

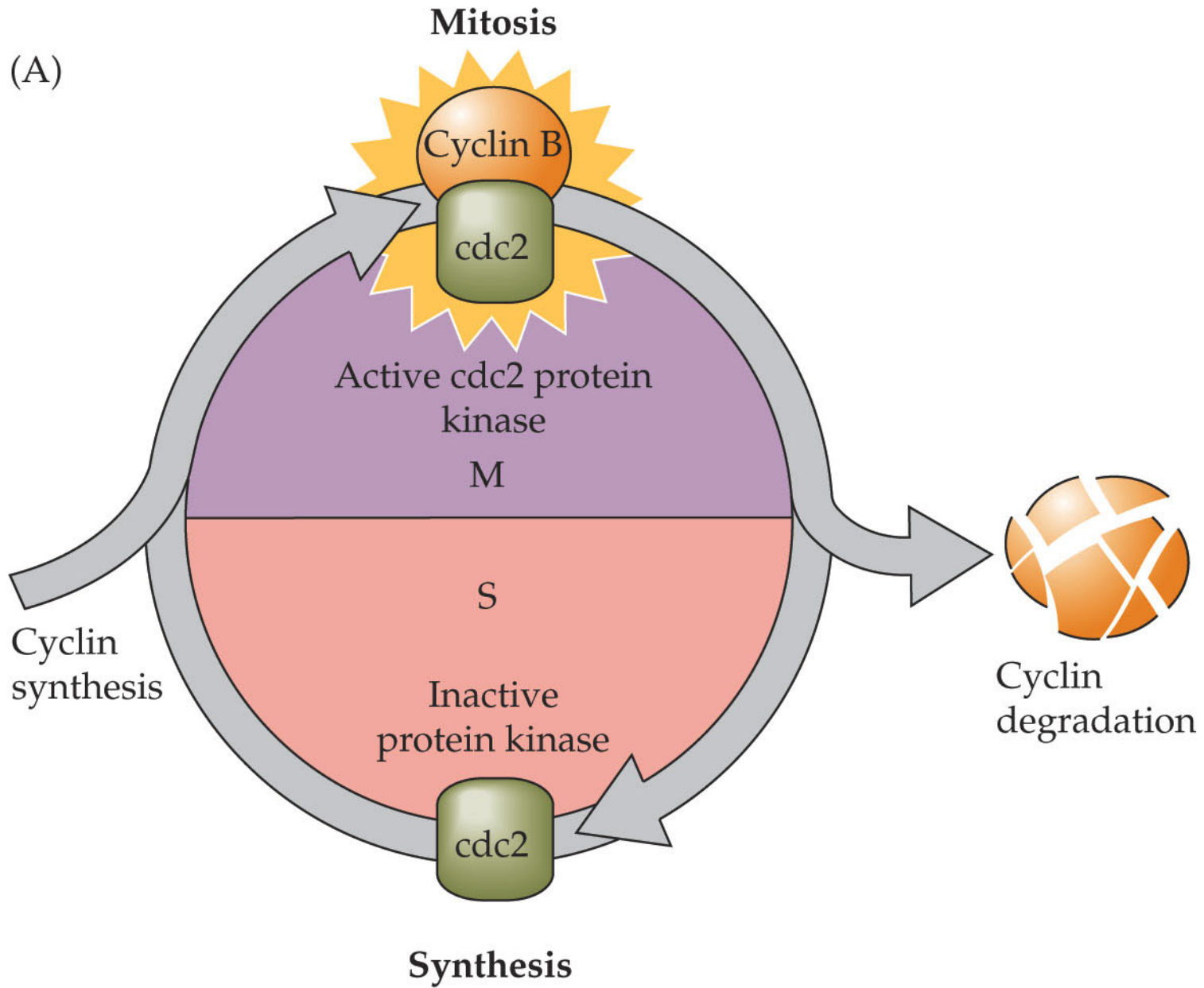
# Cleavage :reading

Ch 11 334- 337, 368-369, Ch 5 p155-161 (10e) (159-165 in 9<sup>th</sup> e)

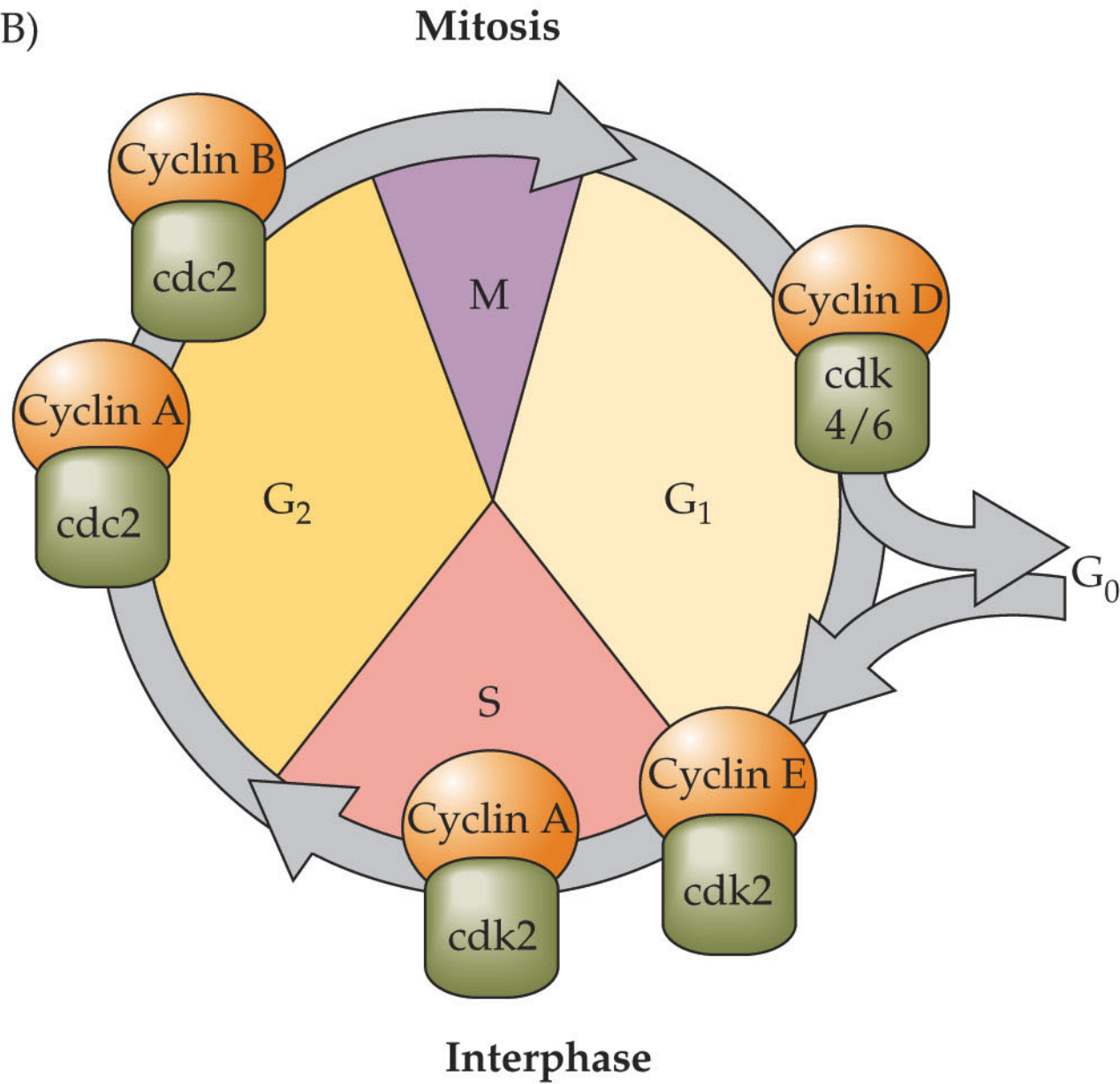
- Ch12 381-382 Ch 8 p286-297 (10e) (287-297 in 9<sup>th</sup>) Bird
- Ch 12 391- 393, Ch8 p298-303 (10e) (300-304 in 9<sup>th</sup>)  
Mammals
- Gastrulation: Birds and mammals Ch 12 in 11e, Ch 9 in 10e, Ch 8 in 9e.

# Mitosis promoting factor

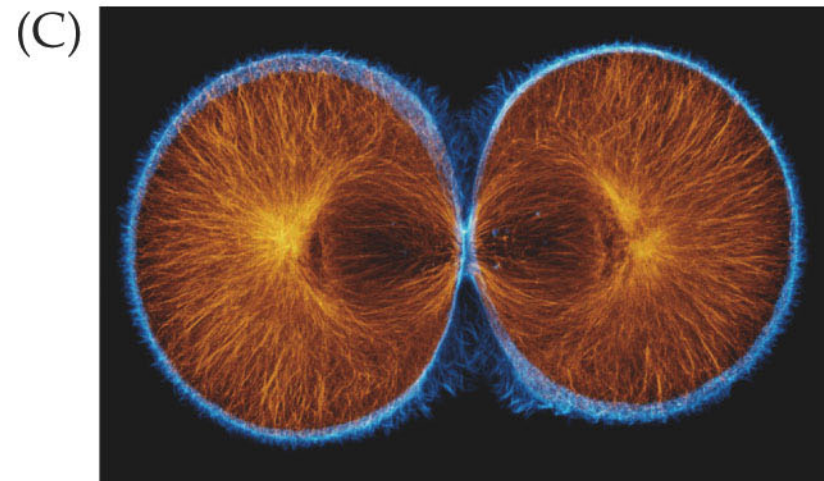
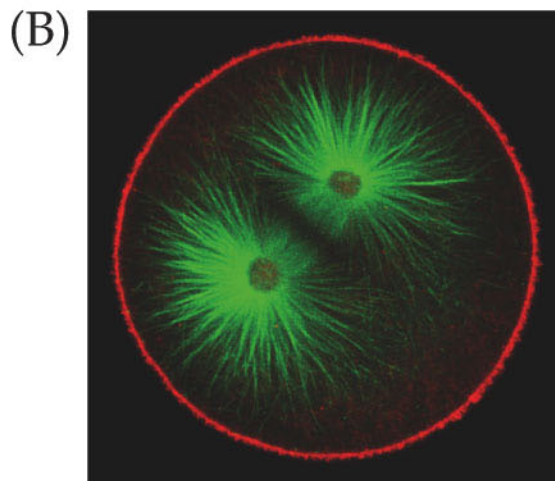
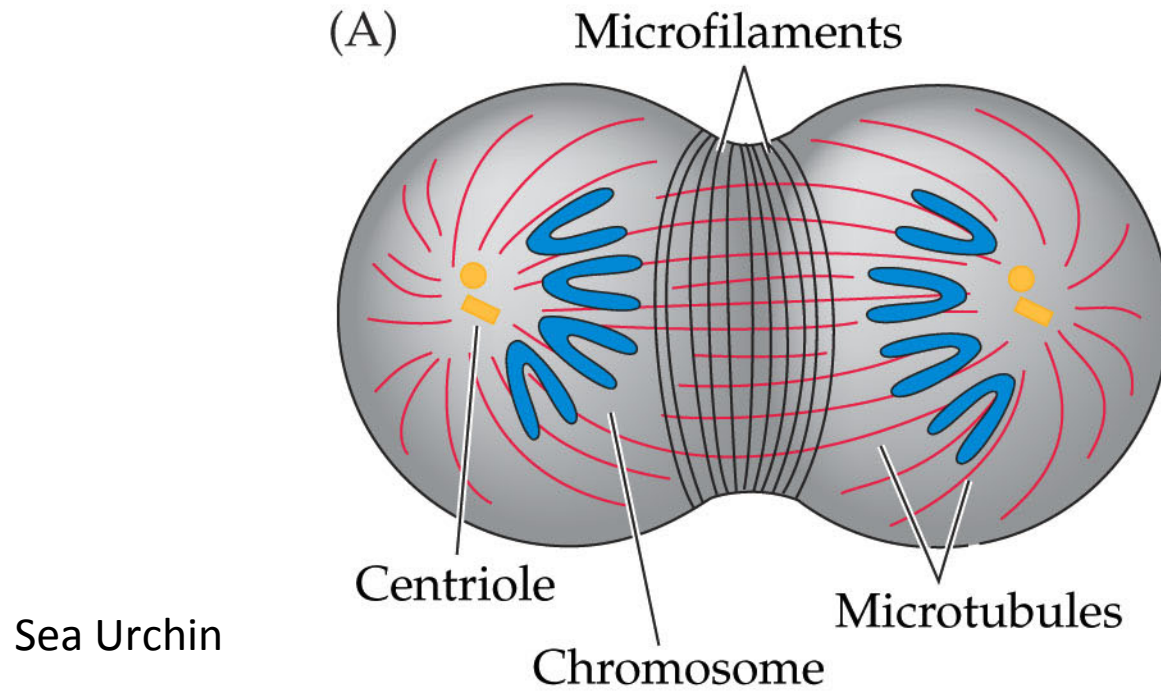
- Cyclin B cdc2
- General principles of the eucaryotic cell cycle



(B)



## 8.2 ROLE OF MICROTUBULES AND MICROFILAMENTS IN CELL DIVISION



Microfil: green actin: red anaphase 1<sup>st</sup> cleav. Microtubules: orange Actin: blue end of 1<sup>st</sup> cleavage

# Cleavage

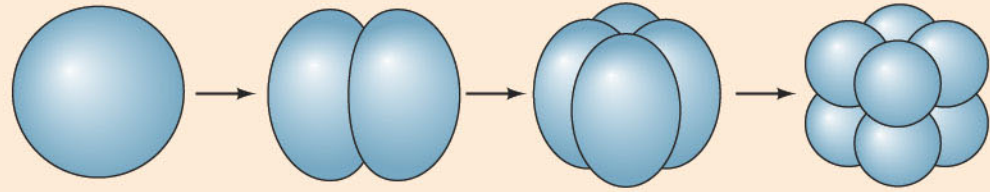
Superficial cleavage (meroblastic) eg fish

Rotational cleavage (holoblastic) eg mammals

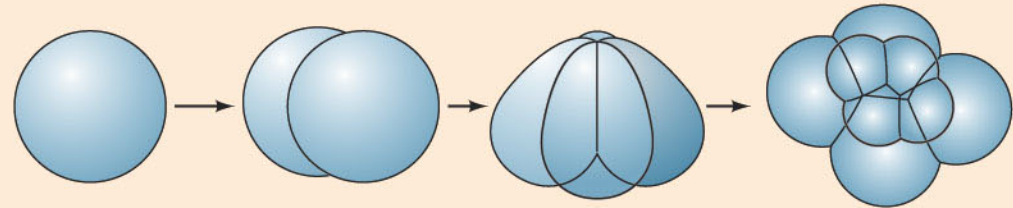
## I. HOLOBLASTIC CLEAVAGE

### A. Isolecithal

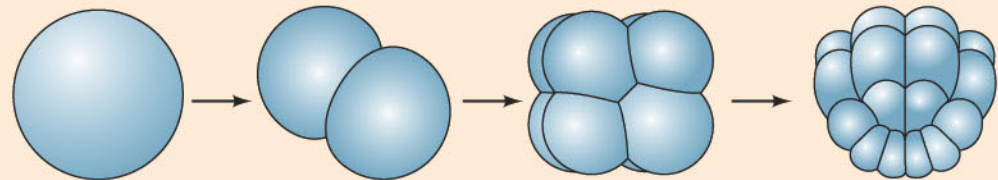
1. Radial cleavage  
Echinoderms,  
amphioxus



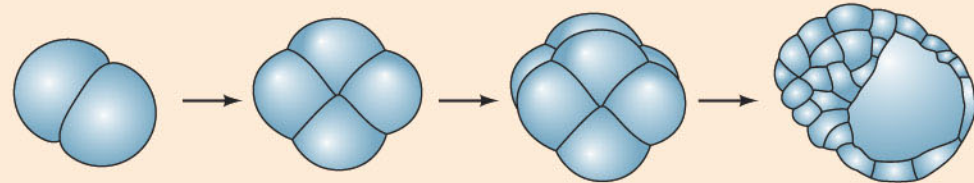
2. Spiral cleavage  
Annelids, molluscs,  
flatworms



3. Bilateral cleavage  
Tunicates

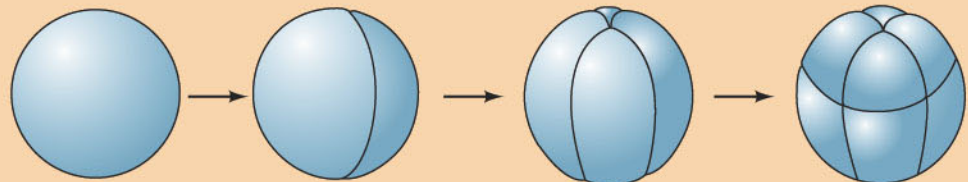


4. Rotational cleavage  
Mammals, nematodes



### B. Mesolecithal

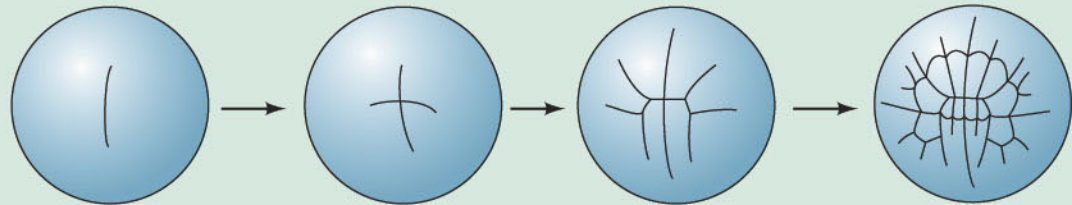
- Displaced radial cleavage  
Amphibians



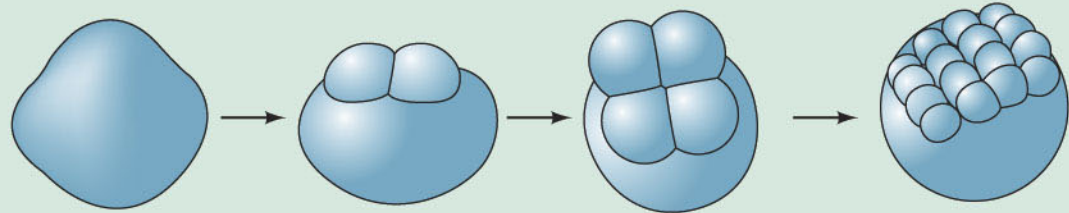
## II. MEROBLASTIC CLEAVAGE

### A. Telolecithal

1. Bilateral cleavage  
Cephalopod molluscs

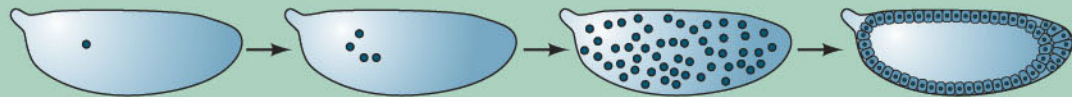


2. Discoidal cleavage  
Fish, reptiles, birds



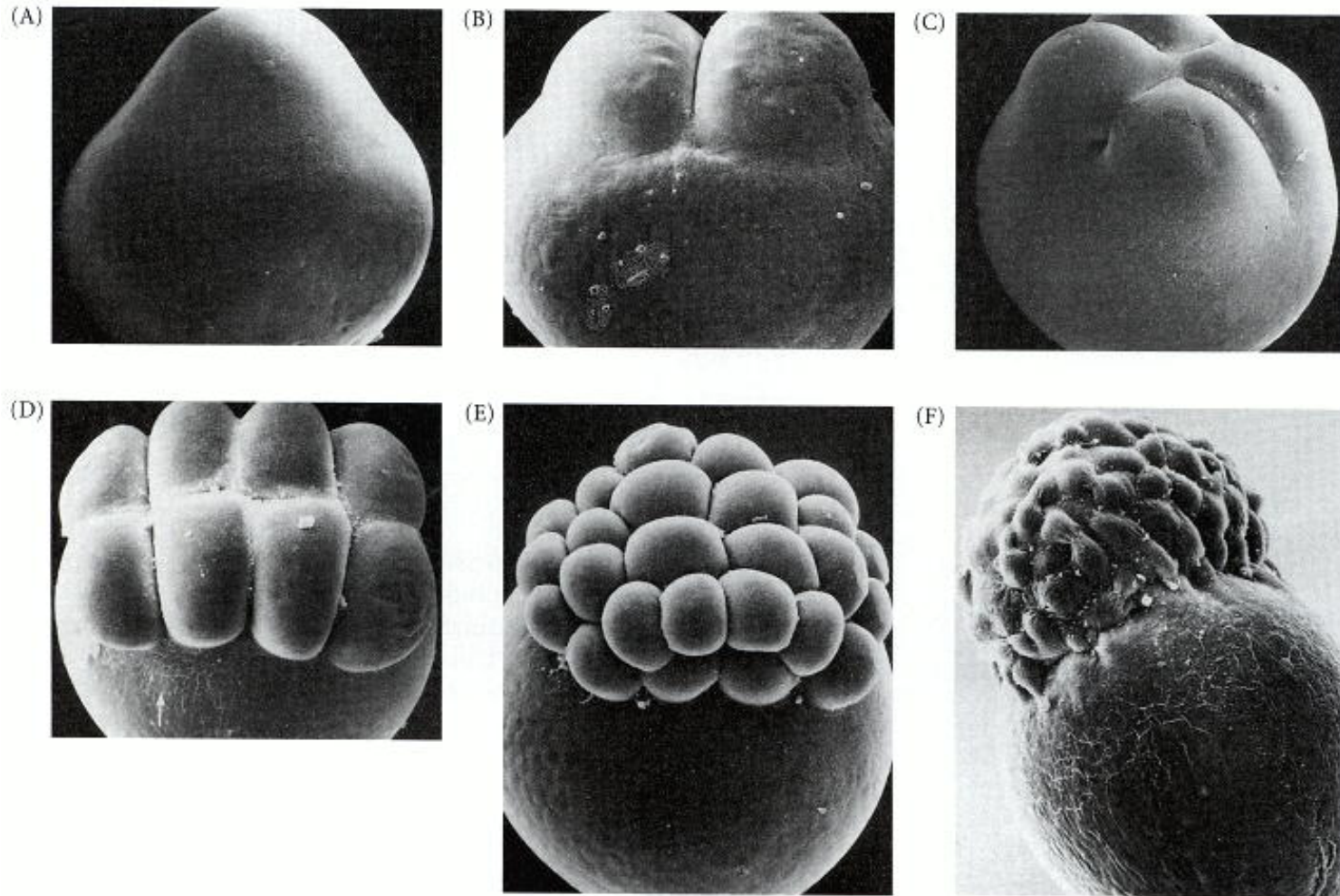
### B. Centrolecithal

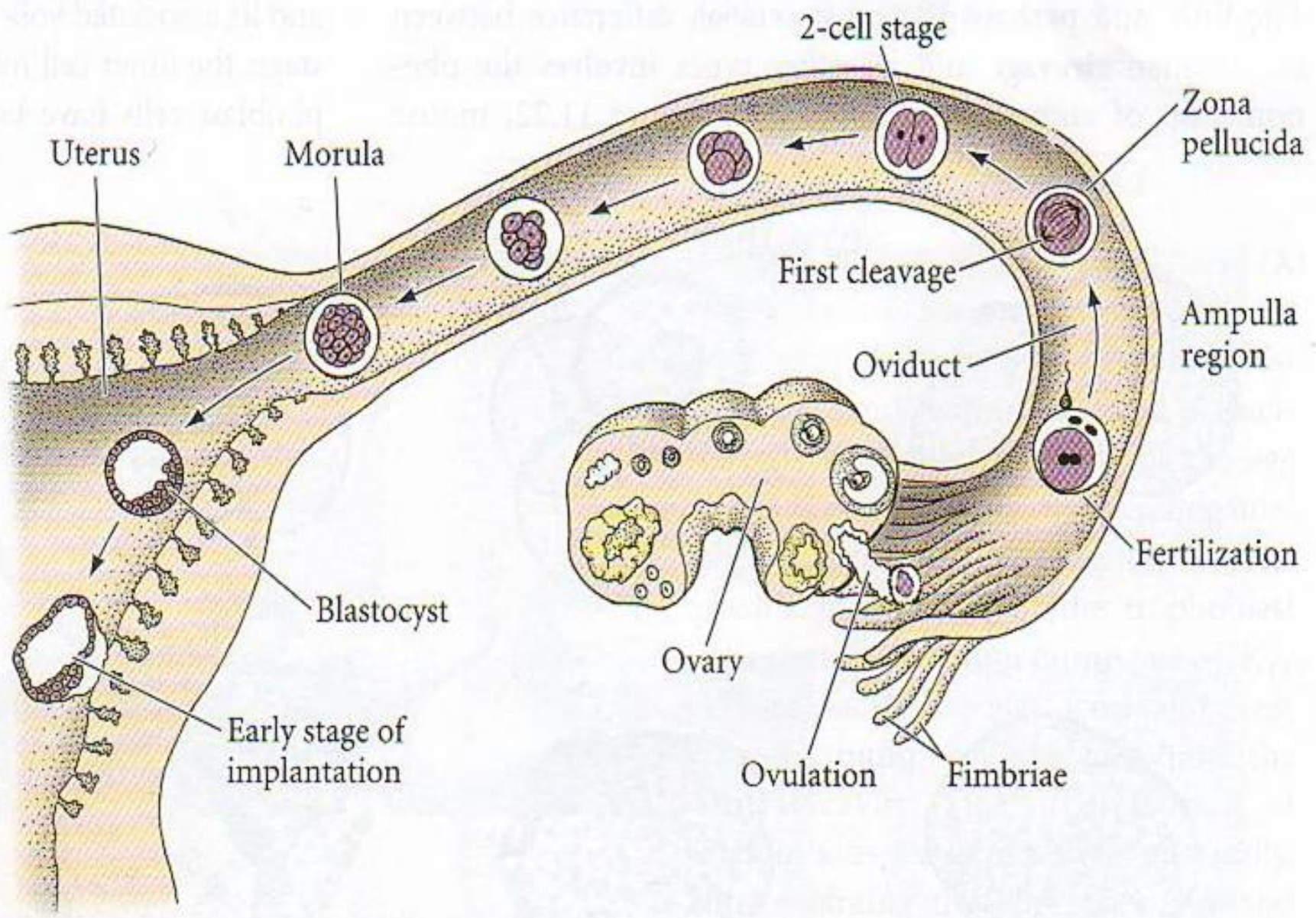
- Superficial cleavage  
Most insects



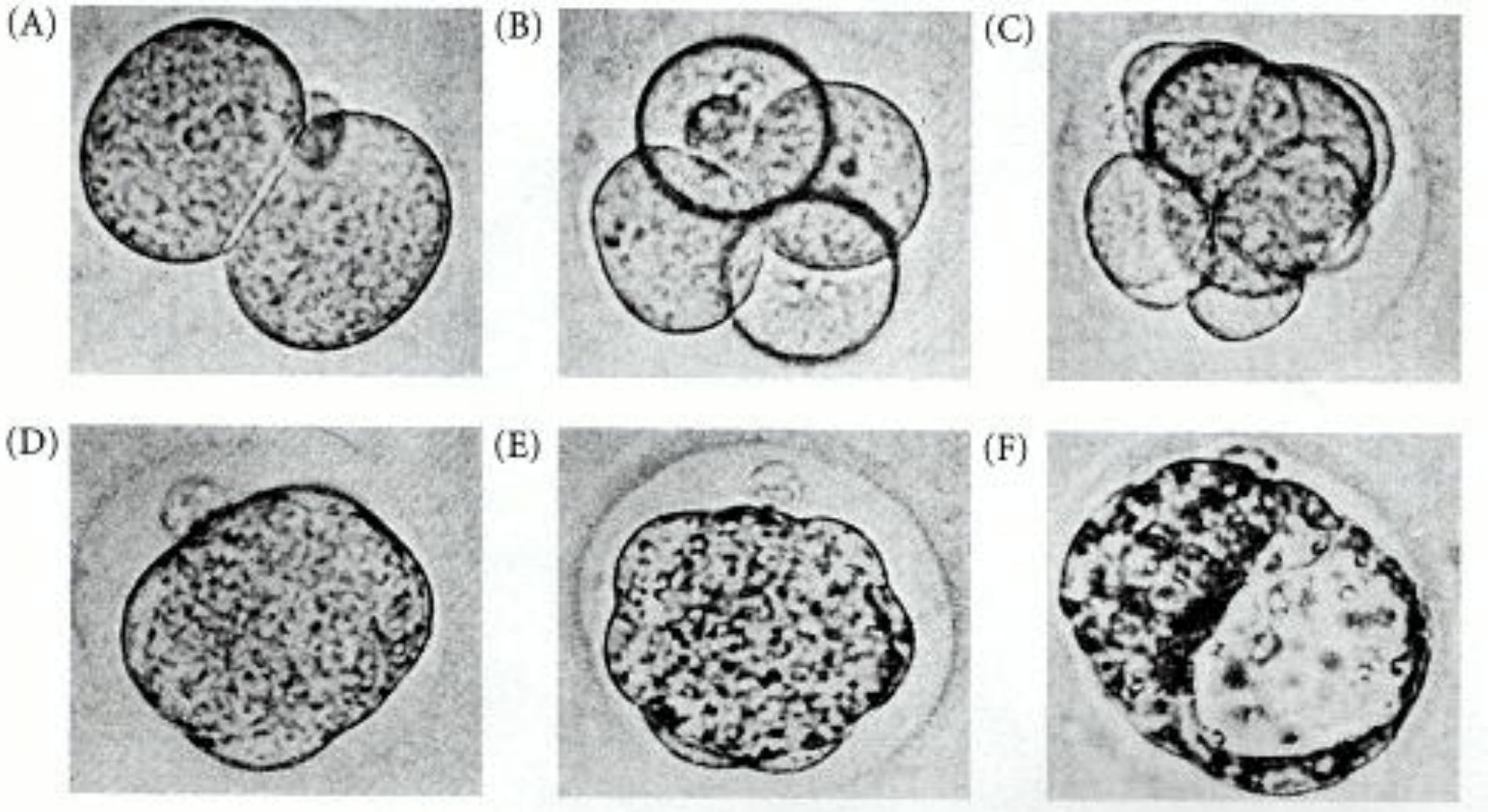


# Example of discoidal meroblastic cleavage in fish

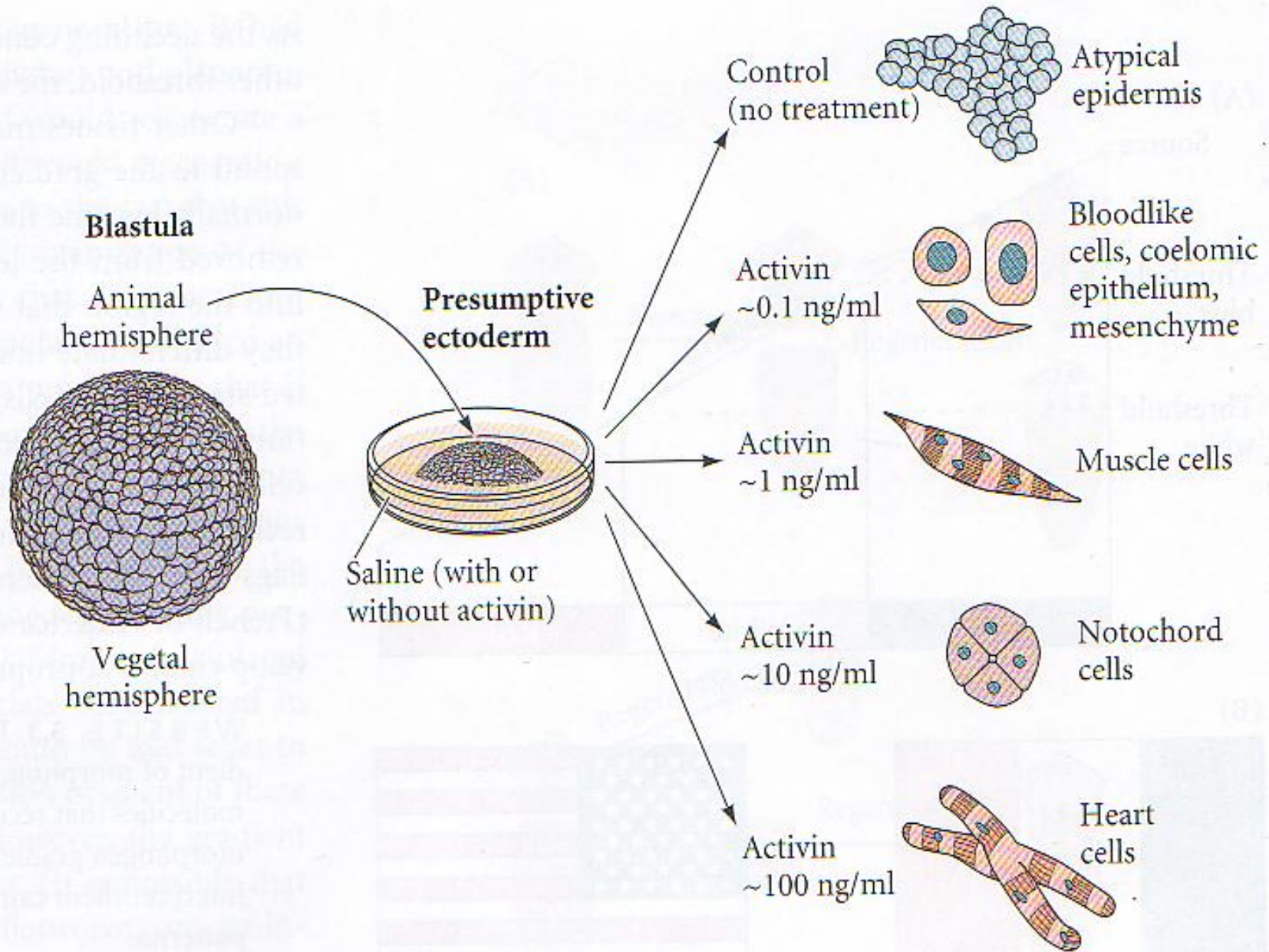




The cleavage of a single mouse embryo in vitro. (A) 2-cell stage. (B) 4-cell stage. (C) Early 8-cell stage. (D) Compacted 8-cell stage. (E) Morula. (F) Blastocyst.



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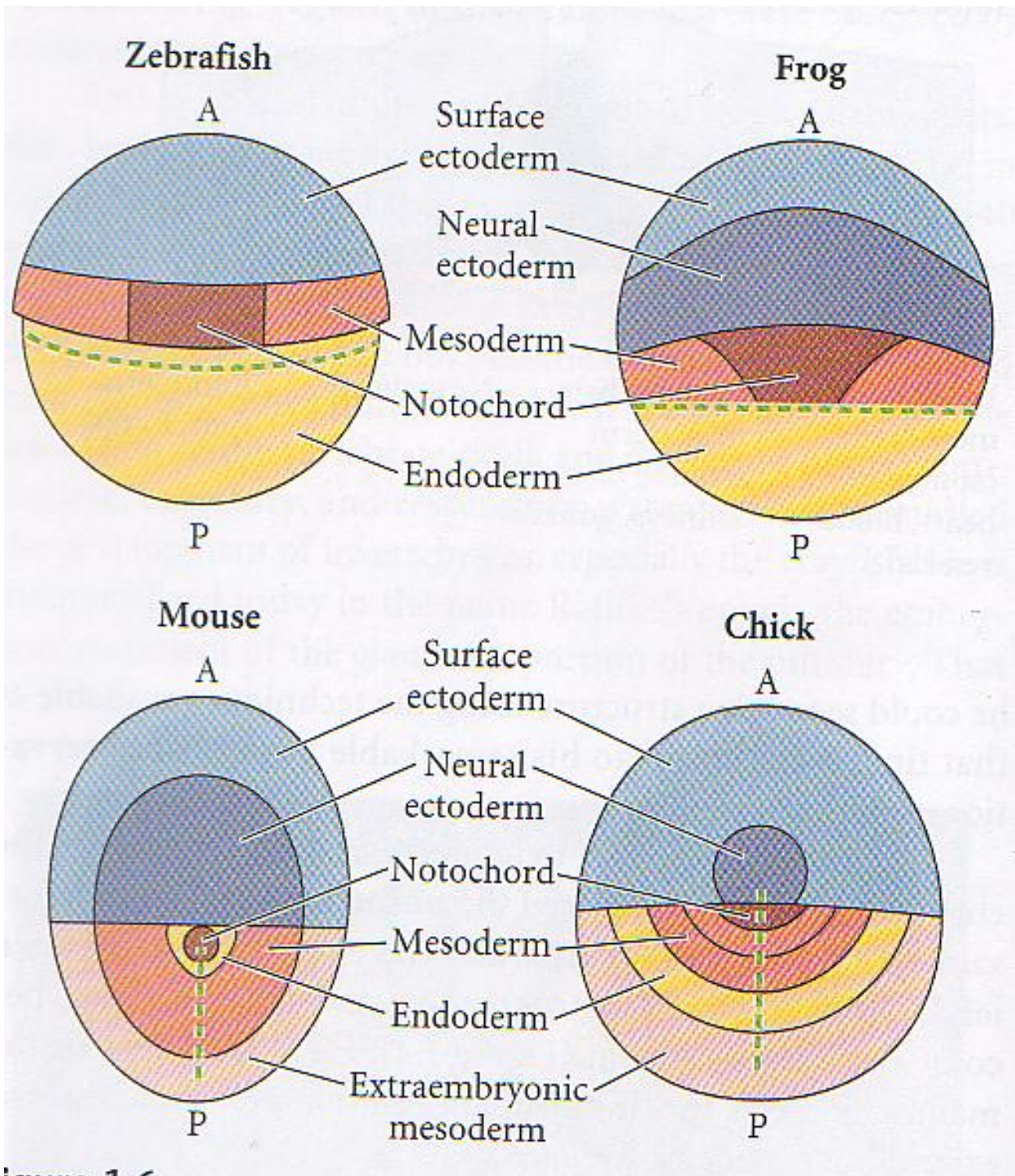


# Gastrulation

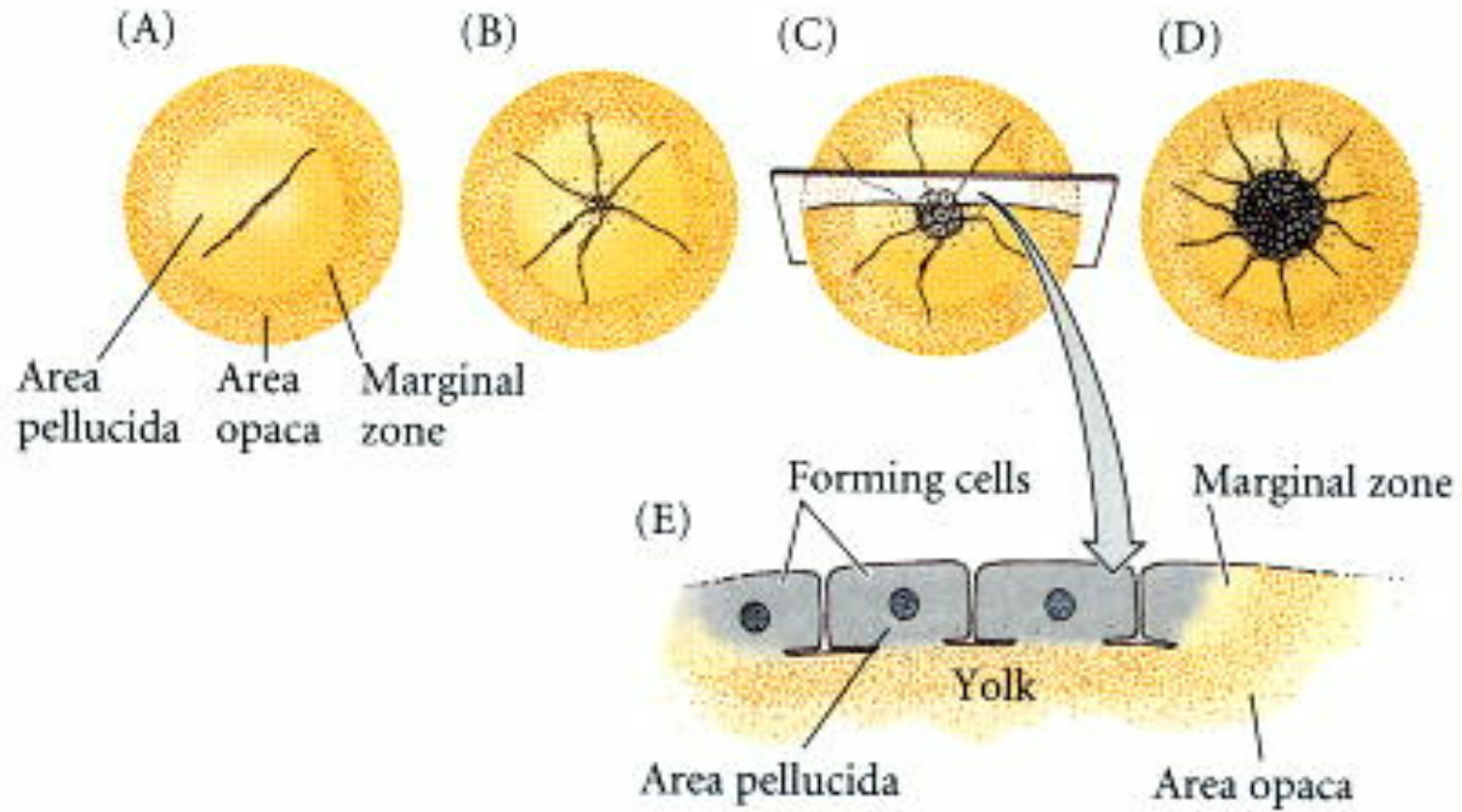
- "the most important time of your life"
- laying down the primary body plan

# Origins of differentiated cell types

- Ectoderm: Outer surface eg. skin cells of epidermis, CNS –neurons of brain, Neural crest
- Mesoderm: Notochord, Heart and Skeletal muscle, Tubules of kidney, RBC, Facial muscle
- Endoderm: digestive tube, pharynx, respiratory tubes (alveolar cells)
- Germ cells Male sperm/female egg

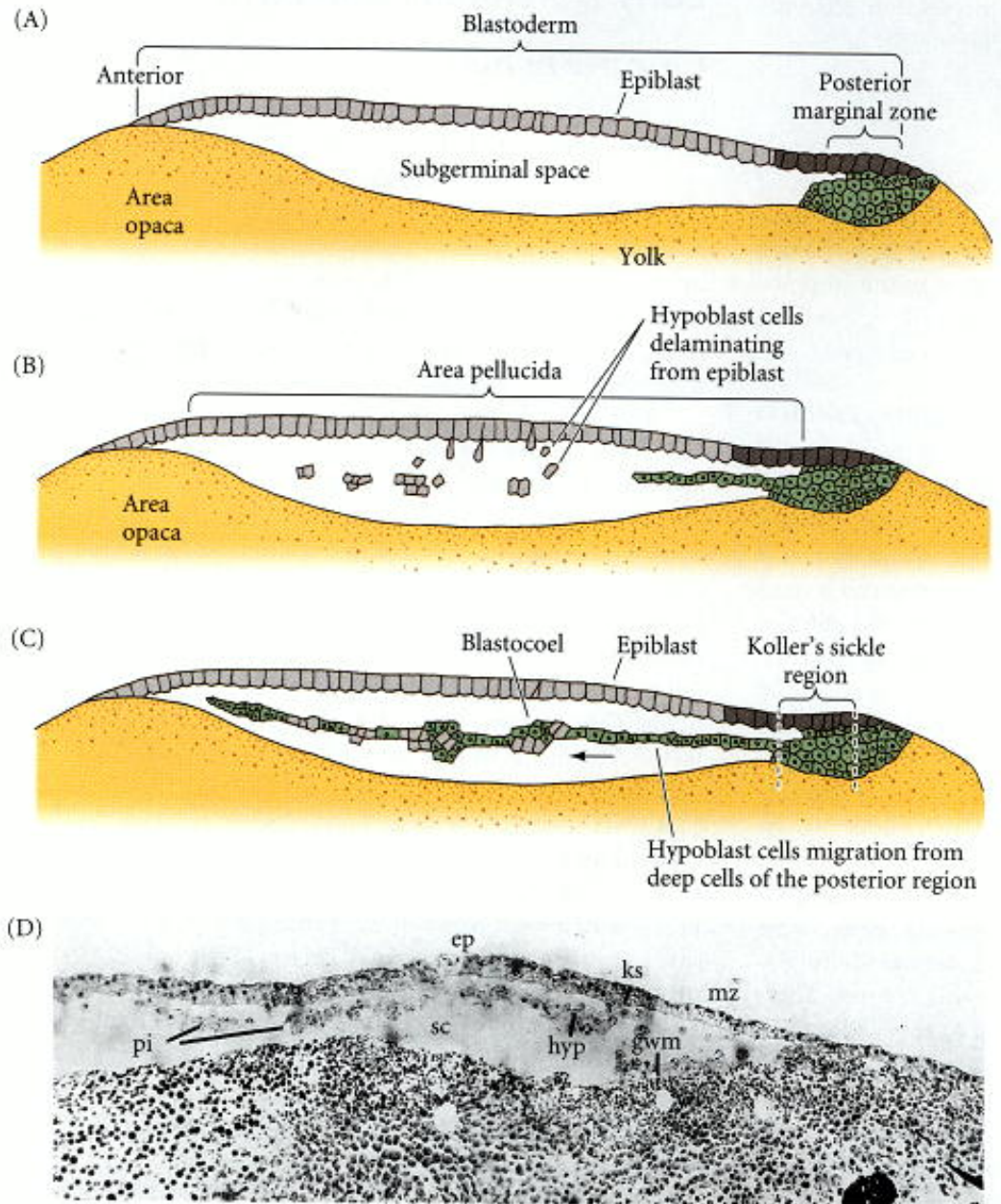


# Chick discoidal cleavage





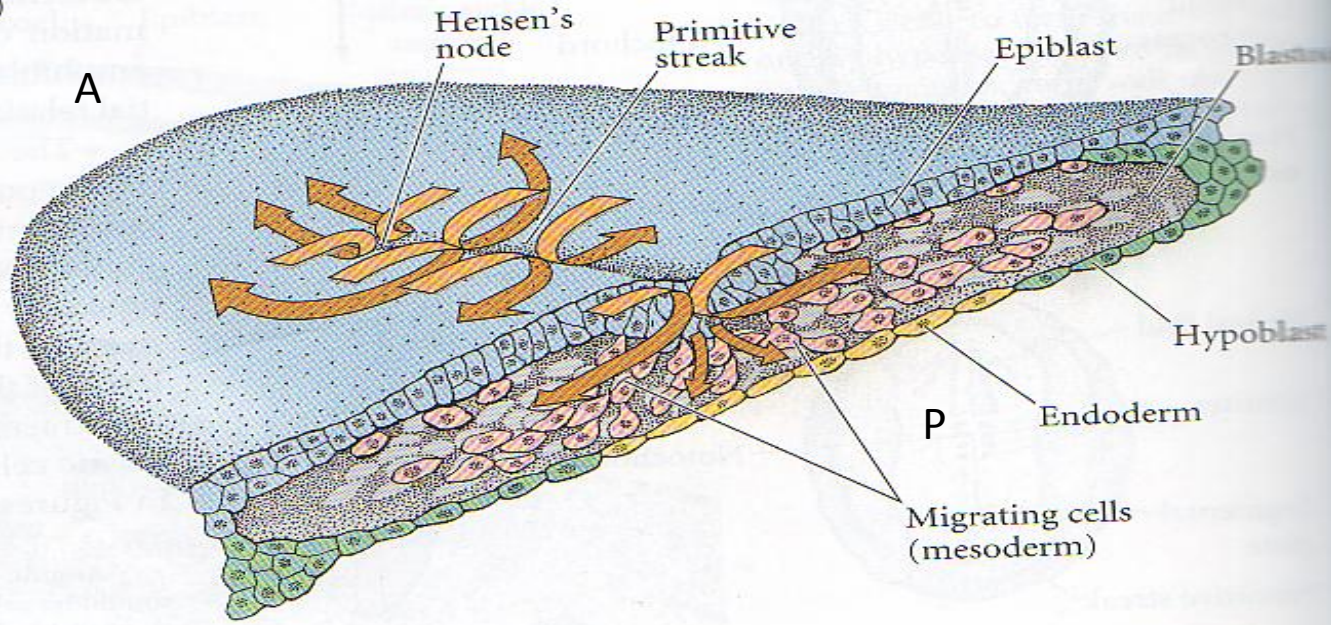
# Two layers of blastoderm in the chick

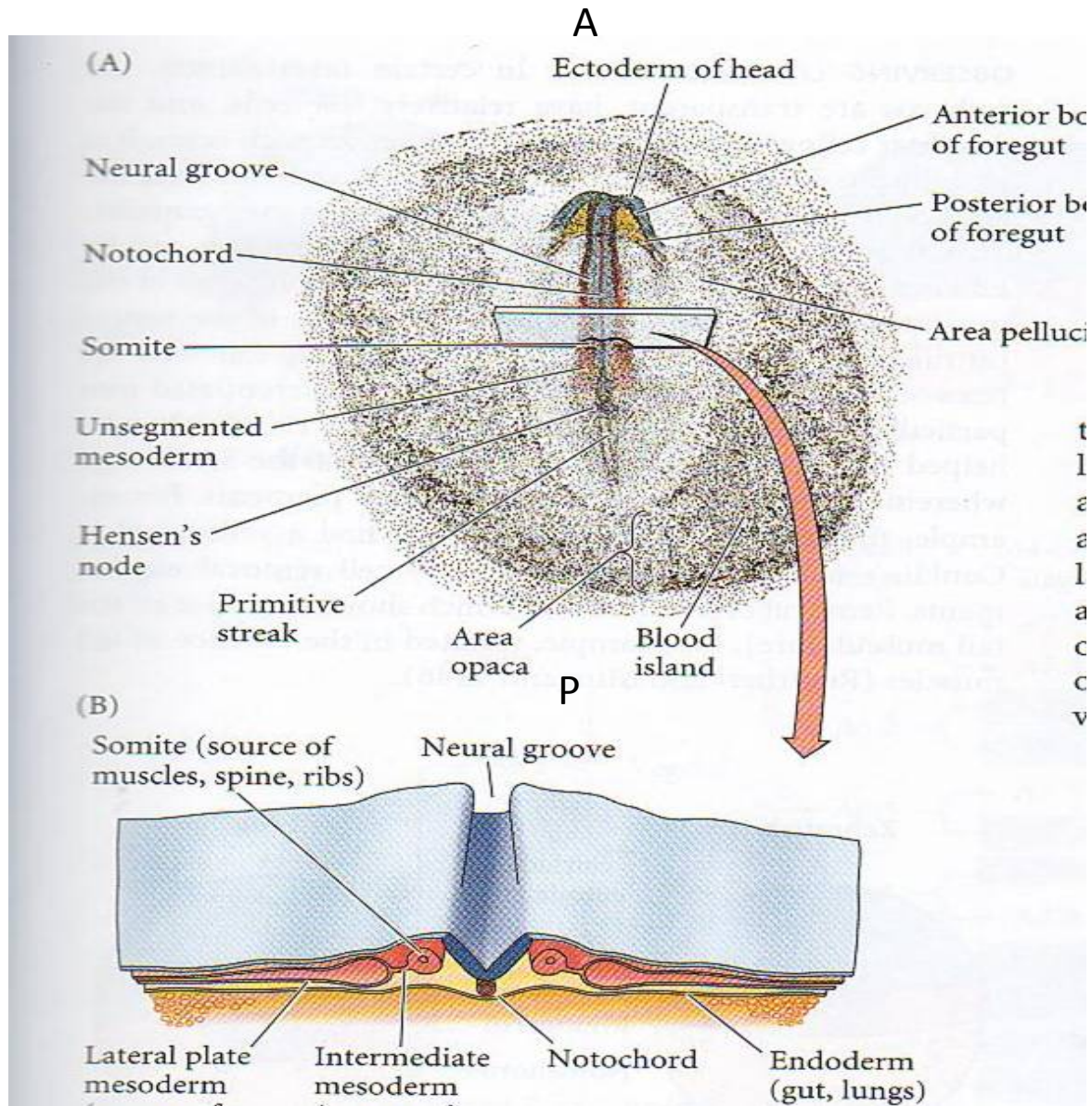


(A)



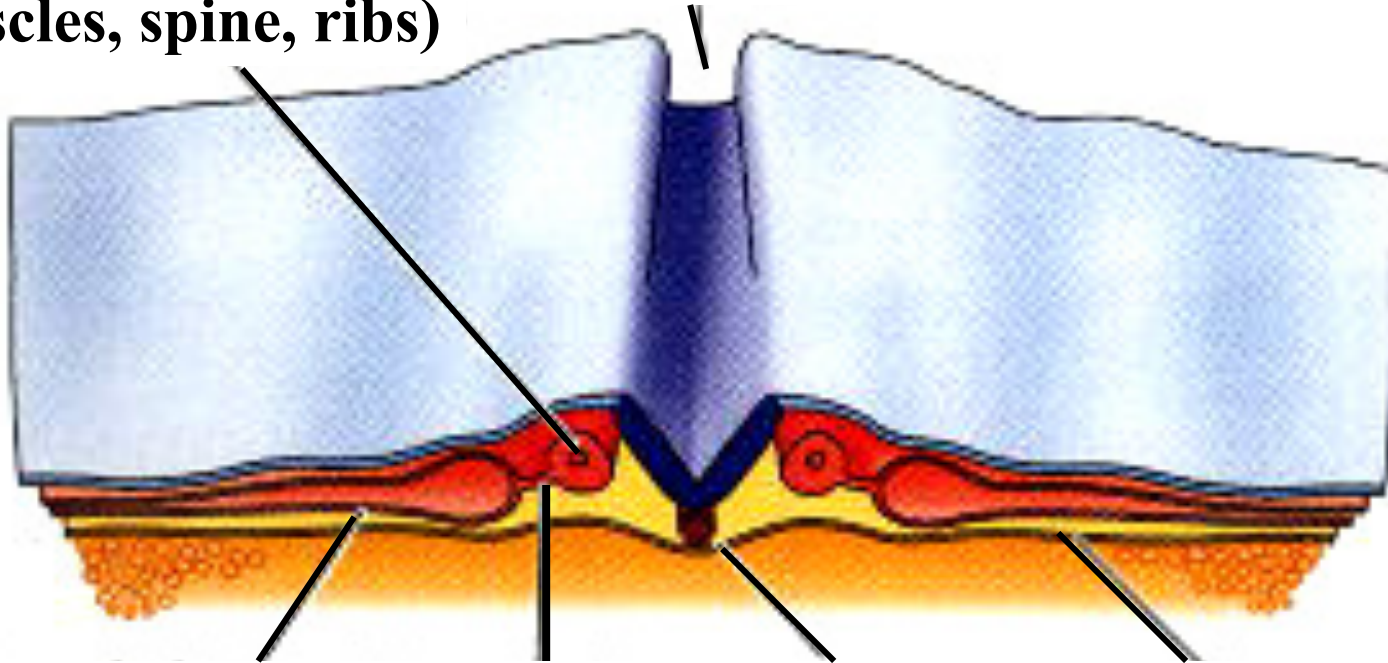
(B)





**Somite (source of muscles, spine, ribs)**

**Neural groove**



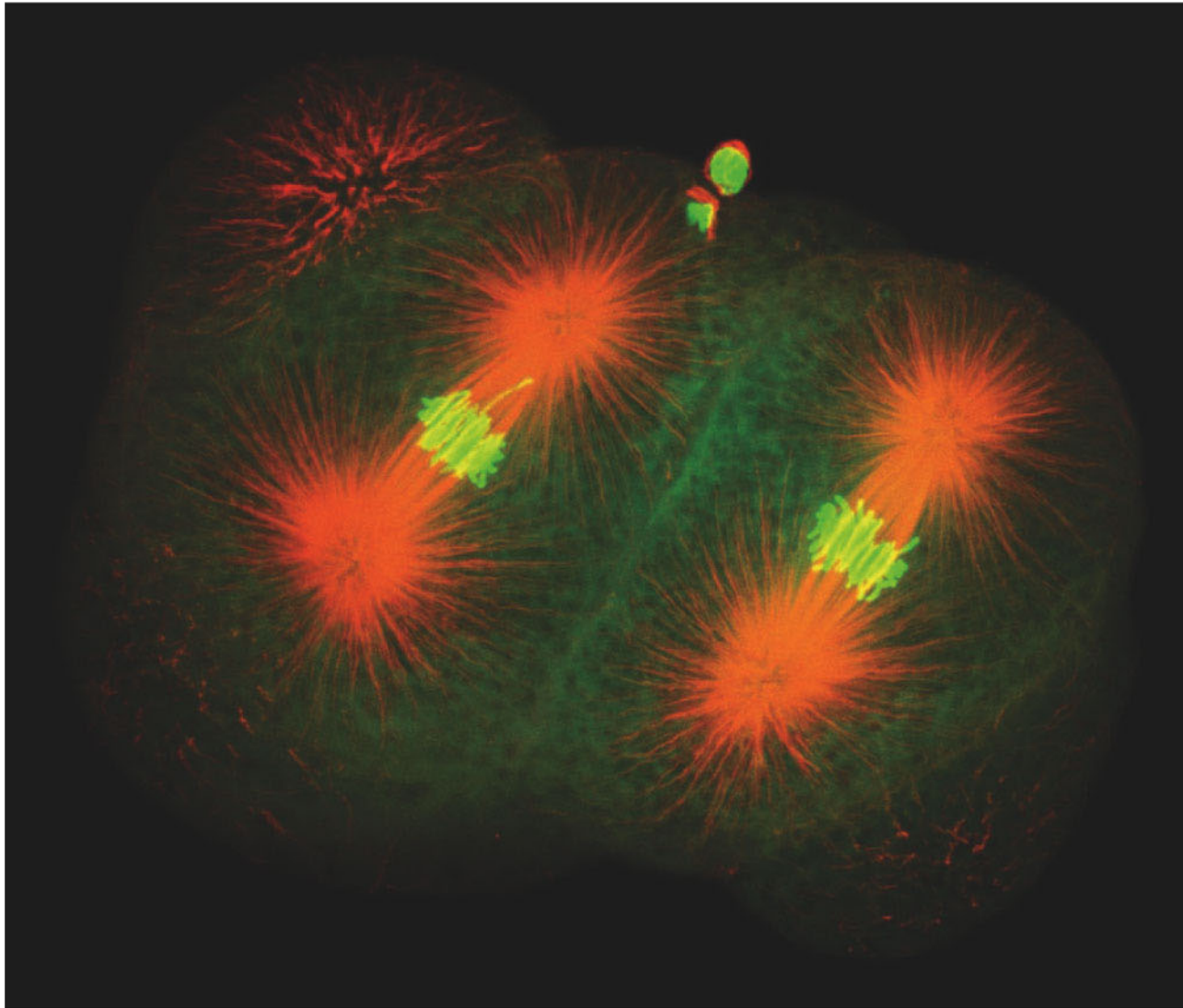
**Lateral plate mesoderm (source of heart, blood vessels)**

**Intermediate mesoderm (source of kidneys, gonads)**

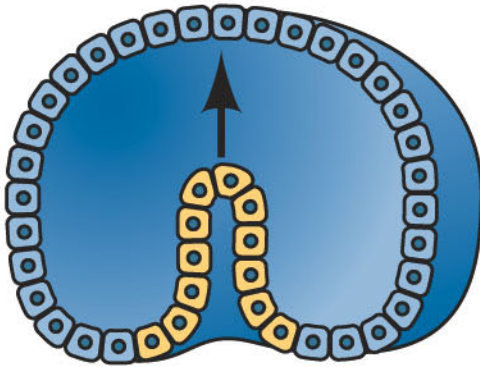
**Notochord**

**Endoderm (gut, lungs)**

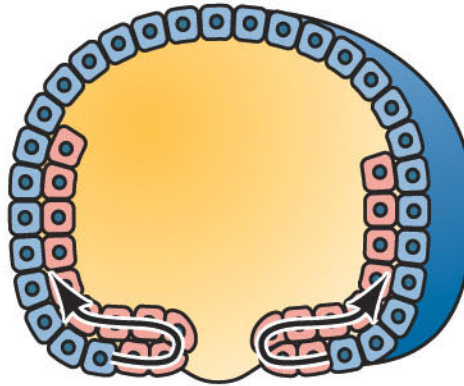
(A)



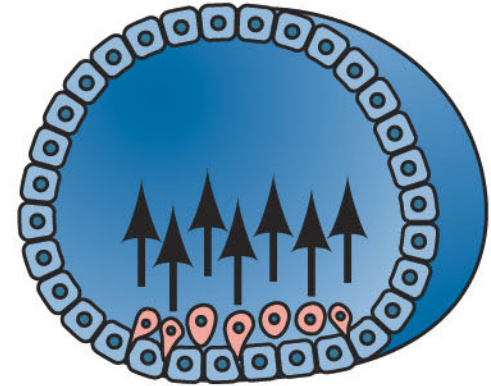
Invagination



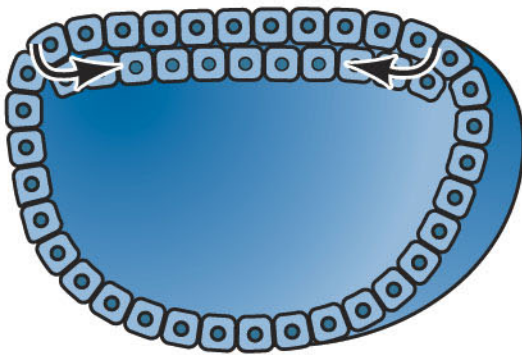
Involution



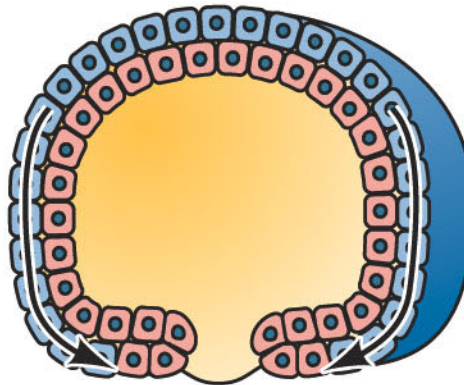
Ingression



Delamination



Epiboly



## 8.5 Axes of a bilaterally symmetrical animal

