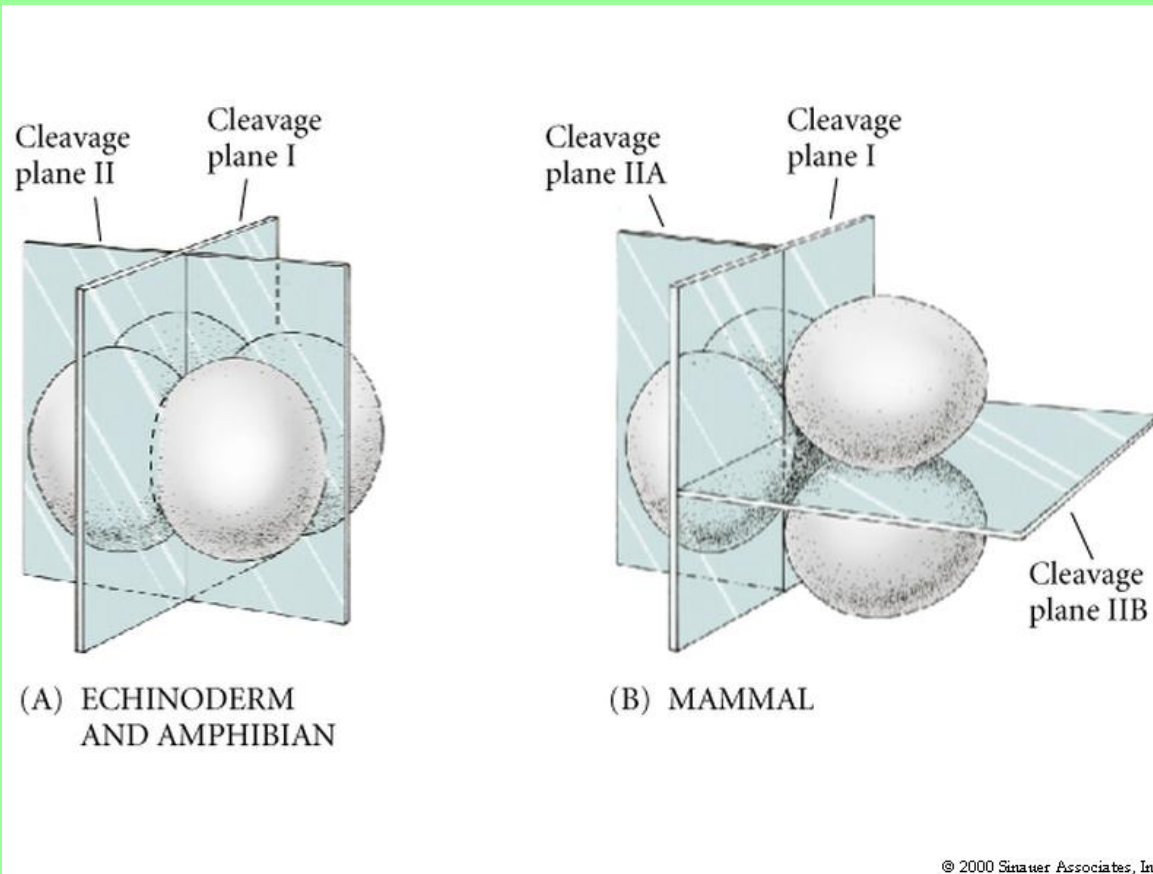


Mammals

Mammalian Development

- Rotational cleavage
- Slow cell division (1 day cycles)
- Asynchronous
- Early zygotic gene activation
- Adaptations for internal development
- Implantation of blastocyst

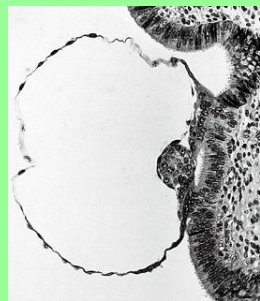
Rotational Cleavage of Mammals



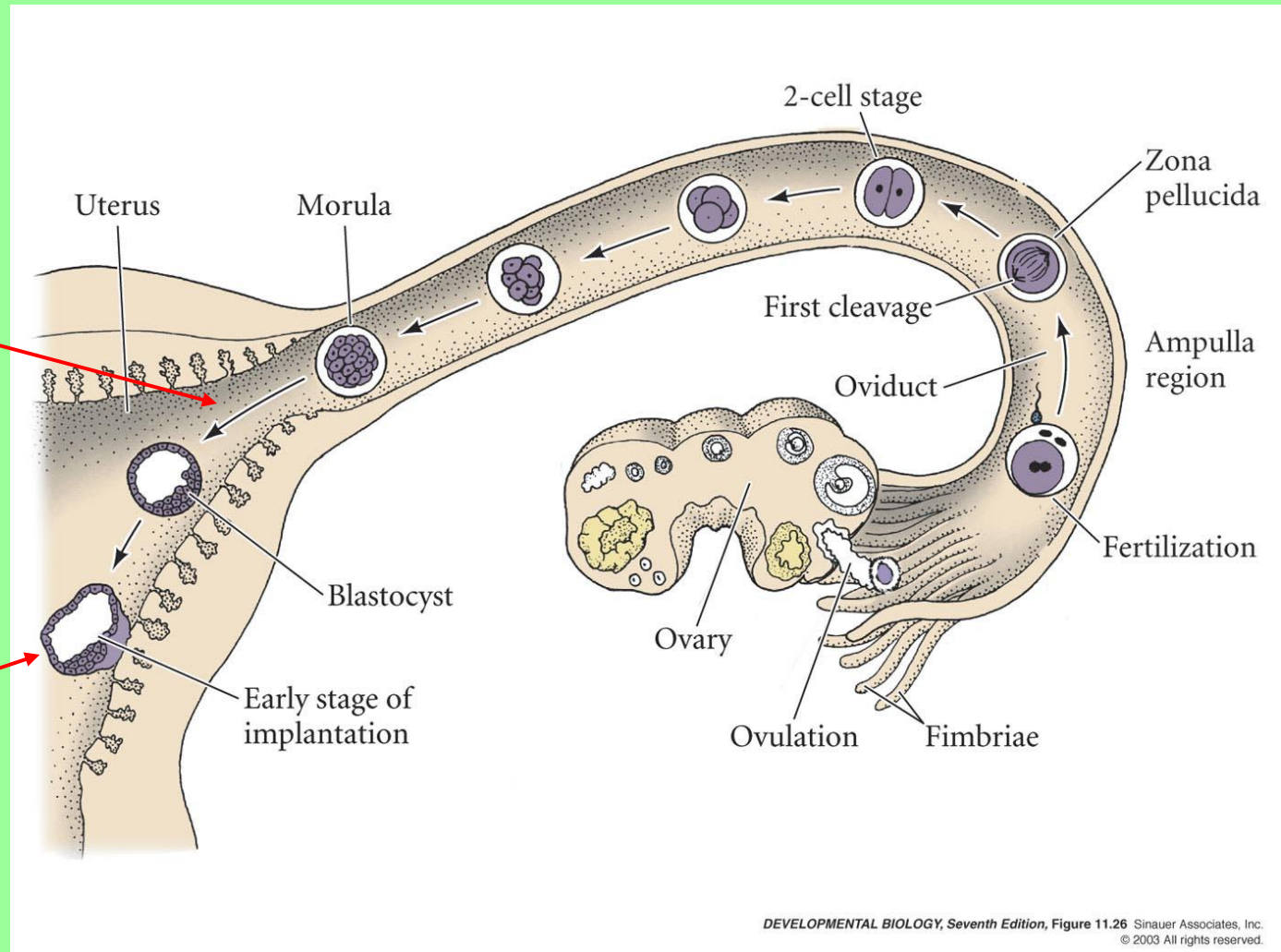
Fertilization to Implantation



Hatching

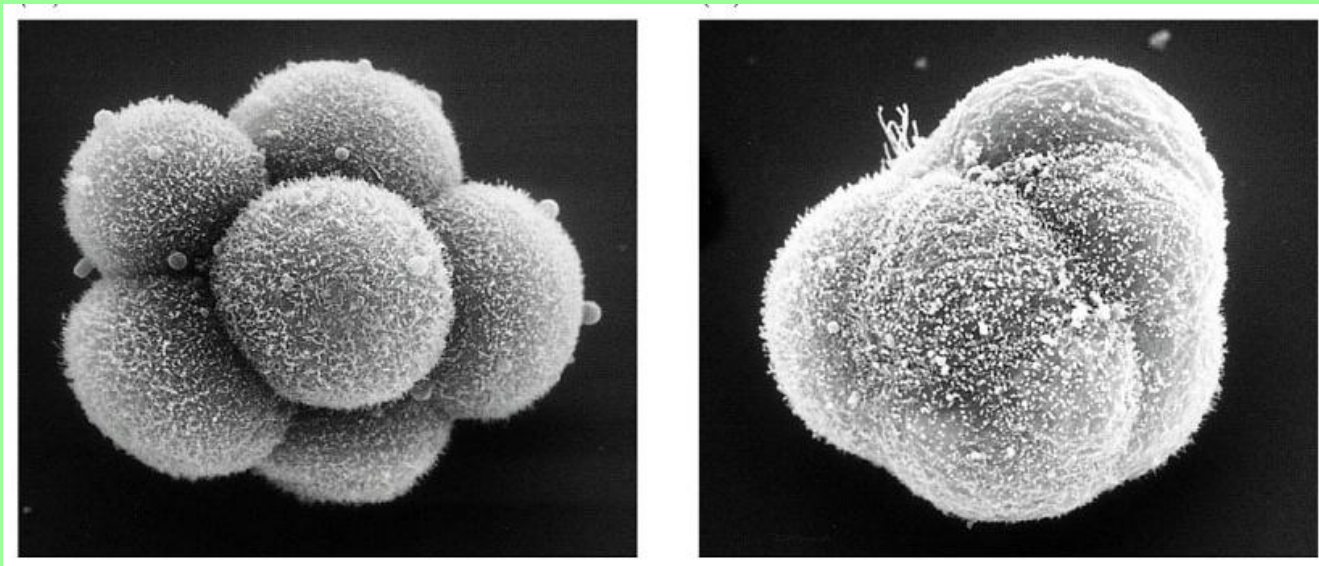


Implantation

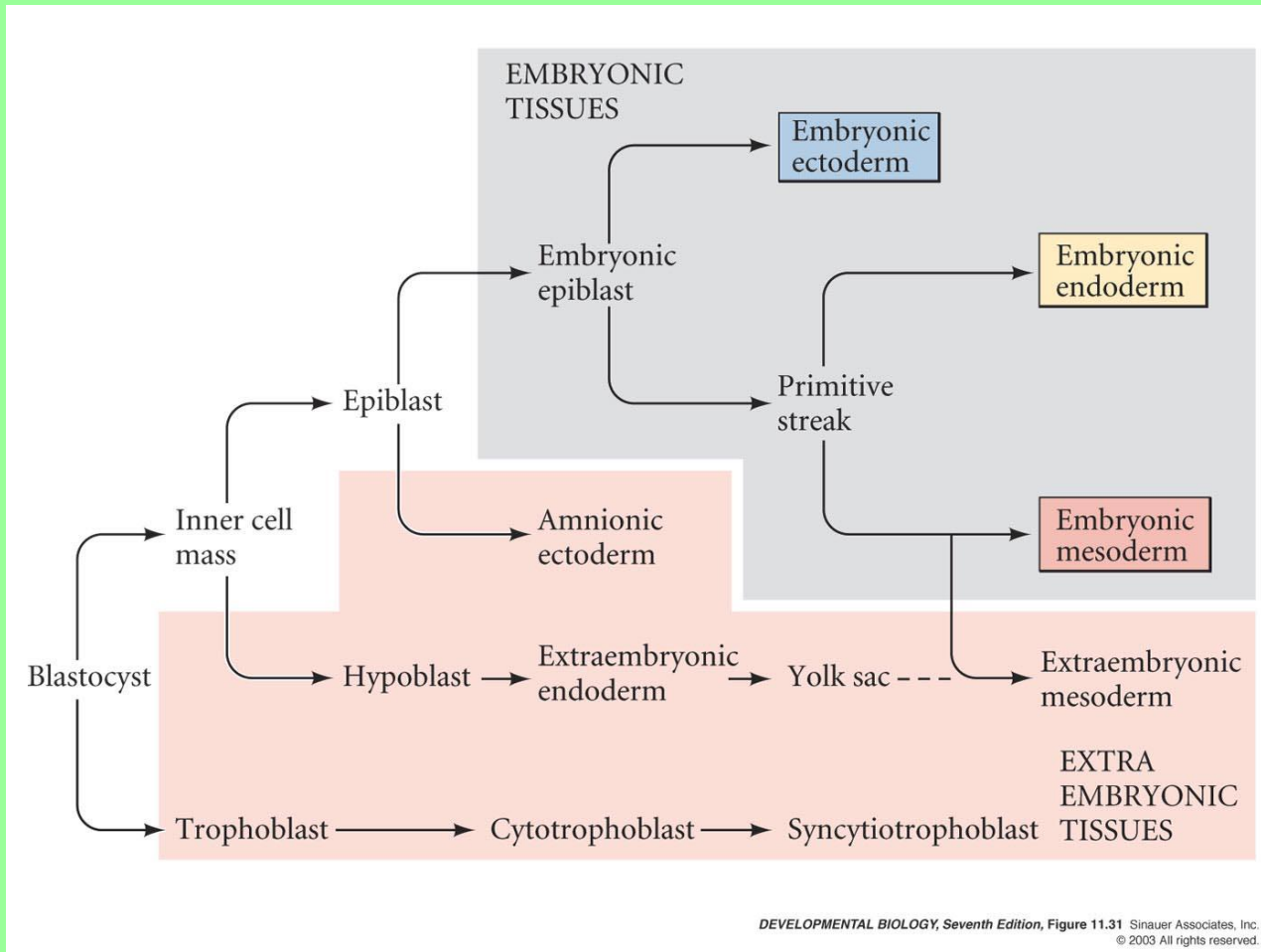


Fate Map

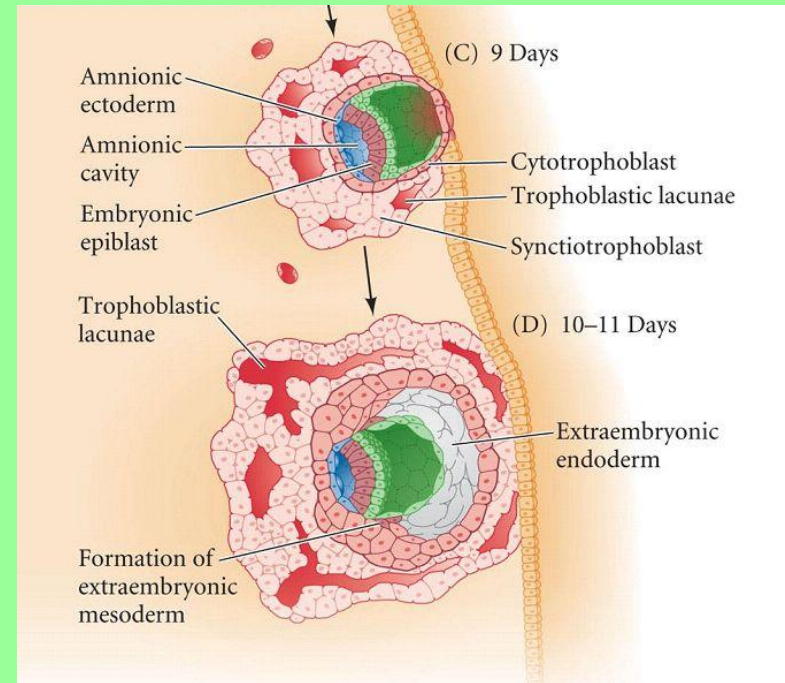
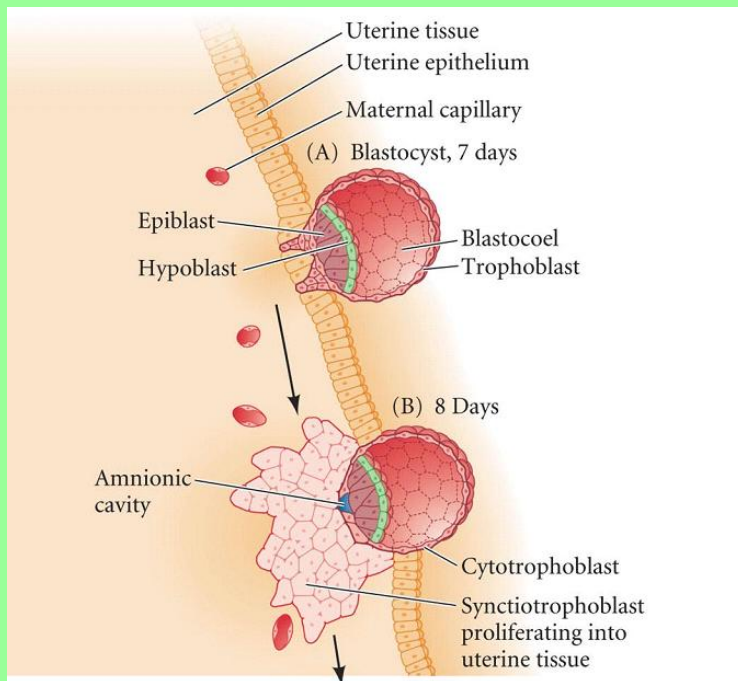
- 8-cell compaction -> 16-cell inner and outer
 - outer become trophoblast -> chorion (part of placenta)
 - inner cell mass -> embryo, yolk sac, amnion, allantois
- Trophoblast allows uterine implantation
- ICM -> blastocyst with blastocoele



Derivation of Mammalian Tissues



How Does Embryo Implant?

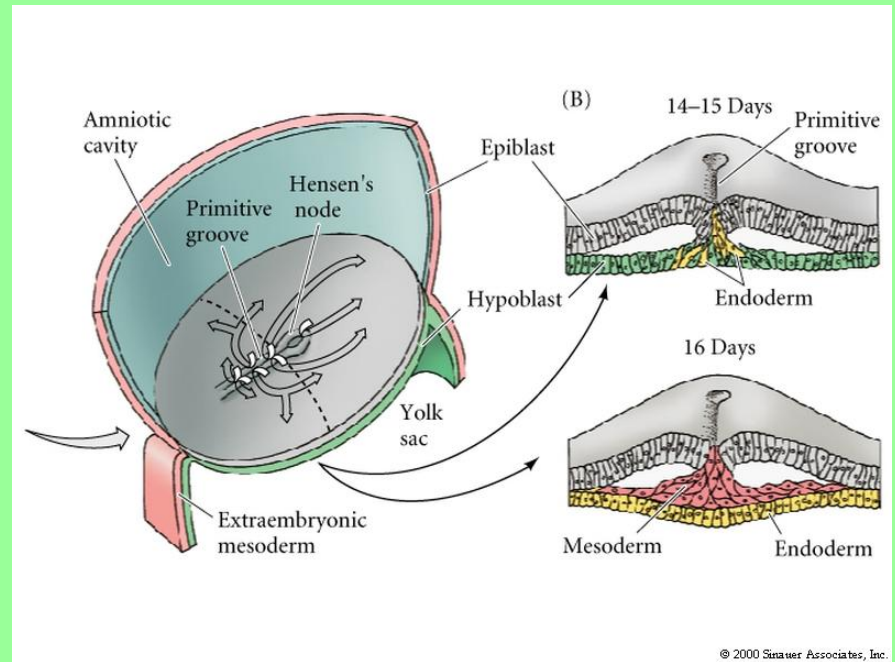
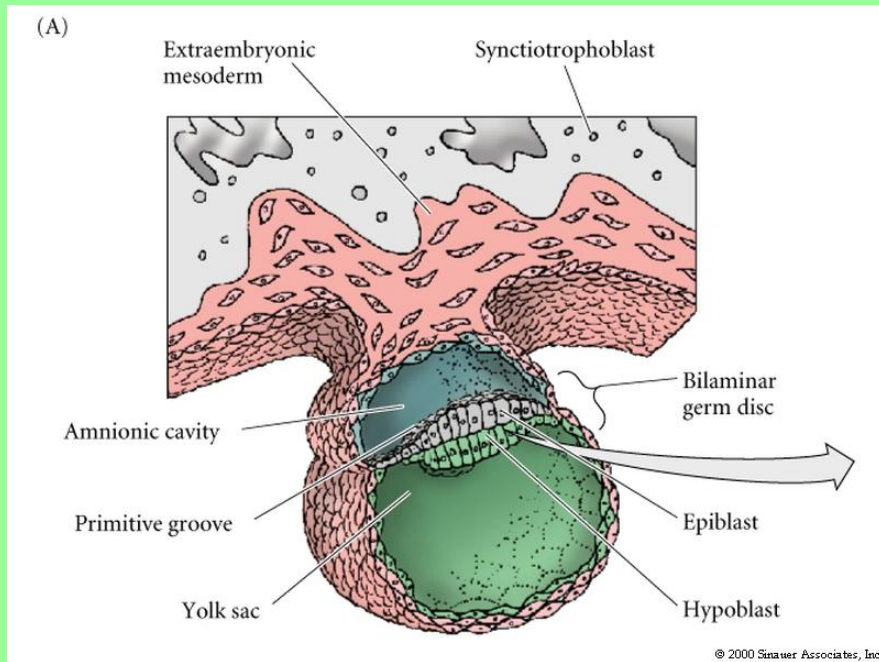


Attachment to endometrium of uterus
Digestion of endometrium ECM and invasion

What Characterizes Mammalian Gastrulation?

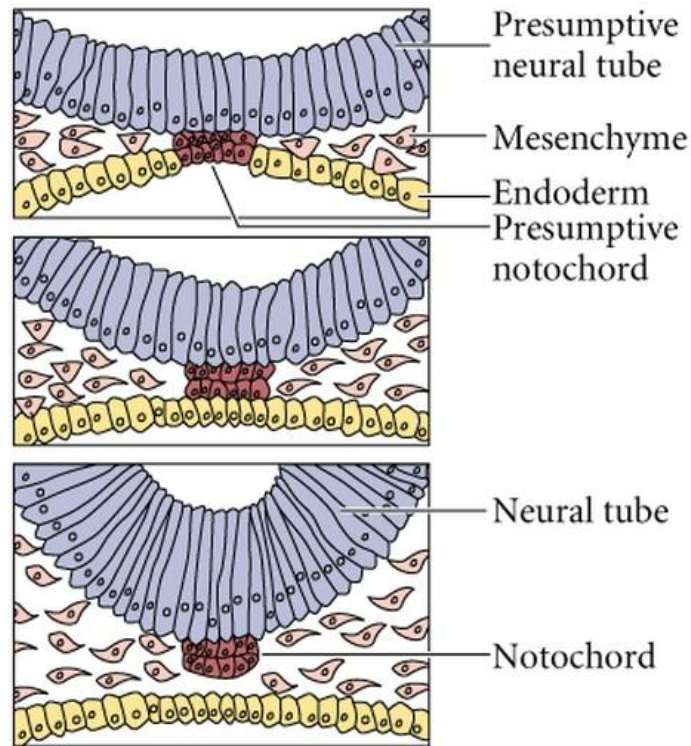
- Cell movements like birds and reptiles but no yolk
- Chorion forms placenta to get maternal nutrients
- Amnion protects embryo
- Yolk sac underdeveloped

Amnion Formation and Gastrulation Movements



Similar to chick, some variation.

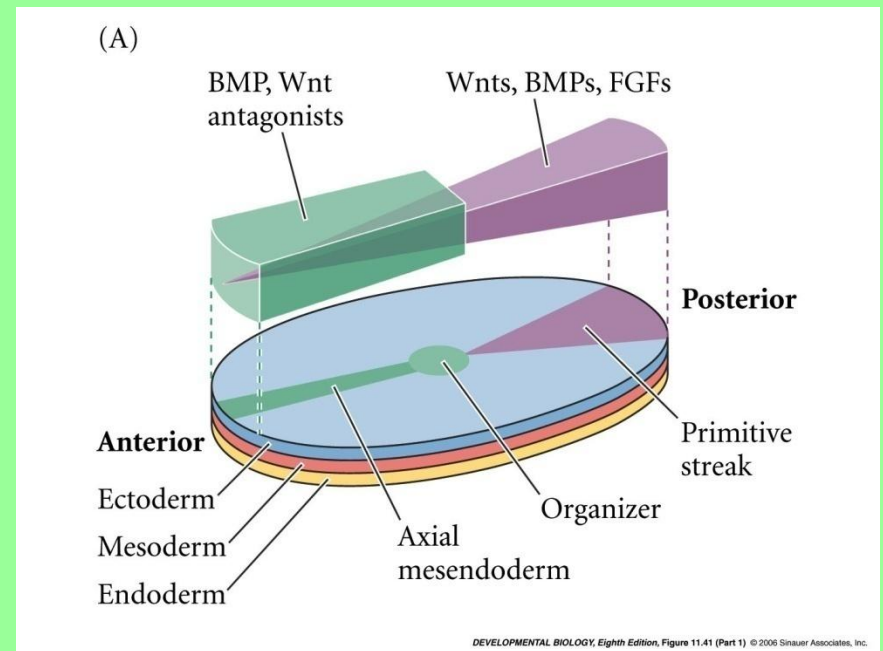
Notochord Formation



(B)

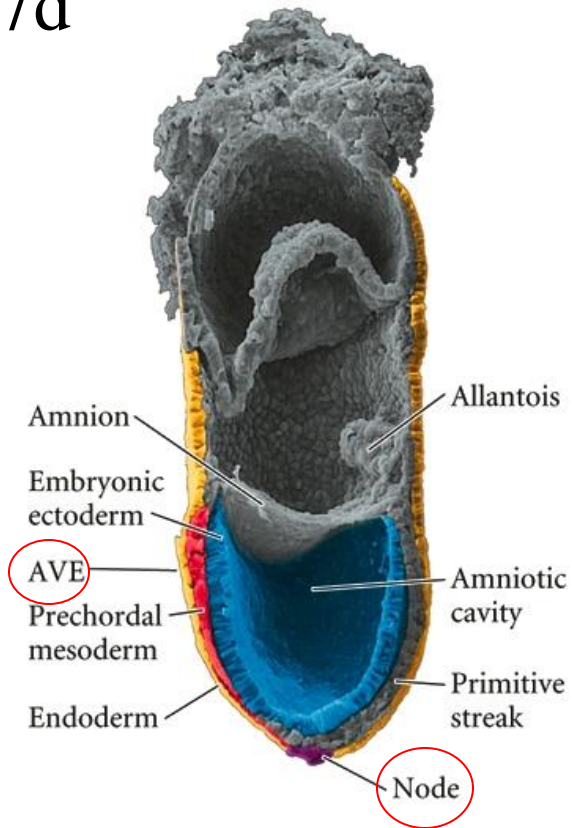
What is Origin of A-P Axis?

- Two signaling centers
 - node (body and forebrain)
 - anterior visceral endoderm (forebrain)
- Analogous to chick and frog organizers
 - signaling molecules *wnts, bmps, fgfs*
 - eventually *noggin, chordin, cerberus*, etc.

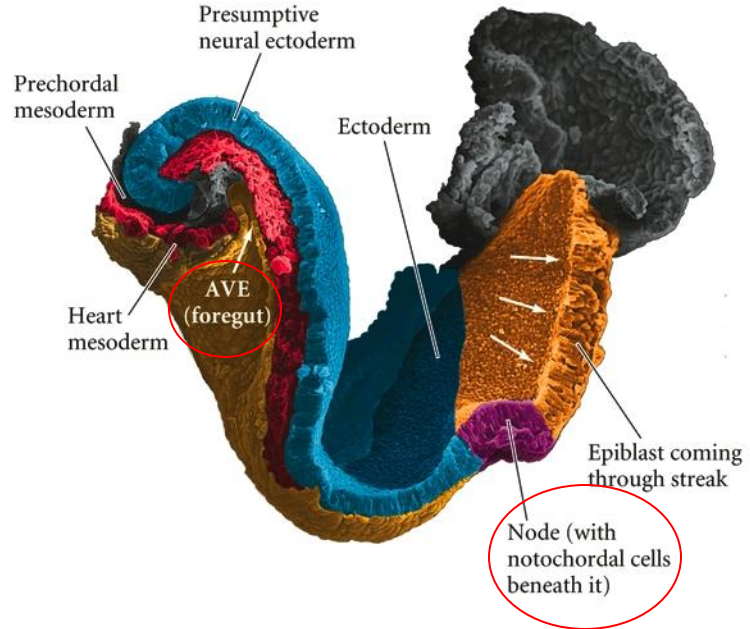


Node and AVE

7d



8d

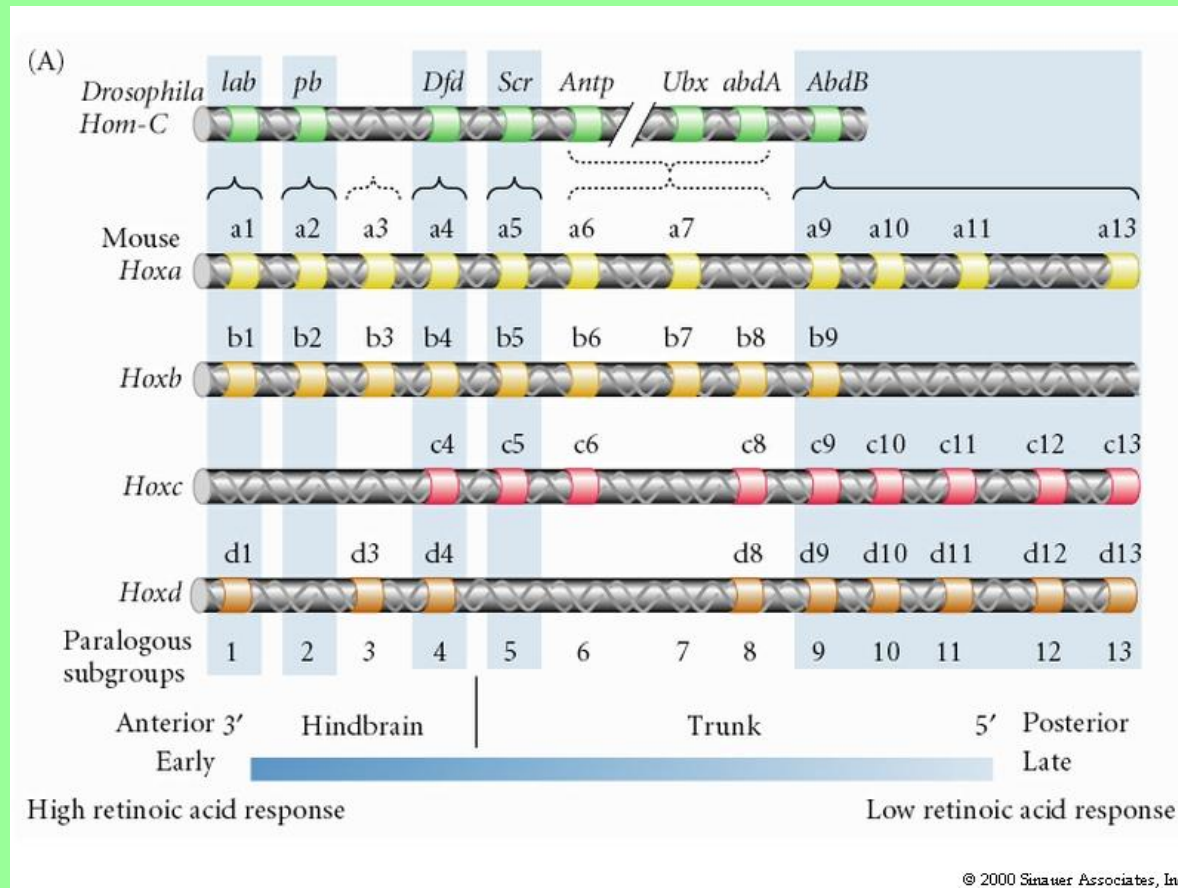


mouse

Are There More Homologies? Patterning Along A-P Axis

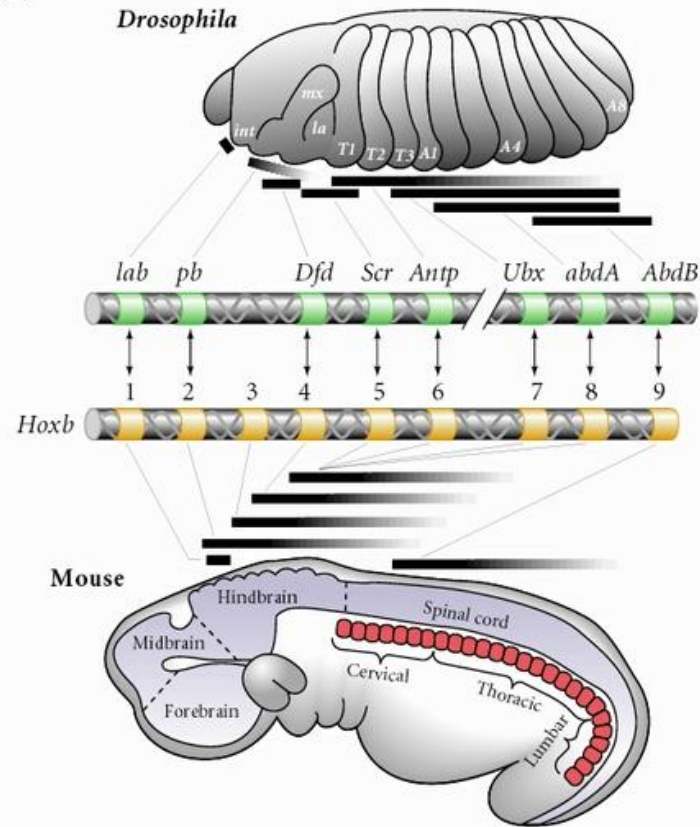
- **Hox** Genes
 - homologous to fly homeotic genes
 - same order anterior to posterior
 - 4 sets instead of one by gene
 - by two duplications
- A combinatorial code specifies identity

Mammalian Hox Clusters



Hox Spatial Expression: Fly vs. Mouse

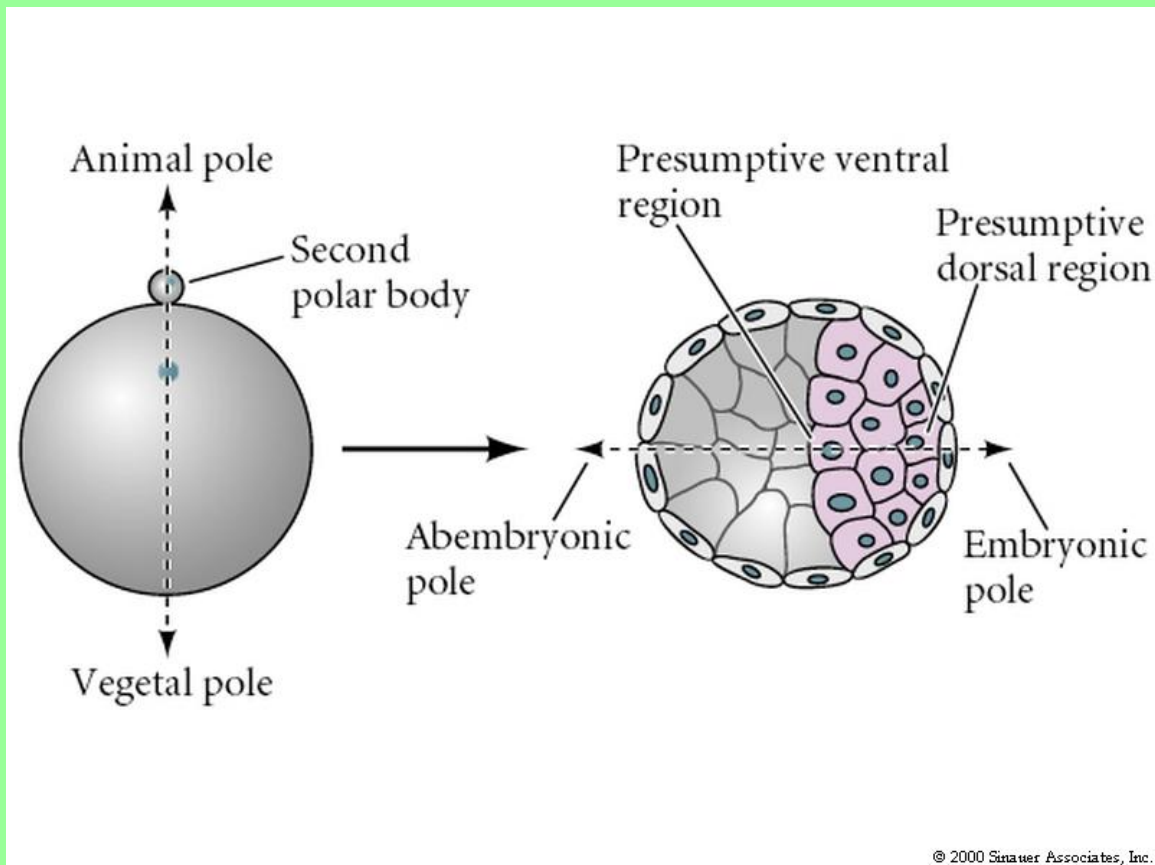
(B)



What is Origin of Dorsal-Ventral Axis?

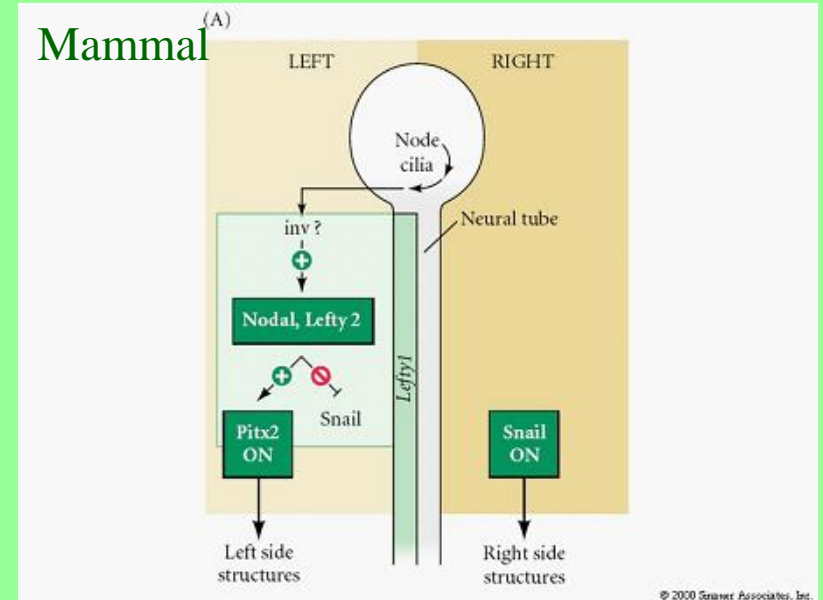
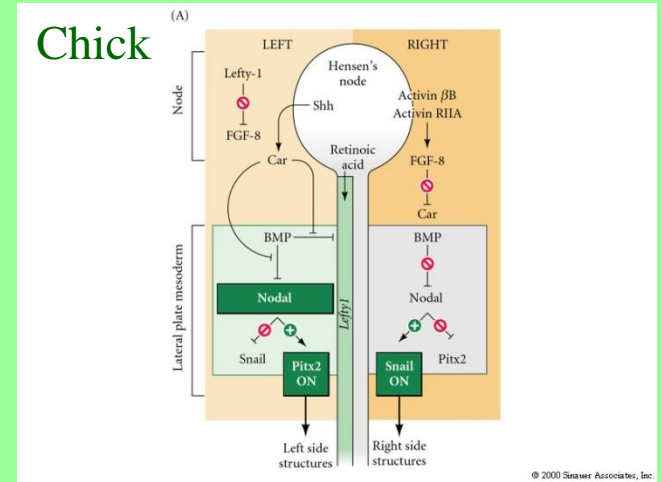
- Dorsal is from cells contacting the trophoblast and ventral is from cells near blastocoele
- Egg A-V axis is perpendicular to embryonic-abembryonic axis (from oocyte?)
 - Dorsal at embryonic pole

Dorsal-Ventral Axis



What is Origin of Left-Right Axis?

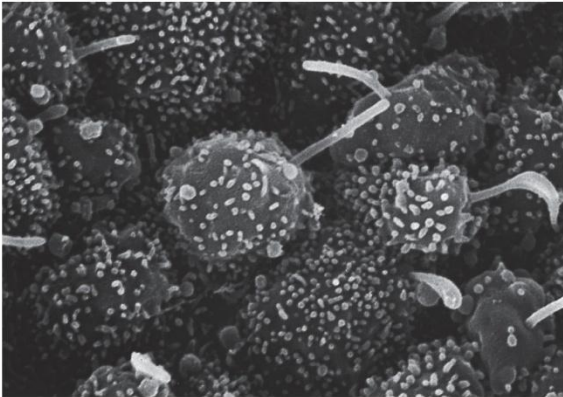
- Cilia in node
 - Cause flow right to left
 - KO (dynein ciliary motor protein)
 - sterile males
 - random heart position
- Symmetry breaking mechanism
- Downstream targets
Nodal, Pitx2 on left



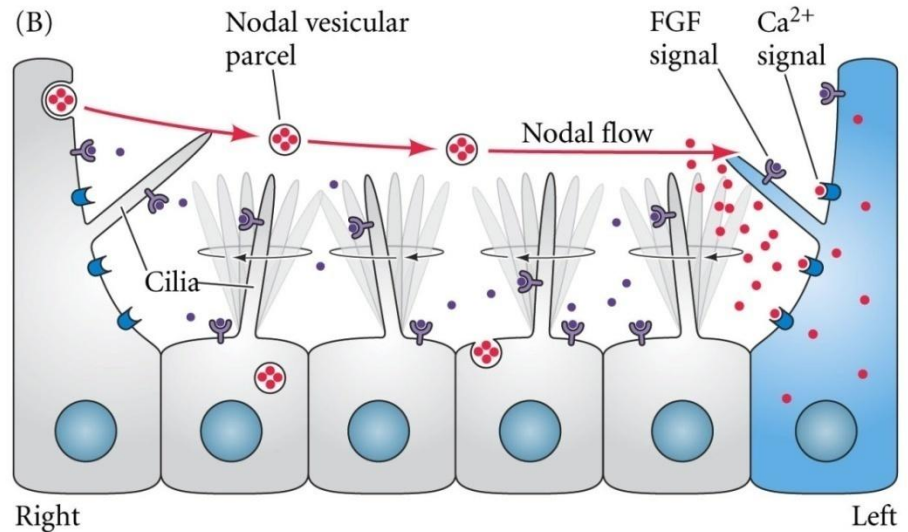
Nodal Vesicle Parcels

- NVS secreted from node because of an FGF signal
 - Contain Shh and retinoic acid
- Swept to left
 - Shh and RA same chick
 - Increase in Ca^{2+} signal on left

(A)



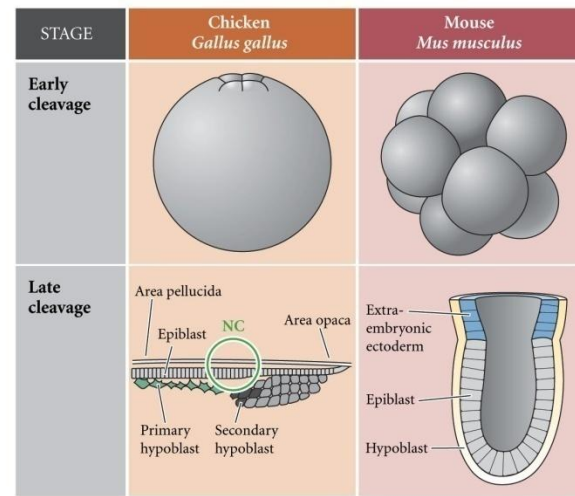
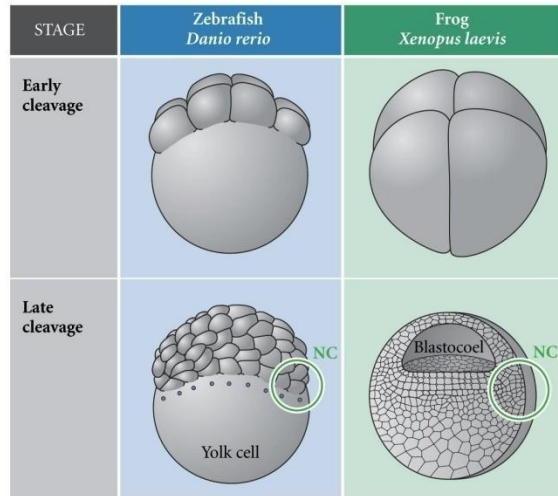
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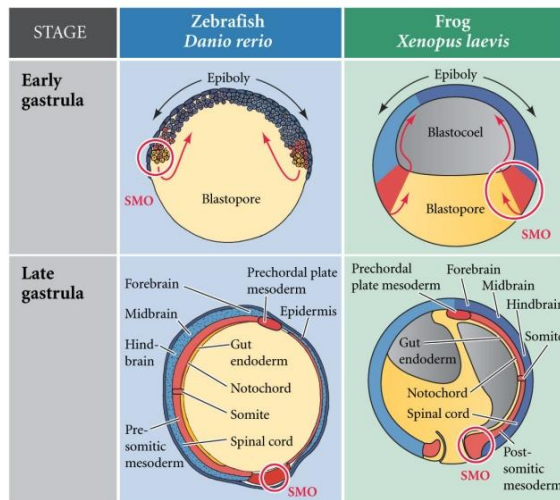
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Vertebrate Patterns

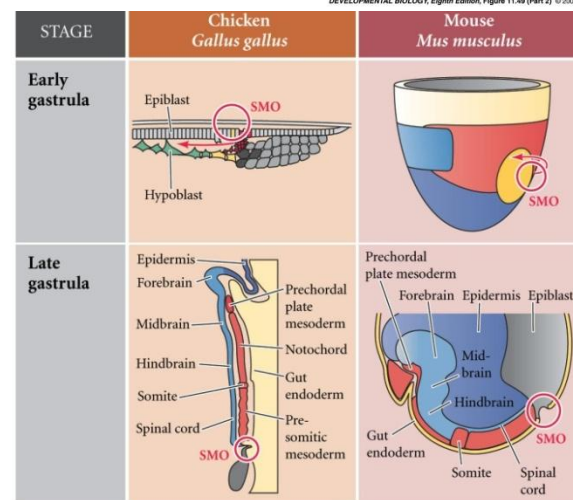
NC-Nieukoop center
SMO-Speeman Mangold organizer



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Human Embryo 50 Days

- Read “Sidelights and Speculations” *Twins and Embryonic Stem Cells*
- Read about and write a page or two on conjoined twins:

<http://8e.devbio.com/subnode.php?ch=11&id=94>

