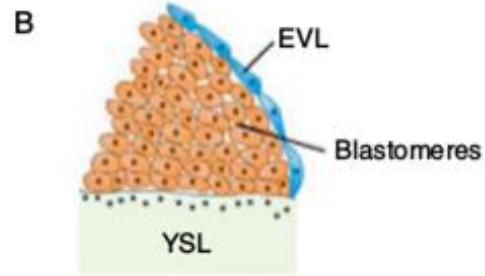
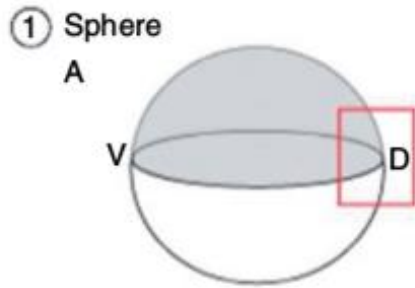


Tres poblaciones celulares:

Capa sincitial vitelínica (YSL)

Capa envolvente (EVL)

Células profundas



Las tres poblaciones celulares sufren **epibolia**



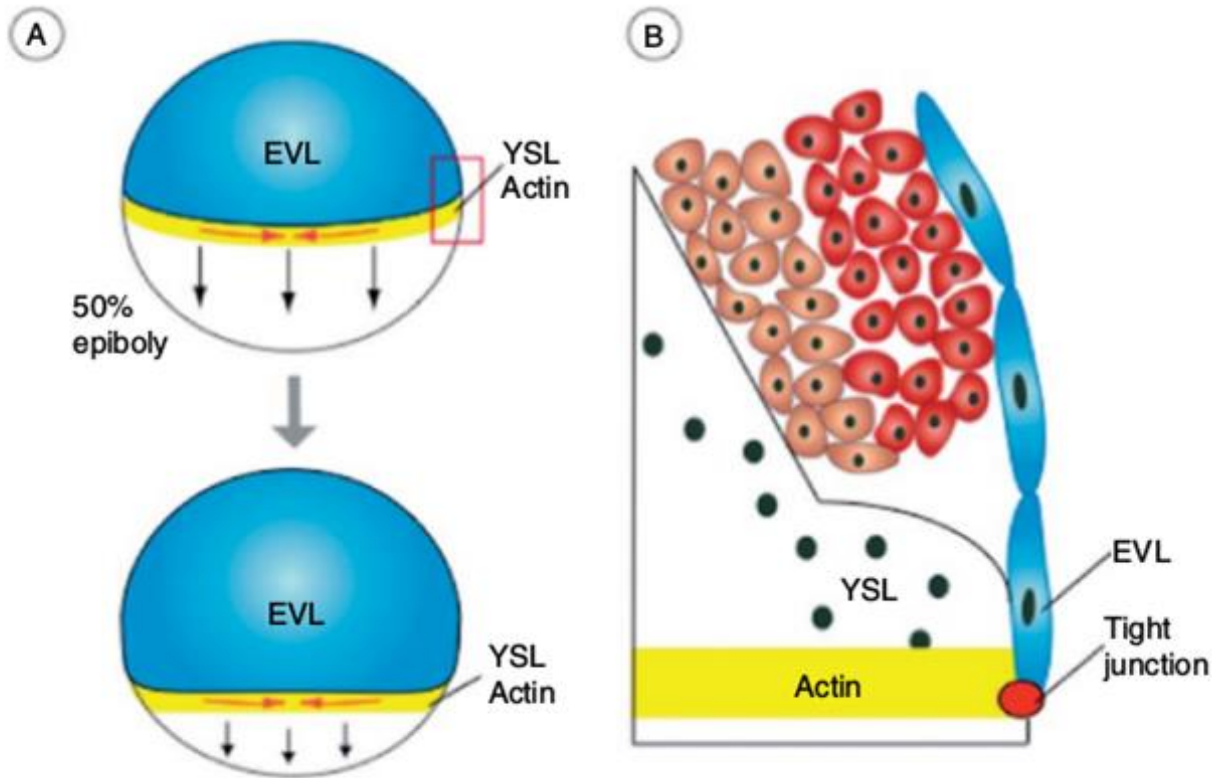
Principles of Development
Fifth Edition



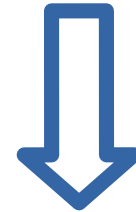
Cell movements at the onset of gastrulation in zebrafish

© Oxford University Press, 2015.

Modelo *purse-string*



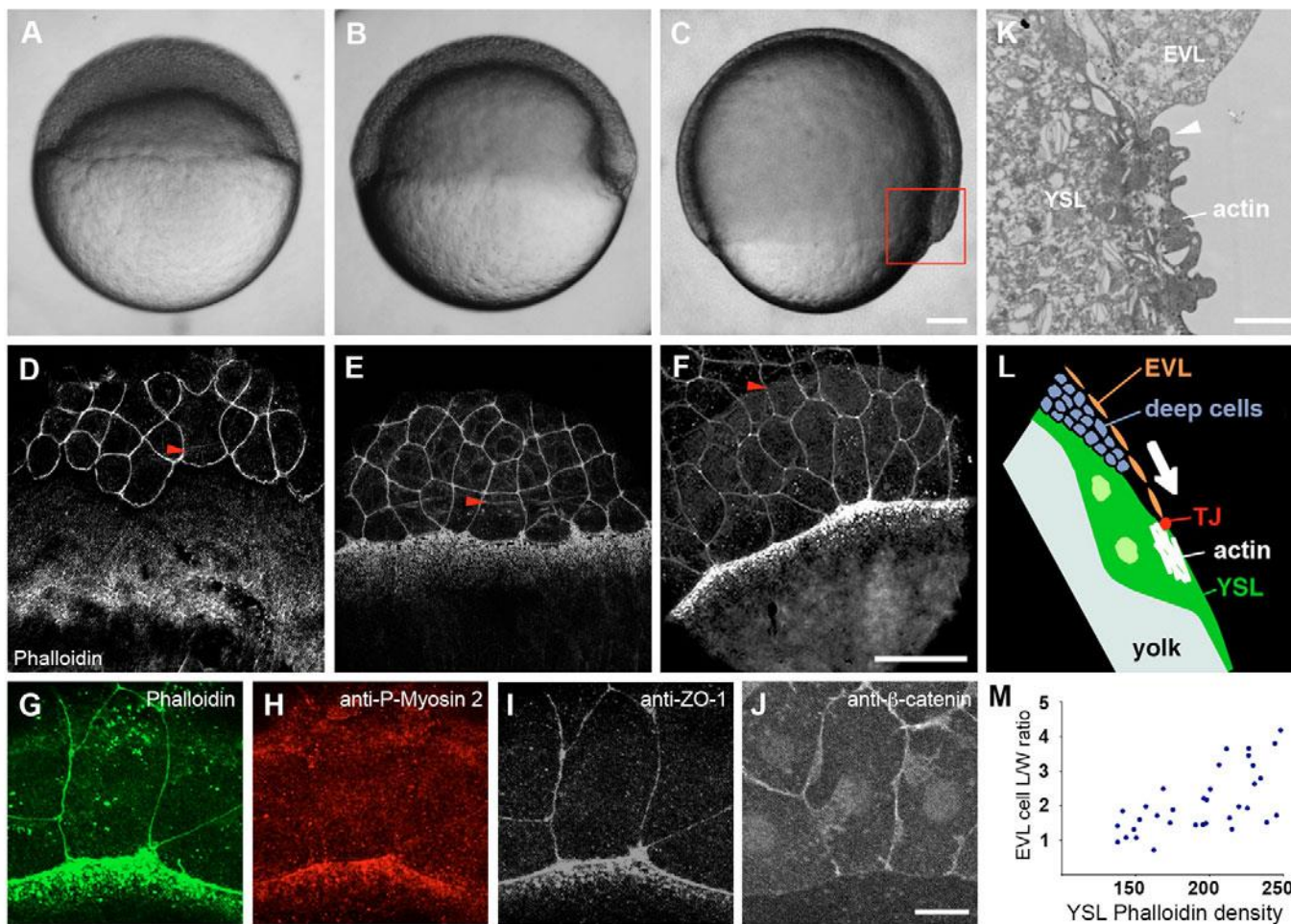
Contracción
cinturón de actina



Epibolia
EVL/YSL

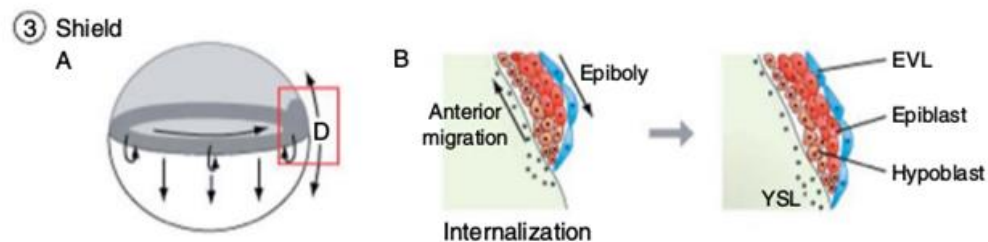
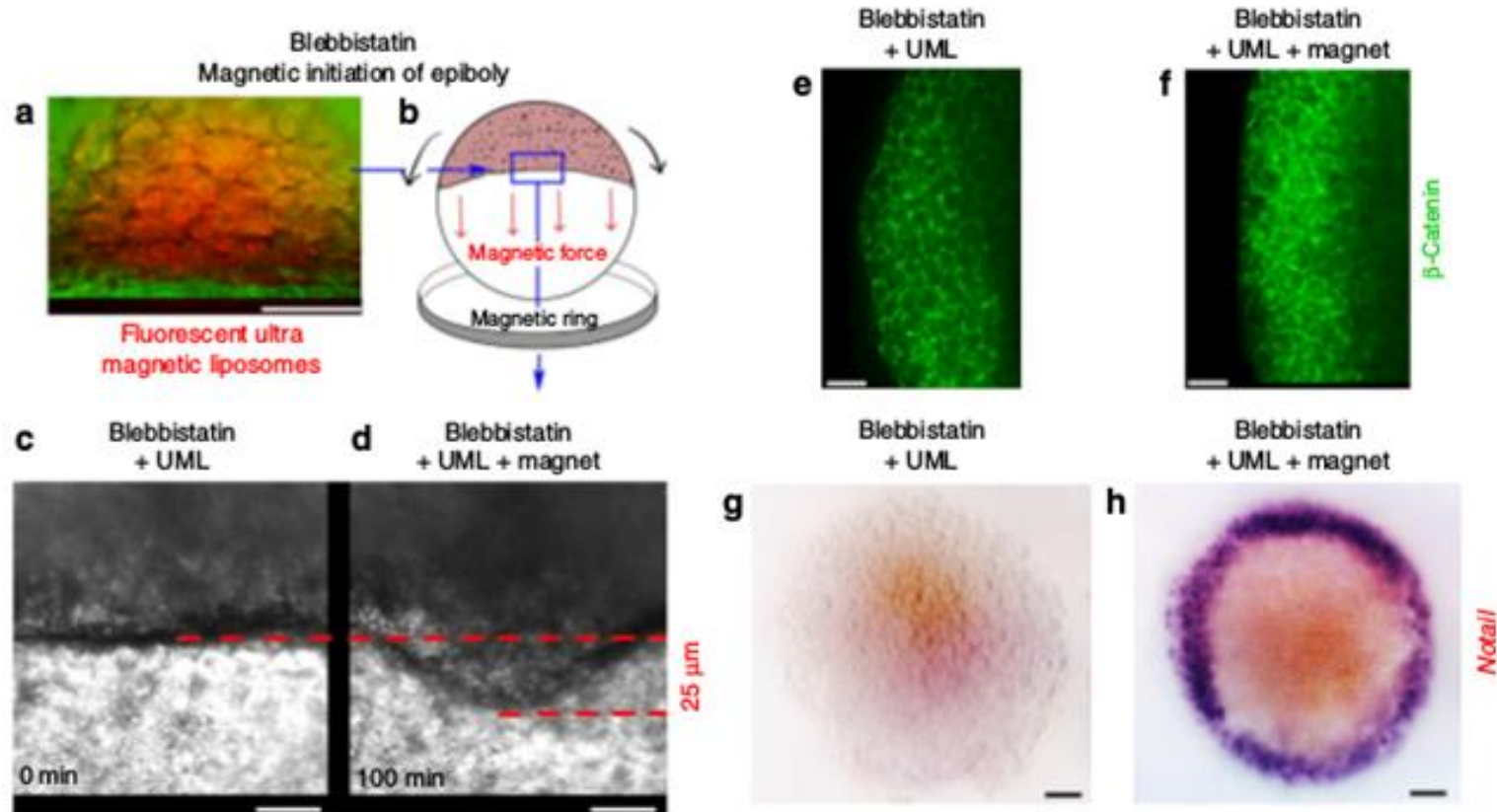
Coordinated cell-shape changes control epithelial movement in zebrafish and *Drosophila*

Mathias Köppen¹, Beatriz García Fernández², Lara Carvalho¹, Antonio Jacinto² and Carl-Philipp Heisenberg^{1,*}



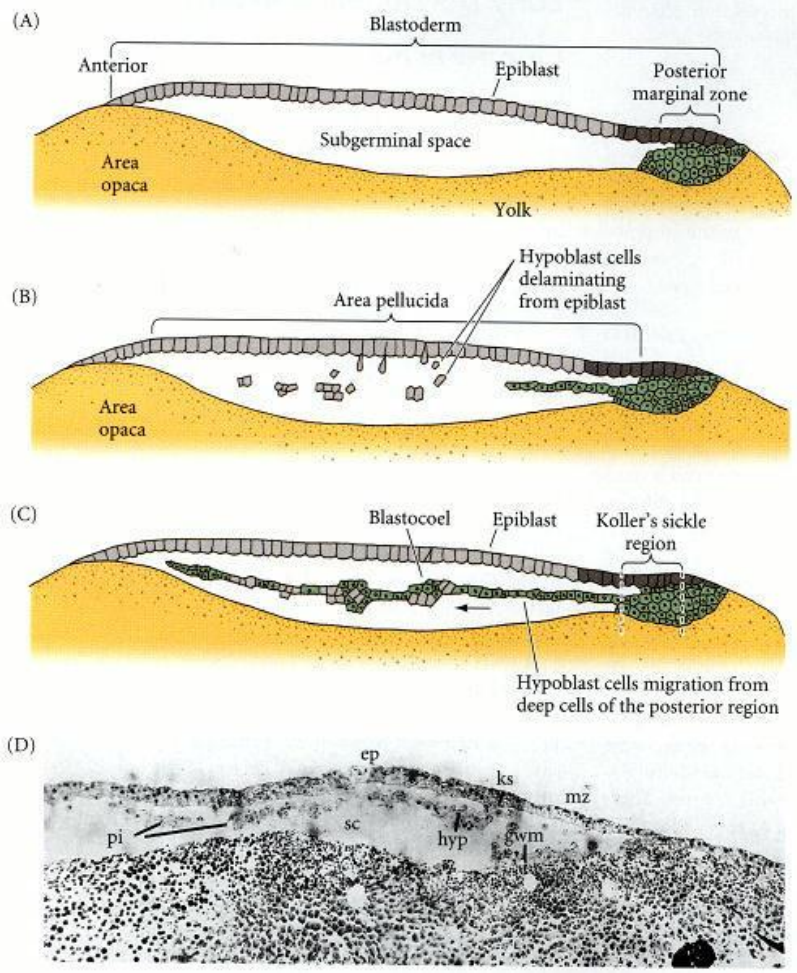
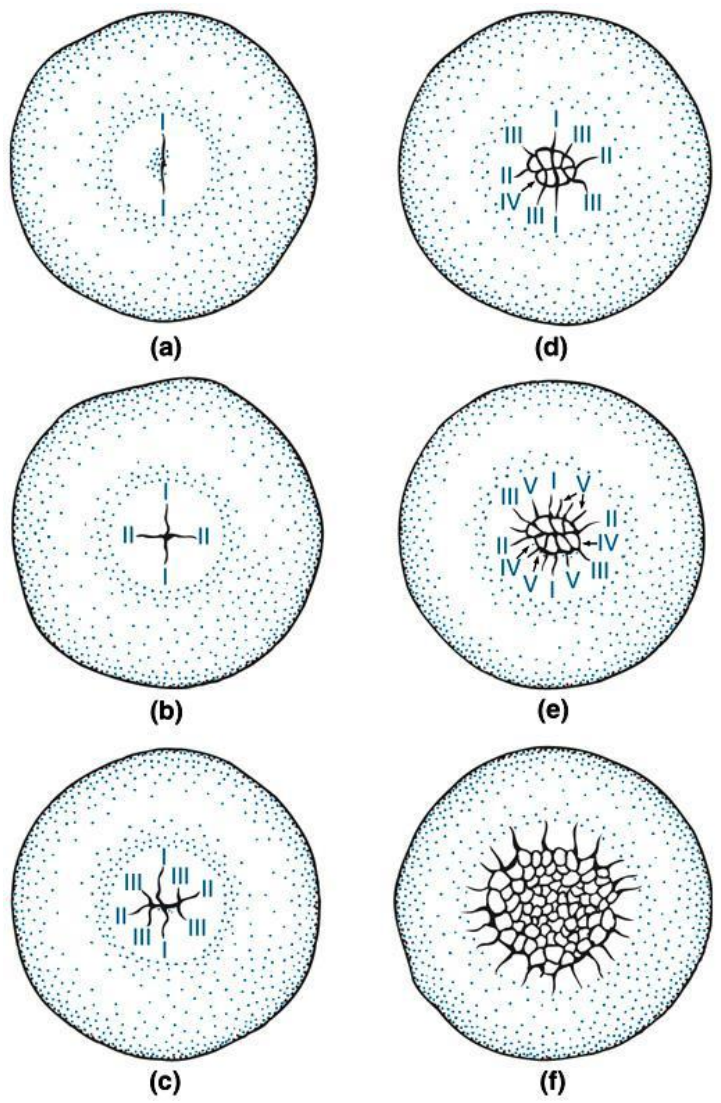
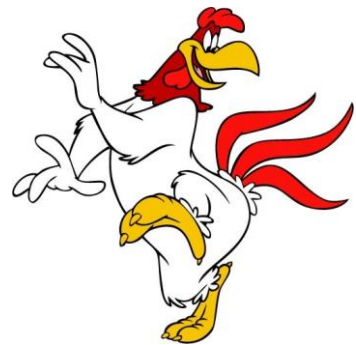
Evolutionary conservation of early mesoderm specification by mechanotransduction in Bilateria

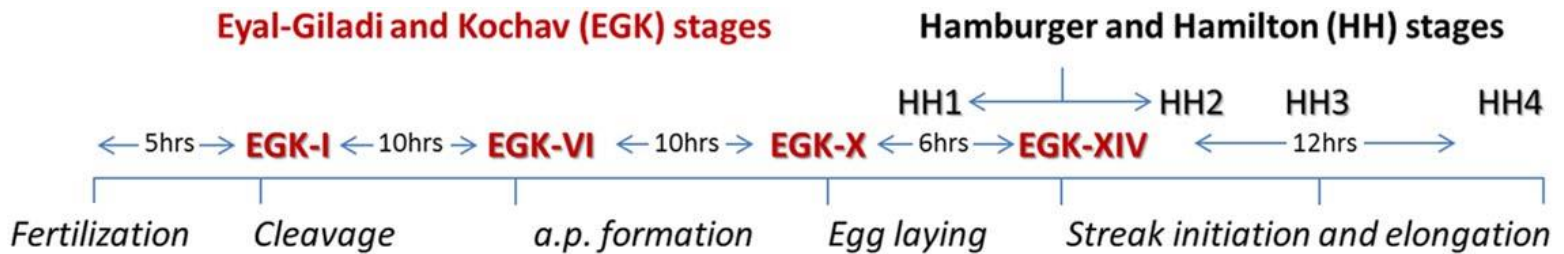
Thibaut Brunet^{1,†,*}, Adrien Bouclet^{1,*}, Padra Ahmadi¹, Démosthène Mitrossilis¹, Benjamin Driquez¹, Anne-Christine Brunet¹, Laurent Henry¹, Fanny Serman¹, Gaëlle Béalle², Christine Ménager², Frédéric Dumas-Bouchiat^{3,4}, Dominique Givord^{3,4}, Constantin Yanicostas⁵, Damien Le-Roy^{3,4}, Nora M. Dempsey^{3,4}, Anne Plessis⁶ & Emmanuel Farge¹



Gastrulación

Embriones con clivaje meroblástico: aves



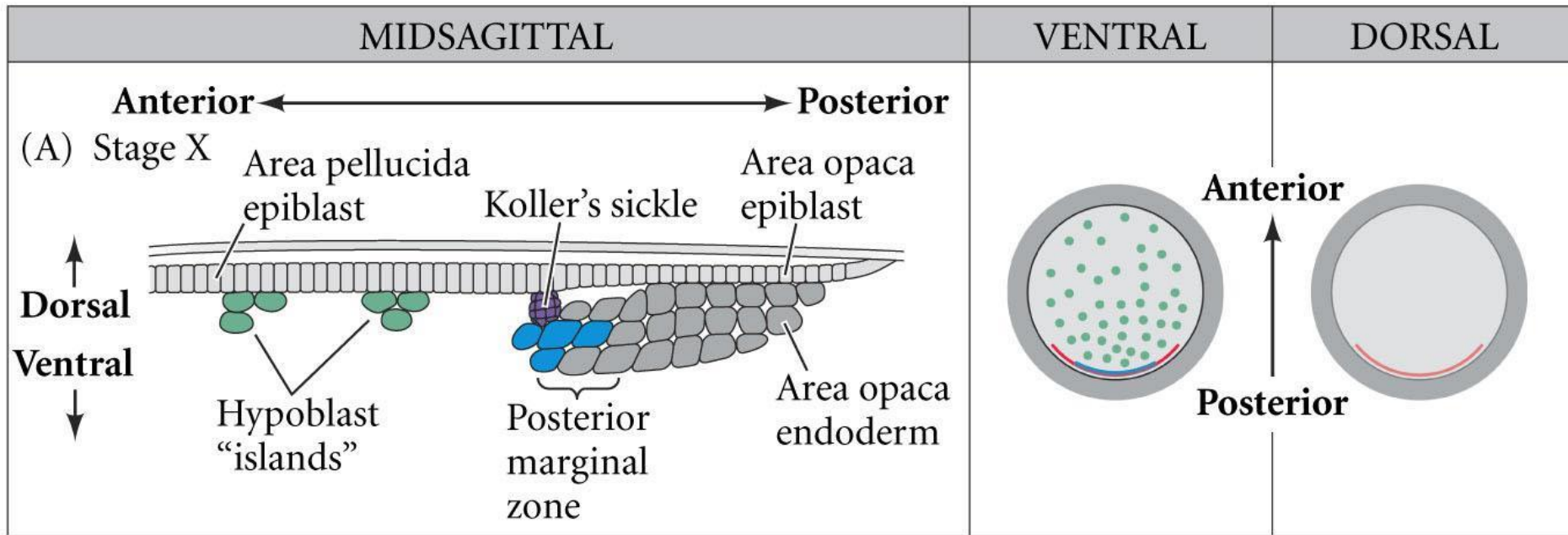


Cleavage →

- Cellularization
- Maternal determinants
- ZGA & MBT
- Layer increase

Area pellucida formation →

- Anterior-posterior polarity
- Layer reduction
- Lineage specification
- Yolk syncytium

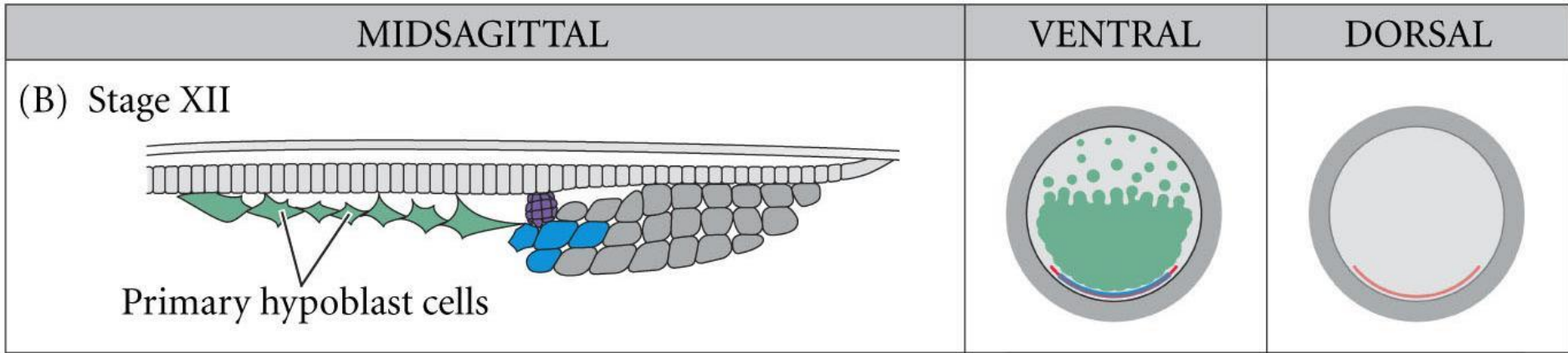


Entre 5-6 capas de células del blastodisco se sueltan y mueren

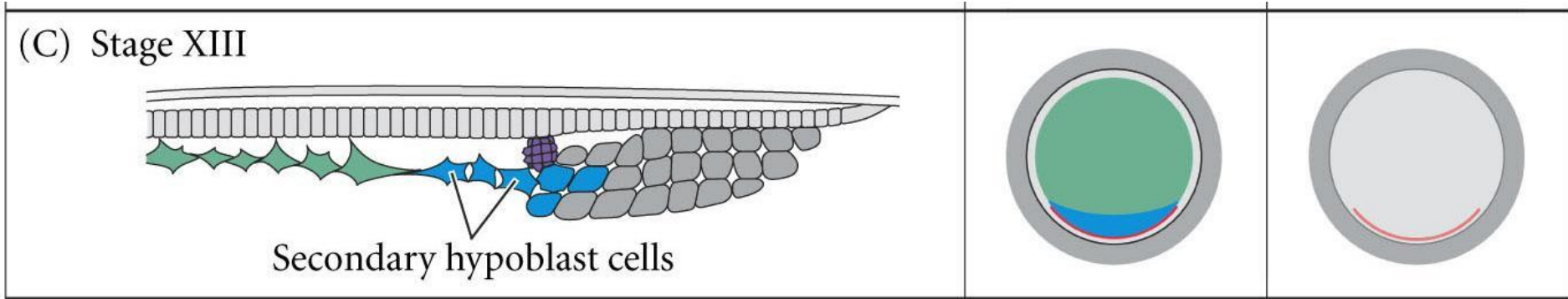
Se mantiene una única capa: **área pelúcida** (epiblasto)

Bordes: **área opaca**

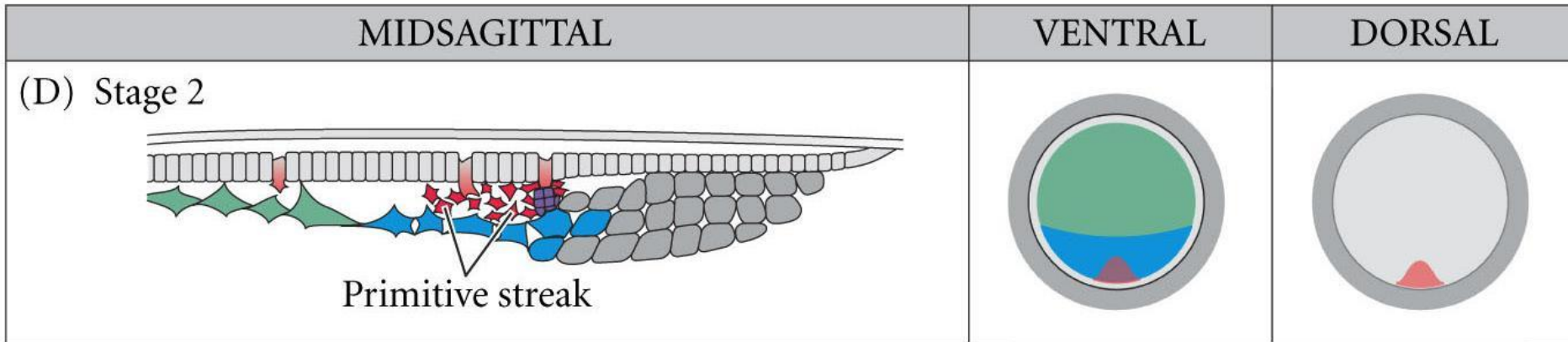
Algunas células del área pelúcida se sueltan: **islas de poli-invaginación**



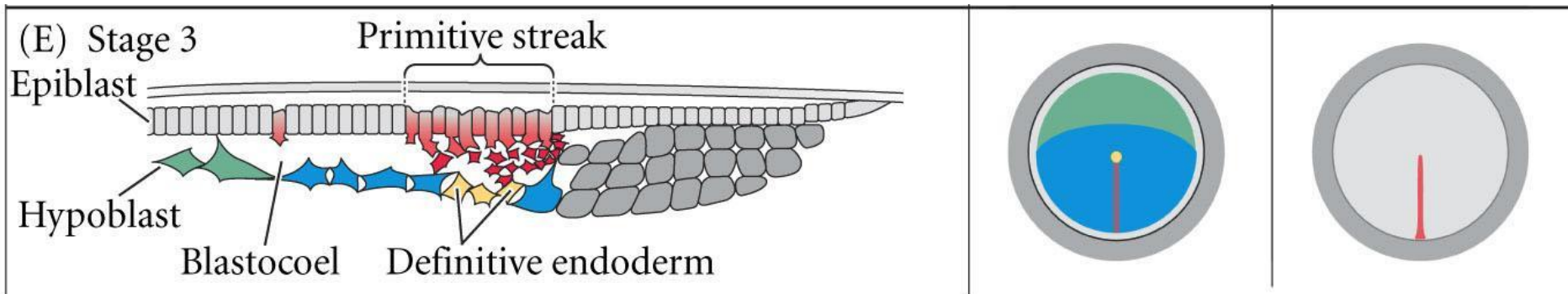
Las islas de poli-invaginación se unen: **hipoblasto primario**



Desde la **Hoz de Koller** migra una capa de células formando el **hipoblasto secundario**



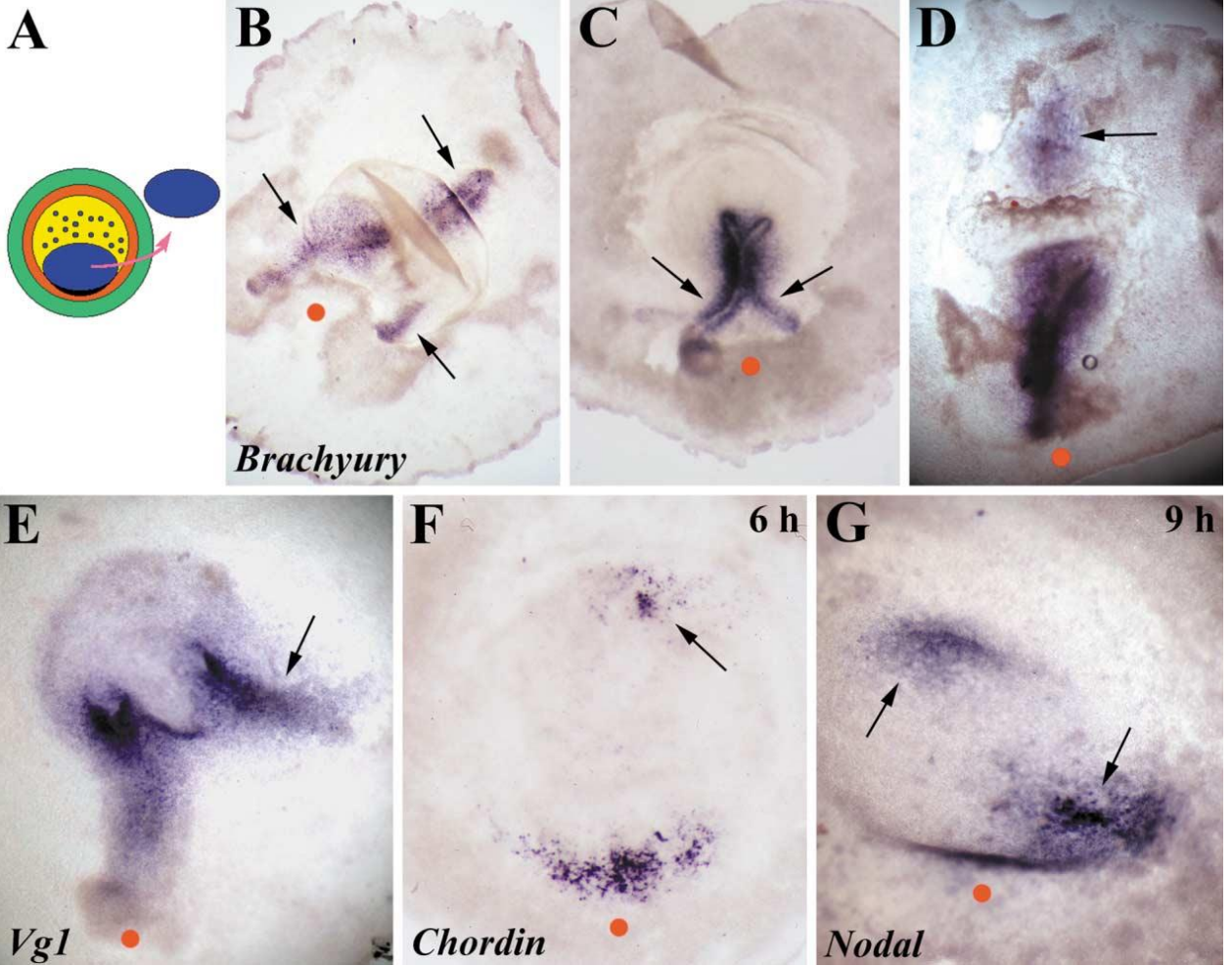
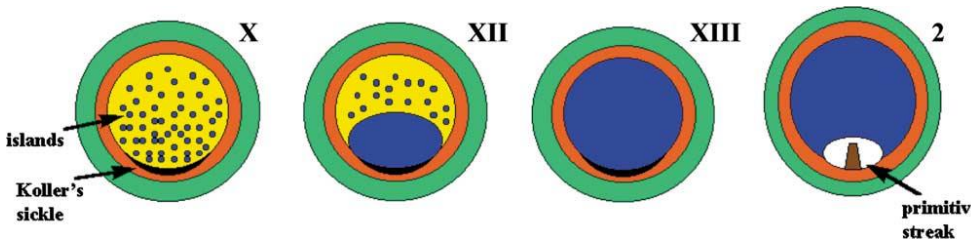
Células del centro del epiblasto se engrosan formando la **línea primitiva**

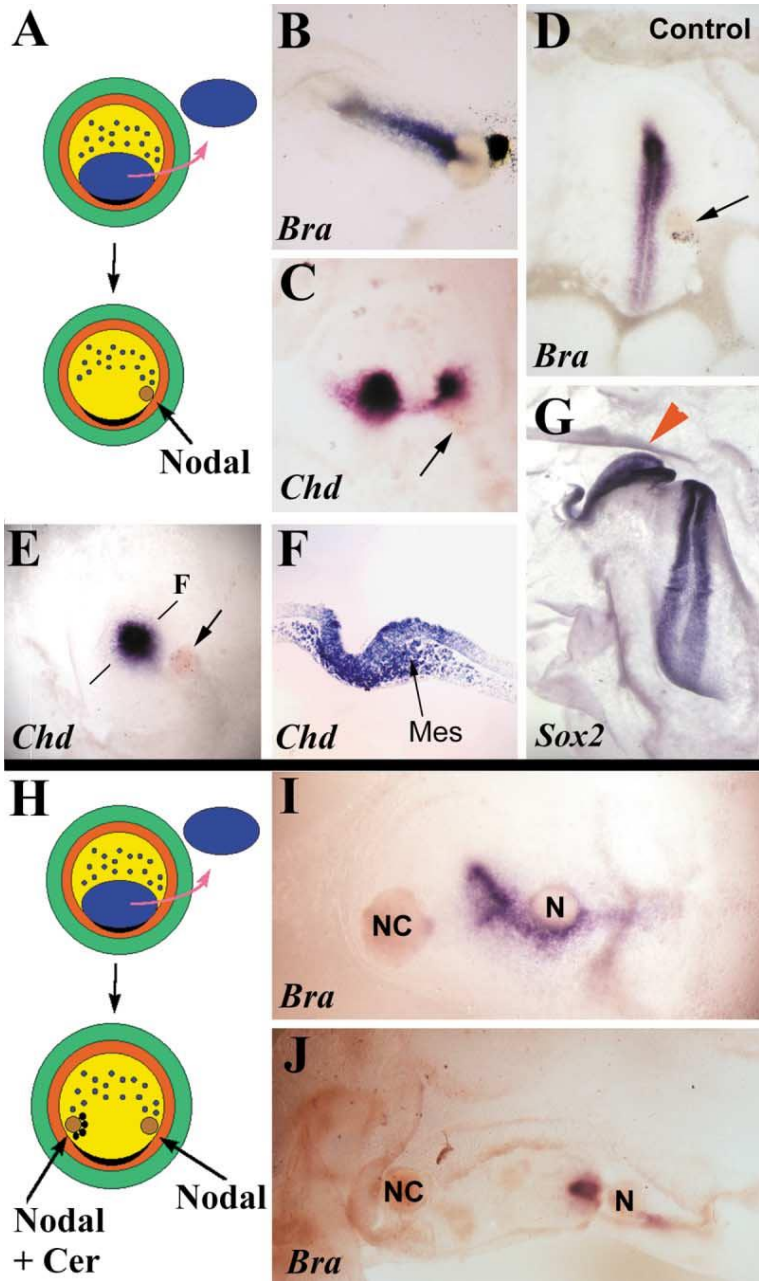


Depresión formada en la línea primitiva: **surco primitivo**
 Células ingresan a través del surco primitivo

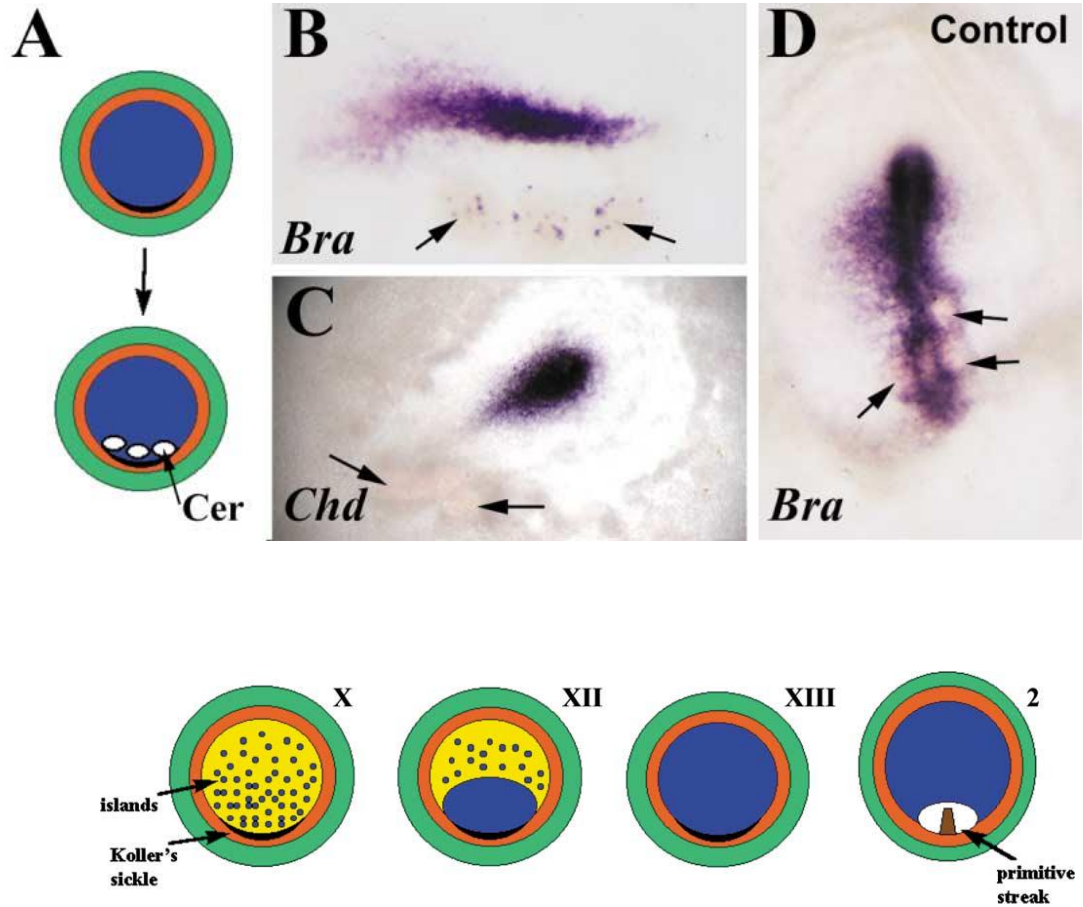
The Hypoblast of the Chick Embryo Positions the Primitive Streak by Antagonizing Nodal Signaling

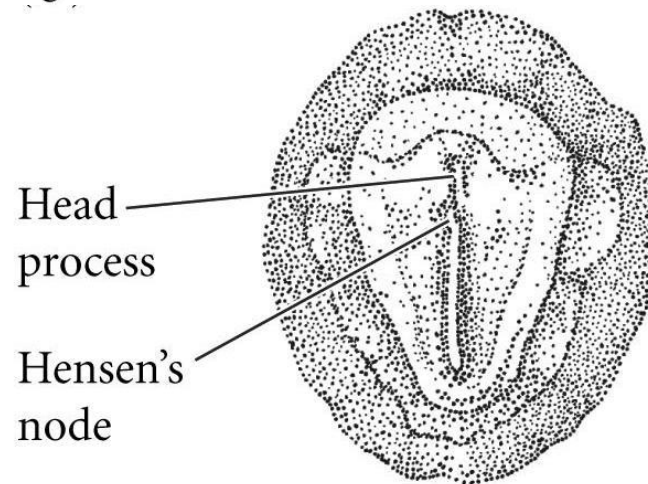
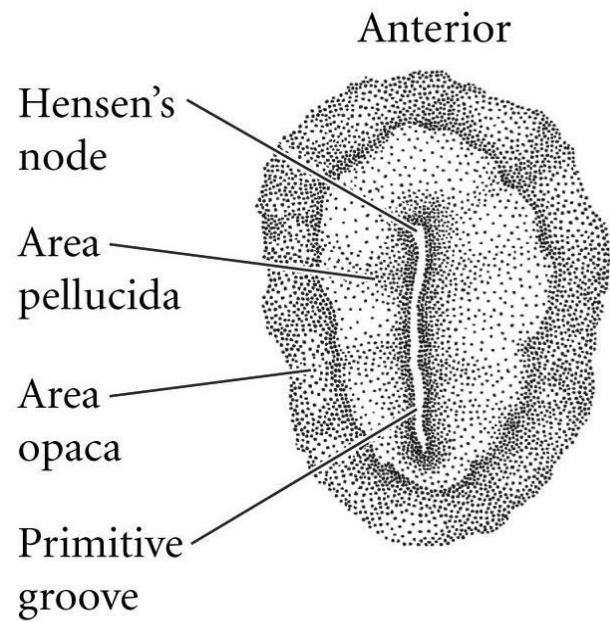
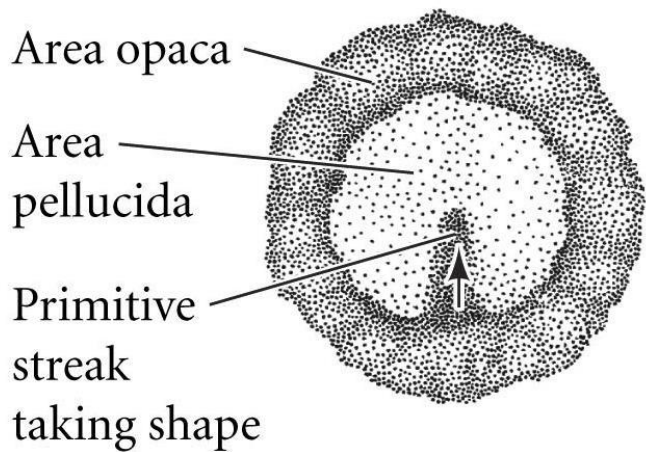
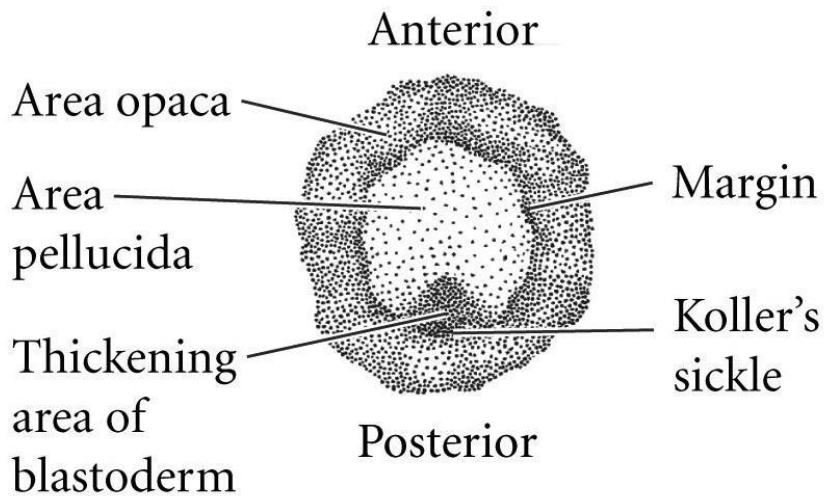
Federica Bertocchini and Claudio D. Stern¹





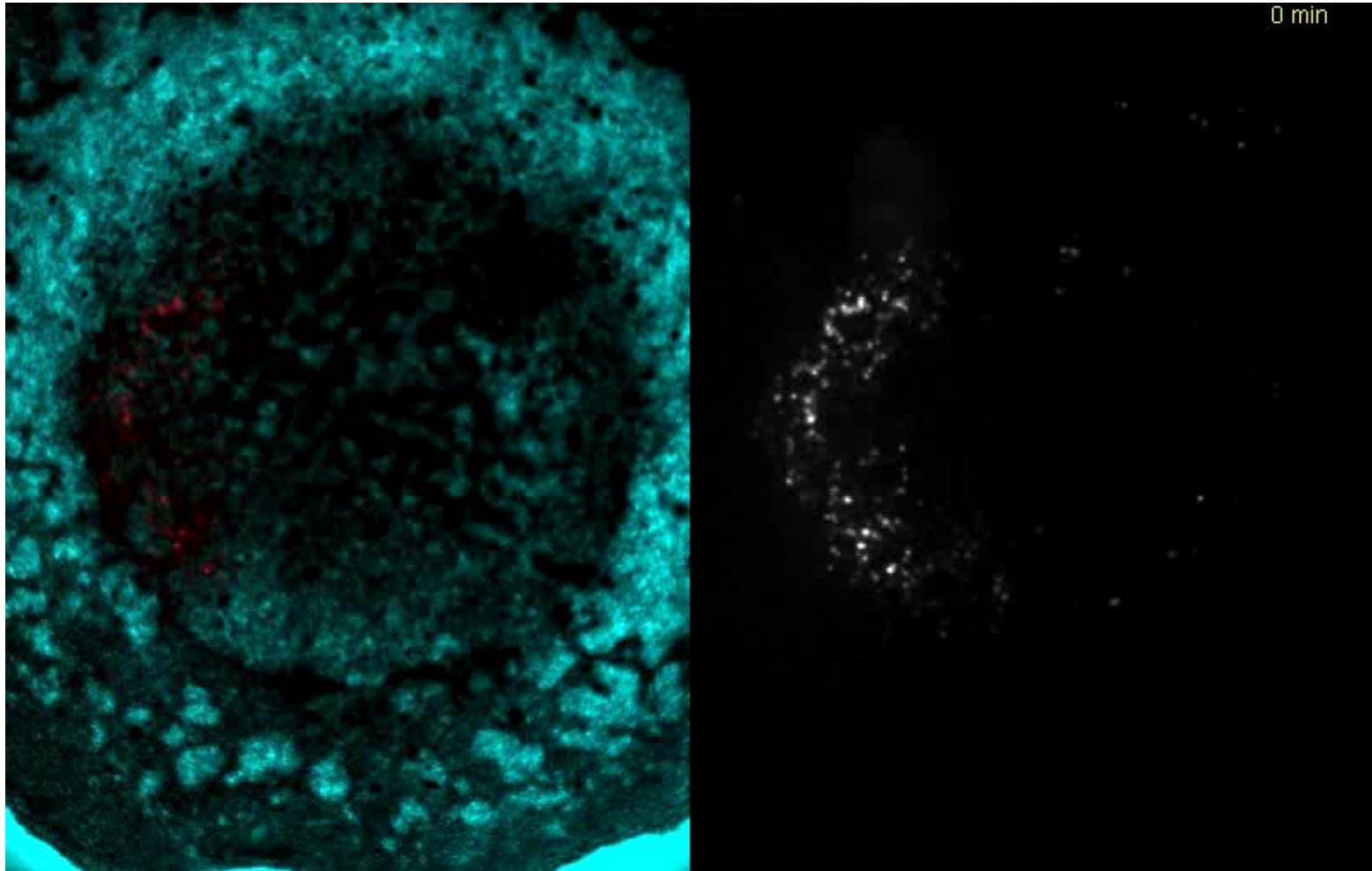
**Nodal induce
Cerberus inhibe**





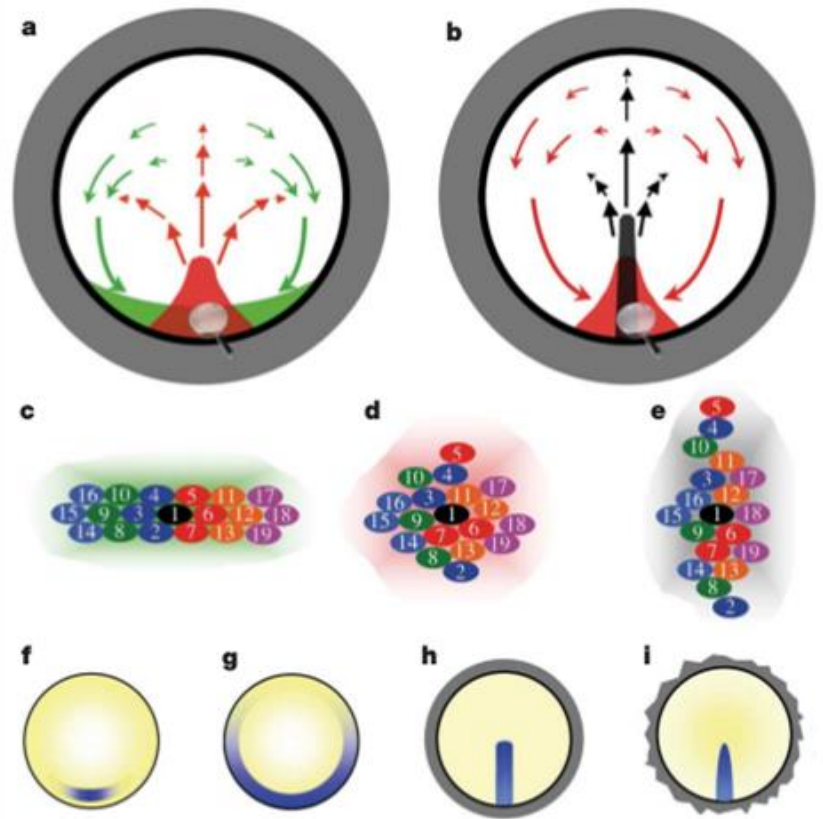
The amniote primitive streak is defined by epithelial cell intercalation before gastrulation

Octavian Voiculescu¹, Federica Bertocchini¹, Lewis Wolpert¹, Ray E. Keller² & Claudio D. Stern¹



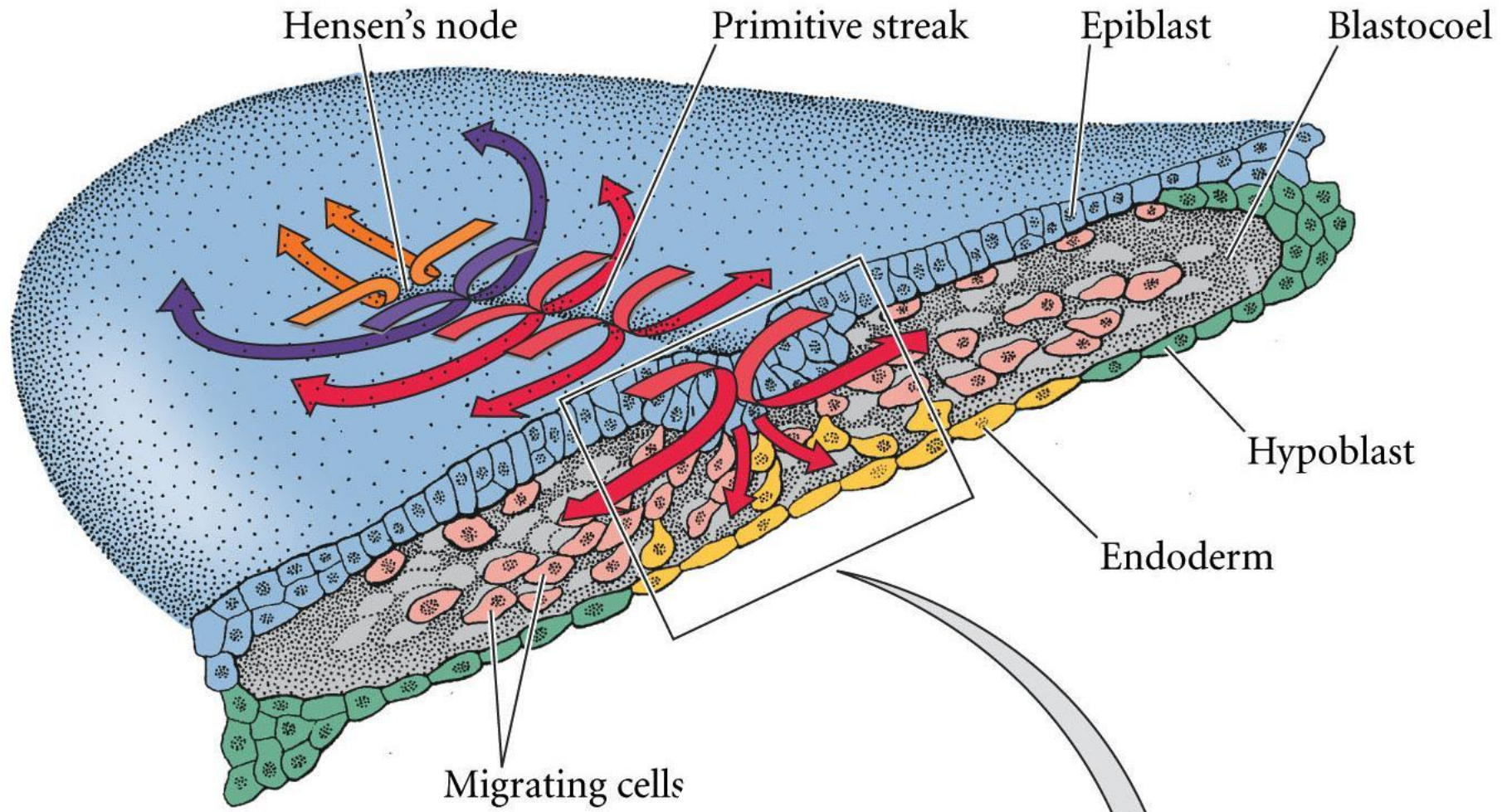
<https://youtu.be/ZPsnVNiOjsU>

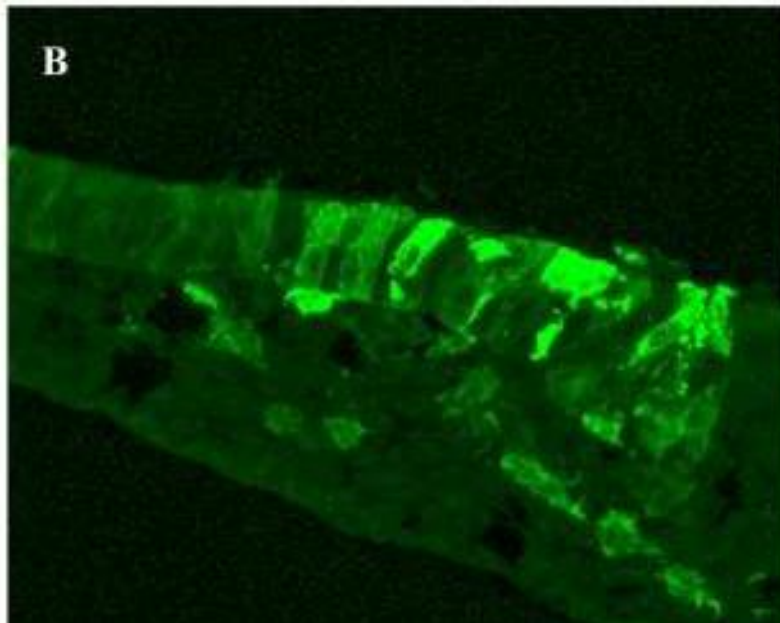
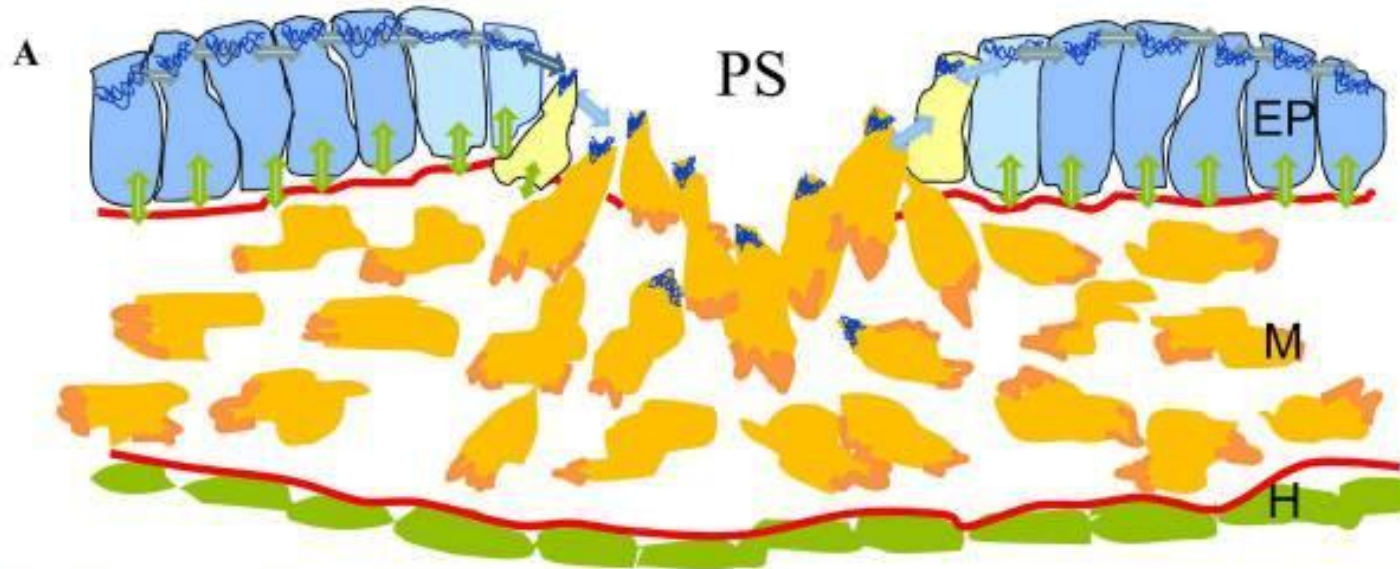
<https://youtu.be/KgJcFpGC0xg>



Extensión de la línea primitiva: **intercalación celular**

Migración a través de la línea primitiva

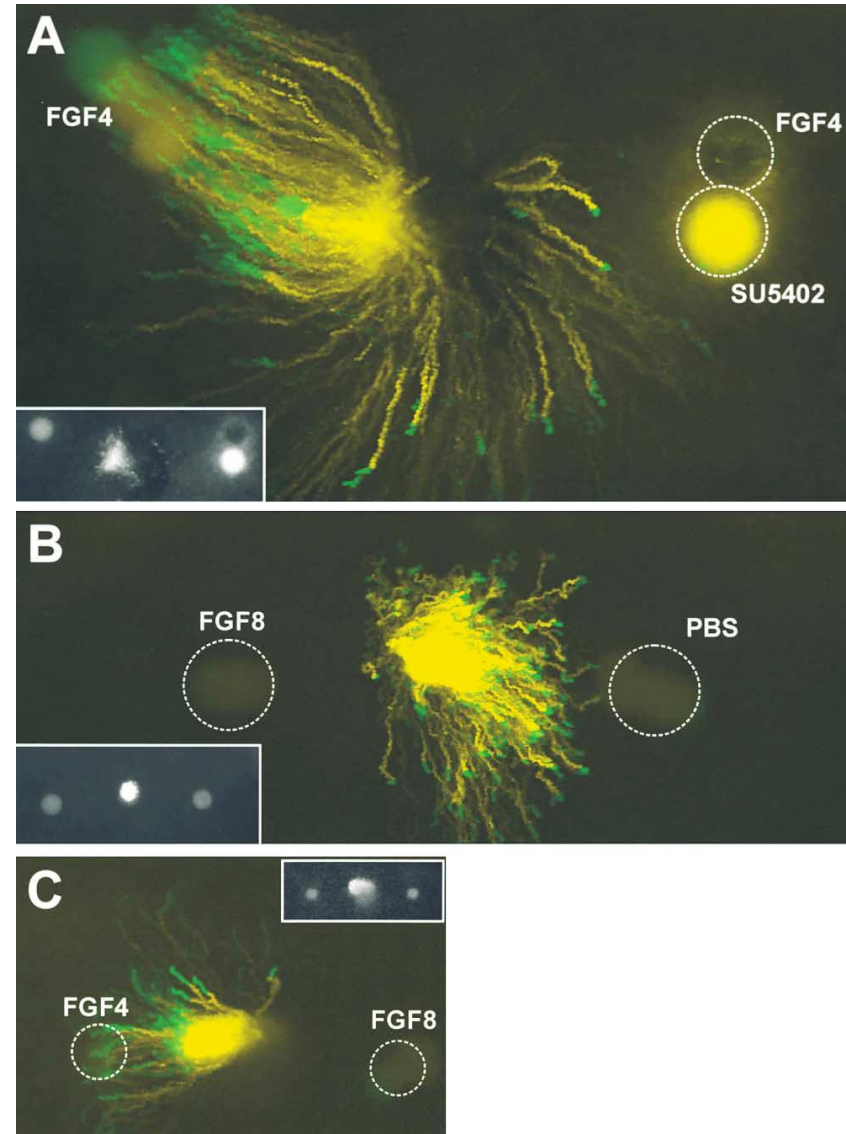
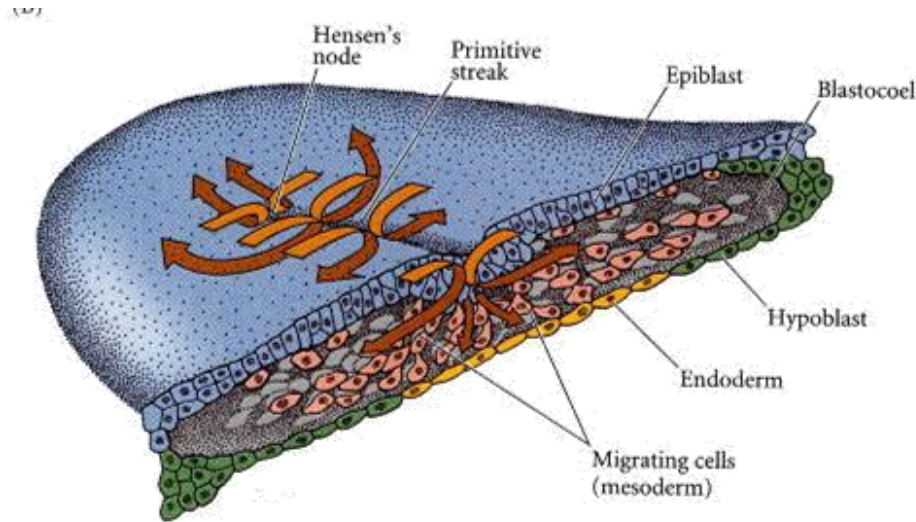




GFP

Cell Movement Patterns during Gastrulation in the Chick Are Controlled by Positive and Negative Chemotaxis Mediated by FGF4 and FGF8

Xuesong Yang, Dirk Dormann,
Andrea E. Münsterberg,² and Cornelis J. Weijer¹



FGF8 se expresa en la línea primitiva
repele las células migratorias

FGF4 producida por el cordamesodermo
atrae células migratorias

Regresión de la línea primitiva

