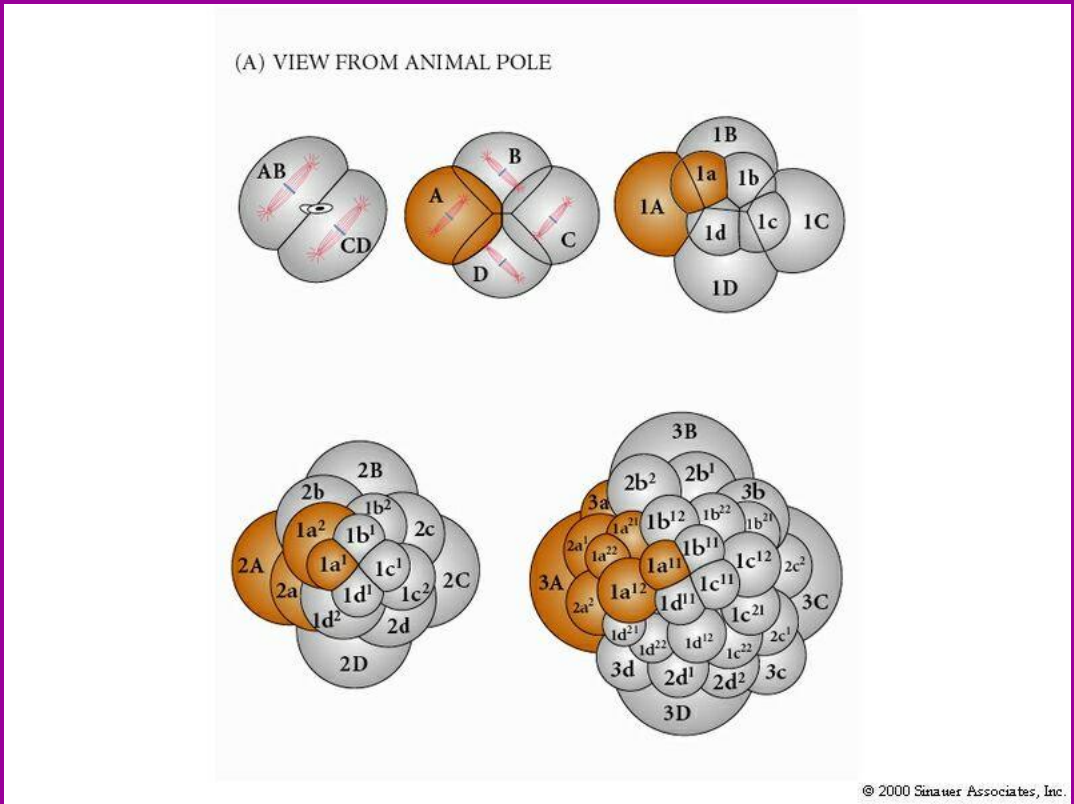
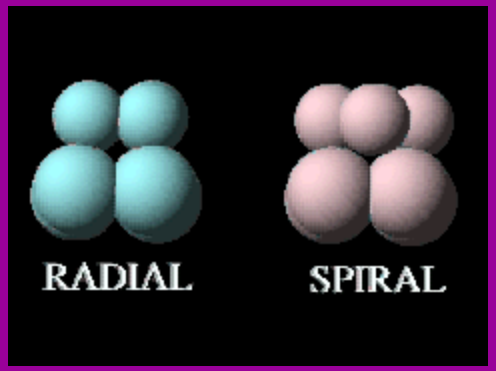
What's a Spiralian?

- Spiralian
  - like many annelids, flatworms and other molluscs
  - cleavage planes at oblique angle to A-V axis
  - produce solid blastula (no blastocoele)
  - cell tiers twist alternately right and left
  - are inherently asymmetric and can produce mirror images
  - often unequal cleavages

Spiral Cleavage in *Trochus*

Top View

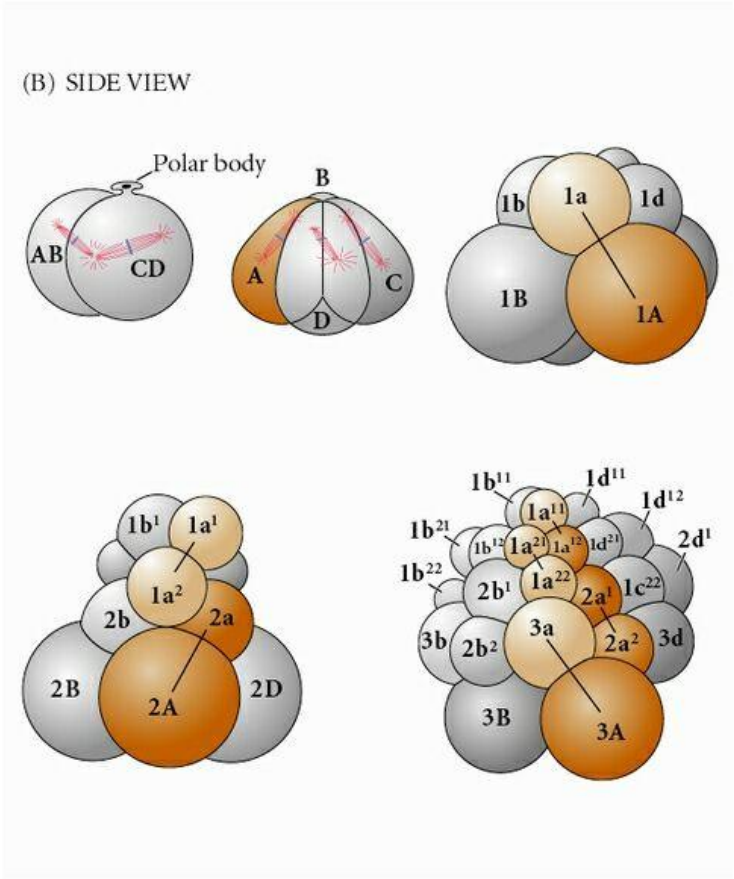




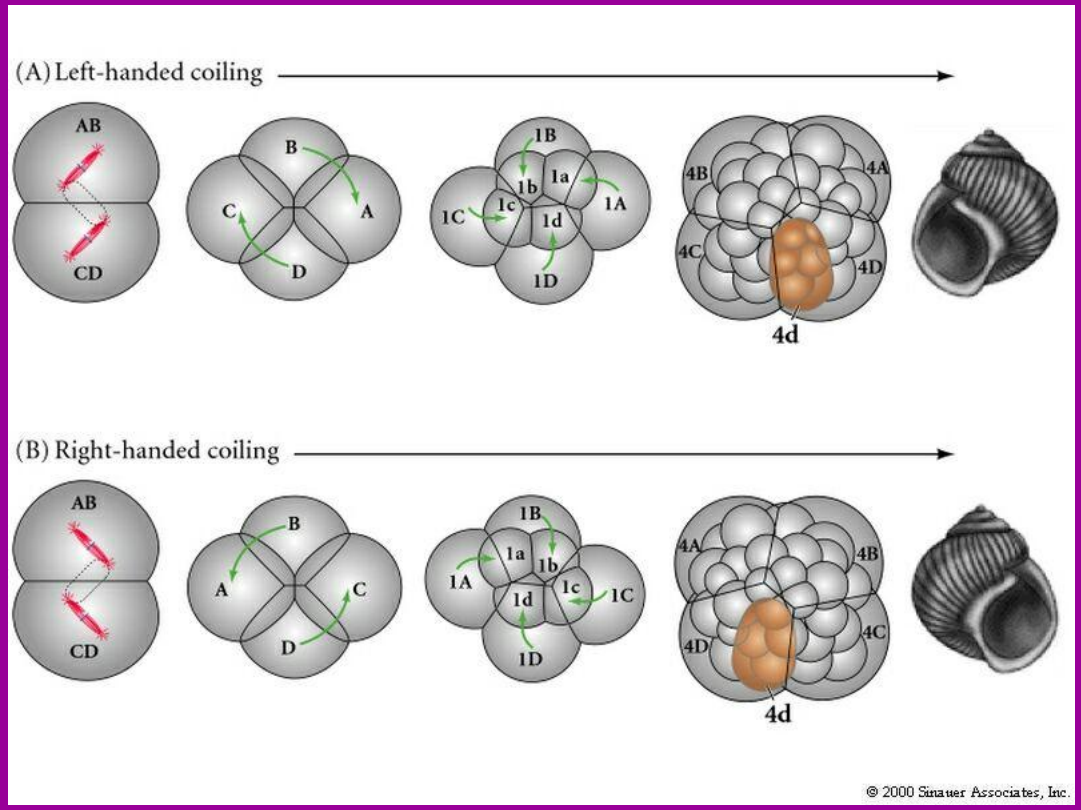
Rad_spir.mov

Spiral Cleavage

Side View



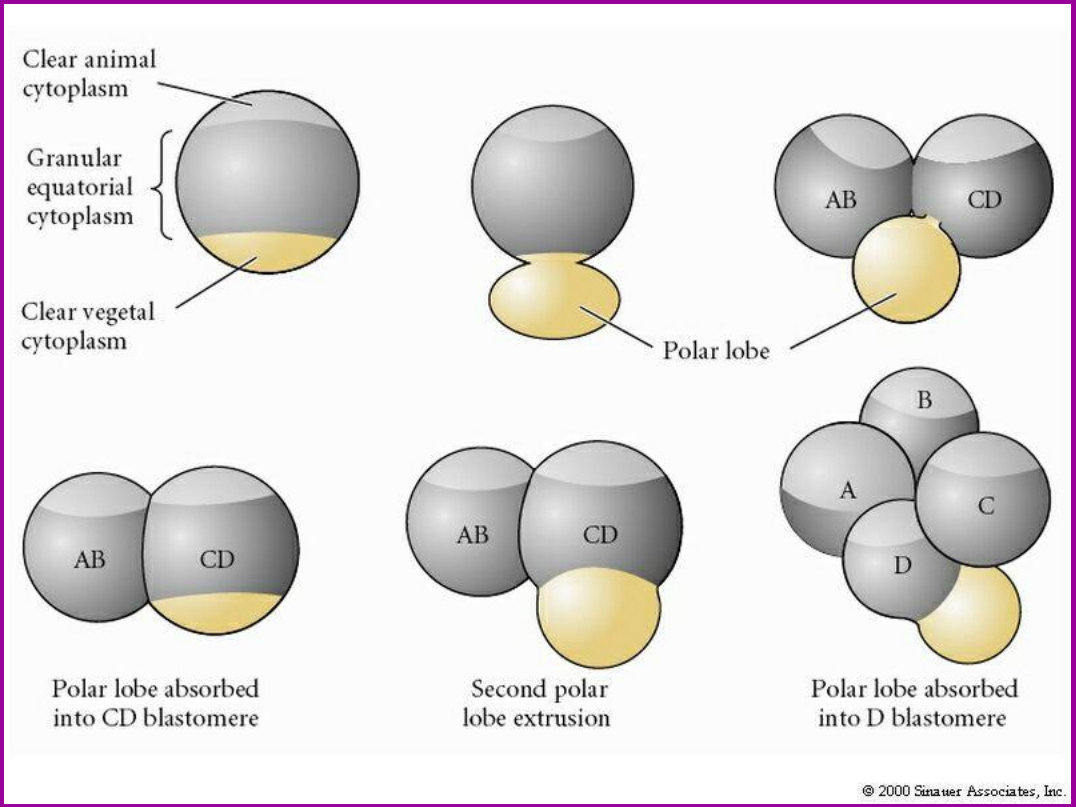
Mirror Images in *Ilyanassa* (snail)



How is Direction of Coiling Controlled?

- Inbred snails give 2 lines, right coiling (D or dextral) and left coiling (d or sinistral)
  - D is dominant to d
- But inheritance is maternal
  - DD ♀ x dd ♂ ⟶ Dd all right coil
  - DD ♂ x dd ♀ ⟶ Dd all left coil
  - Dd x Dd ⟶ DD, Dd, dd all right coil
- the coiling factor is in oocyte cytoplasm
  - microinject from rt coil into embryo from dd ♀

What's a Polar Lobe? (*Dentalium*)



Scaphopod Movie

What Does a Polar Lobe Do?

- Cell that receives polar lobe material
  - is larger
- If cut off polar lobe, don't get muscles, mouth, shell gland, foot
- If successively ablate cells in the D lineage, get less loss suggesting different determinants passed on to different lineages
  - these include inducers

Summary of Deletion Experiments

- 4 cell -D -heart, intestine, shell, eyes, etc.
- 8 cell -1D -H,-I,-S,-E
- 16 cell - 2D -H,-I,-E +S
- 32 cell -3D -H,-I +S,+E
- 64 cell -4D normal
- 64 cell - 4d -H,-I

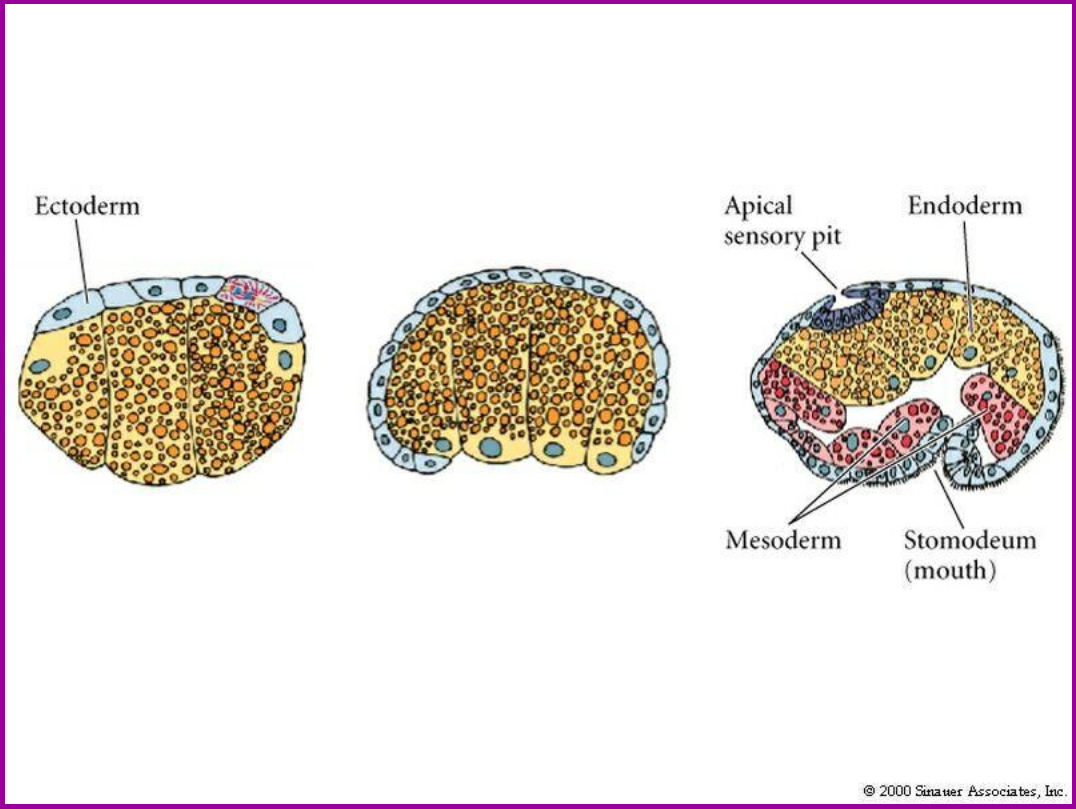
Summary of Deletions

- Cytoplasmic determinants localized progressively in D lineage
- Eyes require 2d and 3 d and 1a and 1c
  - made from 1a and 1c descendants only
  - not segregating little eyes but d lineage inducer of eye
  - eye made by 1a, 1c lineage

Gastrulation in Spiralians

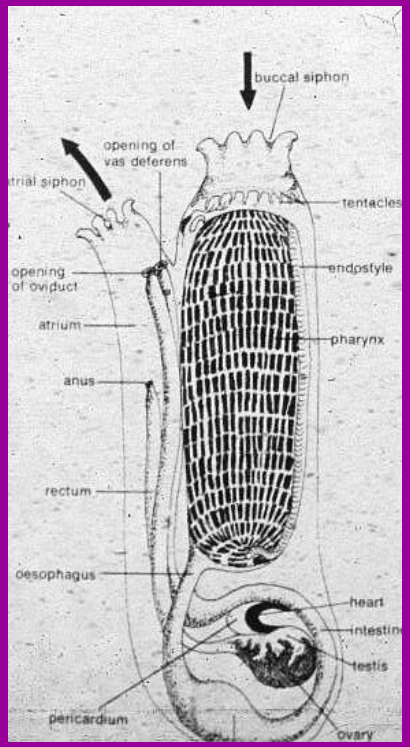
- Stereoblastula
- Cells at animal cap spread by epiboly over the vegetal cells
- A slit forms at the vegetal end of the gastrula, which becomes the mouth (protostomes)

Gastrulation in *Crepidula*

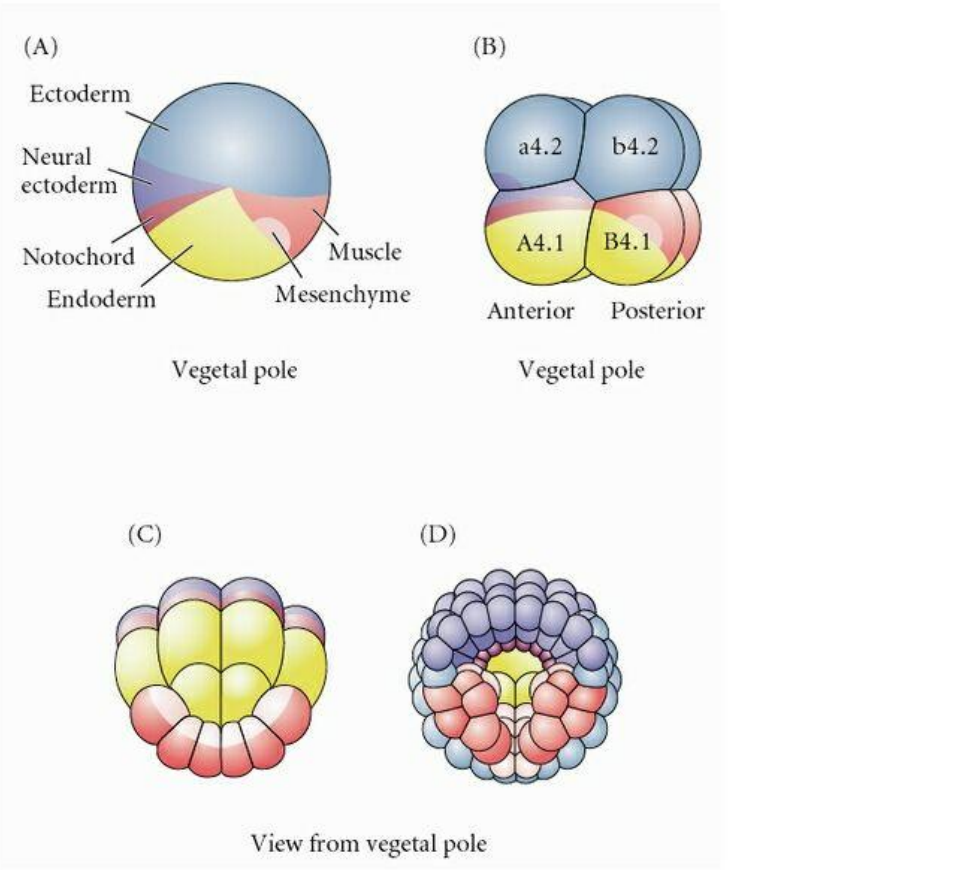


What are Tunicates?

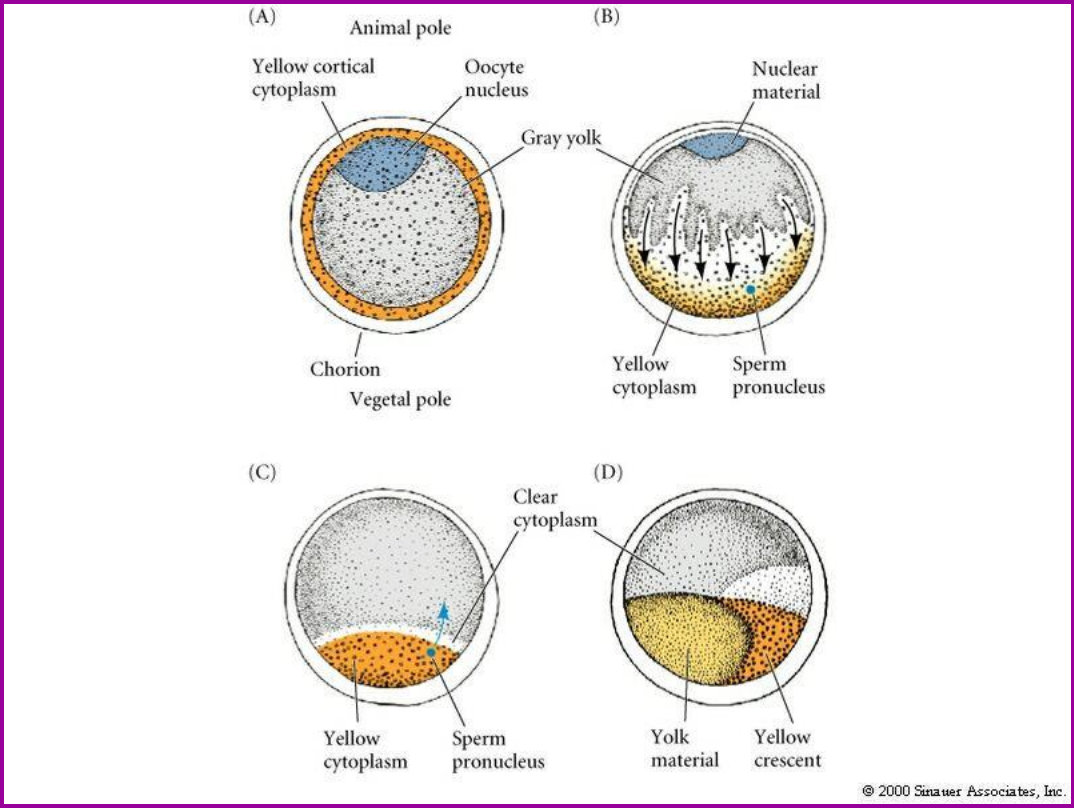
- Ascidians are tunicates
  - invertebrate chordates
  - form free-swimming tadpoles
  - these settle, degenerate, forming a tunic and become sessile



Fate Map of *Styela partita*

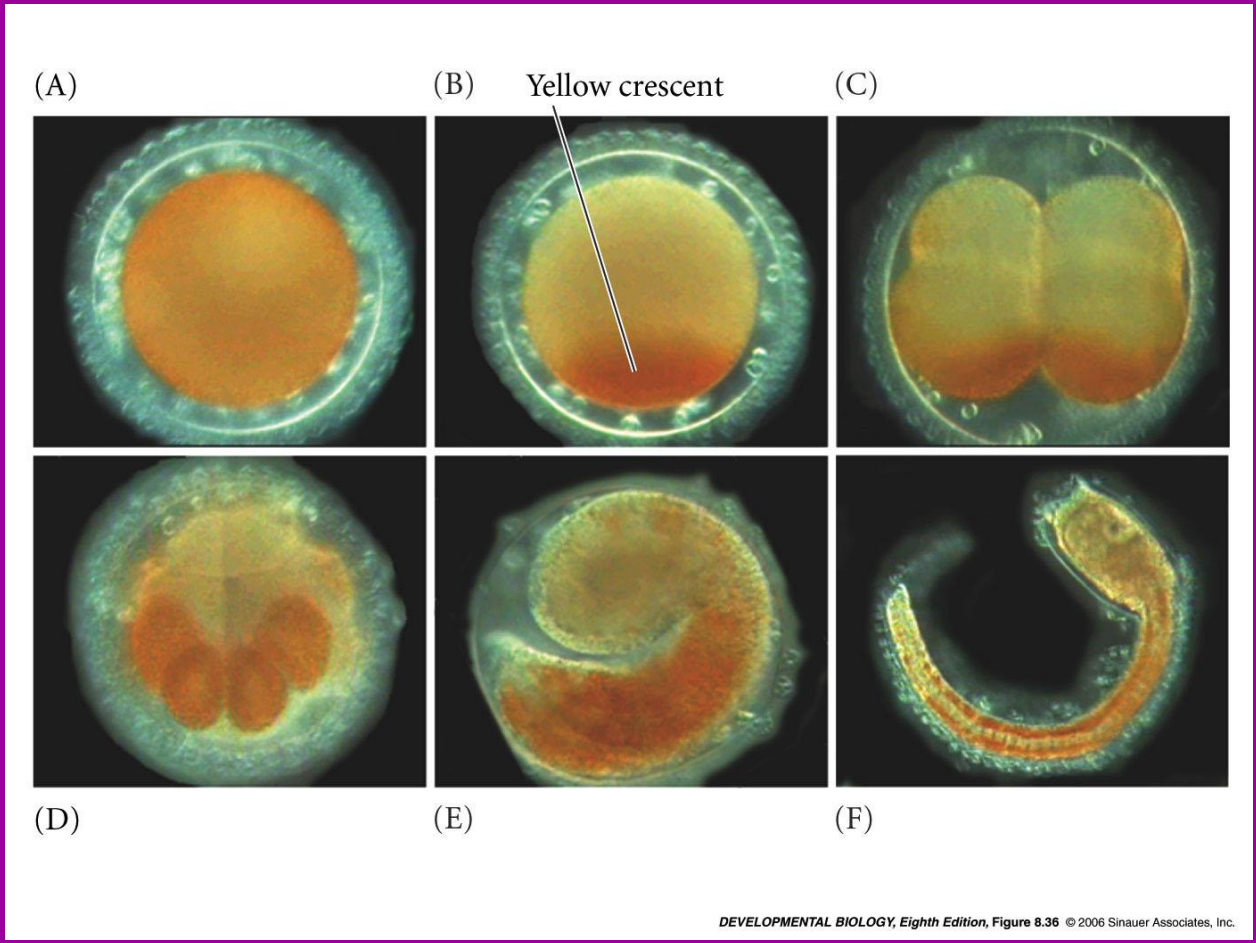


Cytoplasmic Rearrangments in *Styela*



Ascidian Movie

Yellow Crescent



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Corella Movie

When are Axes Formed in *Styela?*

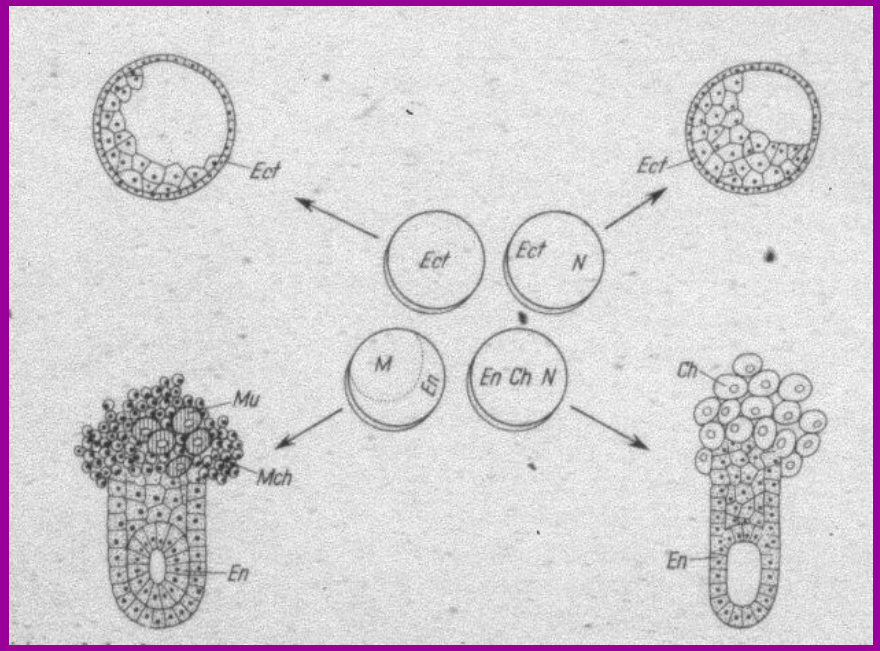
- Bilateral holoblastic cleavage
- First 2 cells define left-right
- Next 2 divisions perpendicular but unequal
- Larger cells are anterior

What Do Colored Regions in *Styela* Tell Us?

- Pigmentation indicates fate map
  - Yellow crescent → muscle, mesenchyme
  - Gray crescent → notochord, endoderm
  - Clear region → ectoderm
  - Yolky region → endoderm
- Isolation experiments show high degree of autonomy, but an induction of brain

What Are the Fates of Isolated Quadrants?

- Separation at 8-Cell Stage
  - upper anter ⟶ ecto
  - upper post ⟶ ecto
  - lower anter ⟶ musc, mesench, endo
  - lower poster ⟶ notochord, endo
  - where is brain and s.c.?

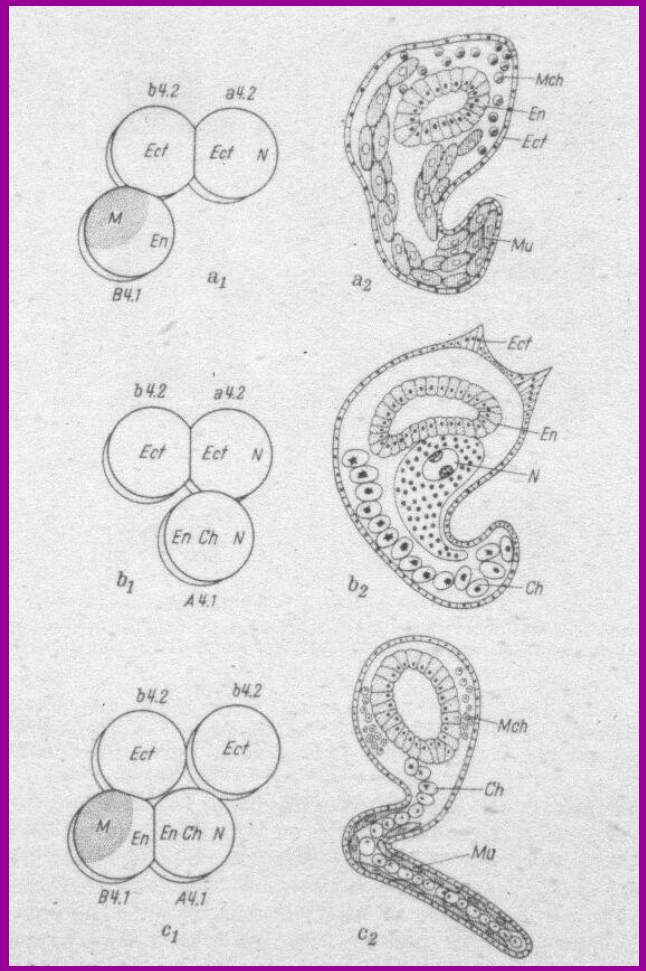


Conclusions to Isolation Experiments

- No cells give more than their normal fate
- Some make less
- No cell communication in isolation, only self-differentiation
- Maybe signals needed for formation of nervous system

What Do We Learn From Recombination Experiments?

- -A4.1: larva lacks notochord, nervous system
  - but A4.1 does not make brain, a4.2 does
- -B4.1: - mesenchyme, - muscle, + brain
- -a4.2: - brain
  - because a4.2 makes brain, not b4.2
- A4.1 induces a4.2 to make brain, need both
  - not all ectoderm competent



What are Characteristics of Tunicate Gastrulation?

- Invagination of endoderm
- Involution of mesoderm
- Epiboly of ectoderm
- Deuterostome