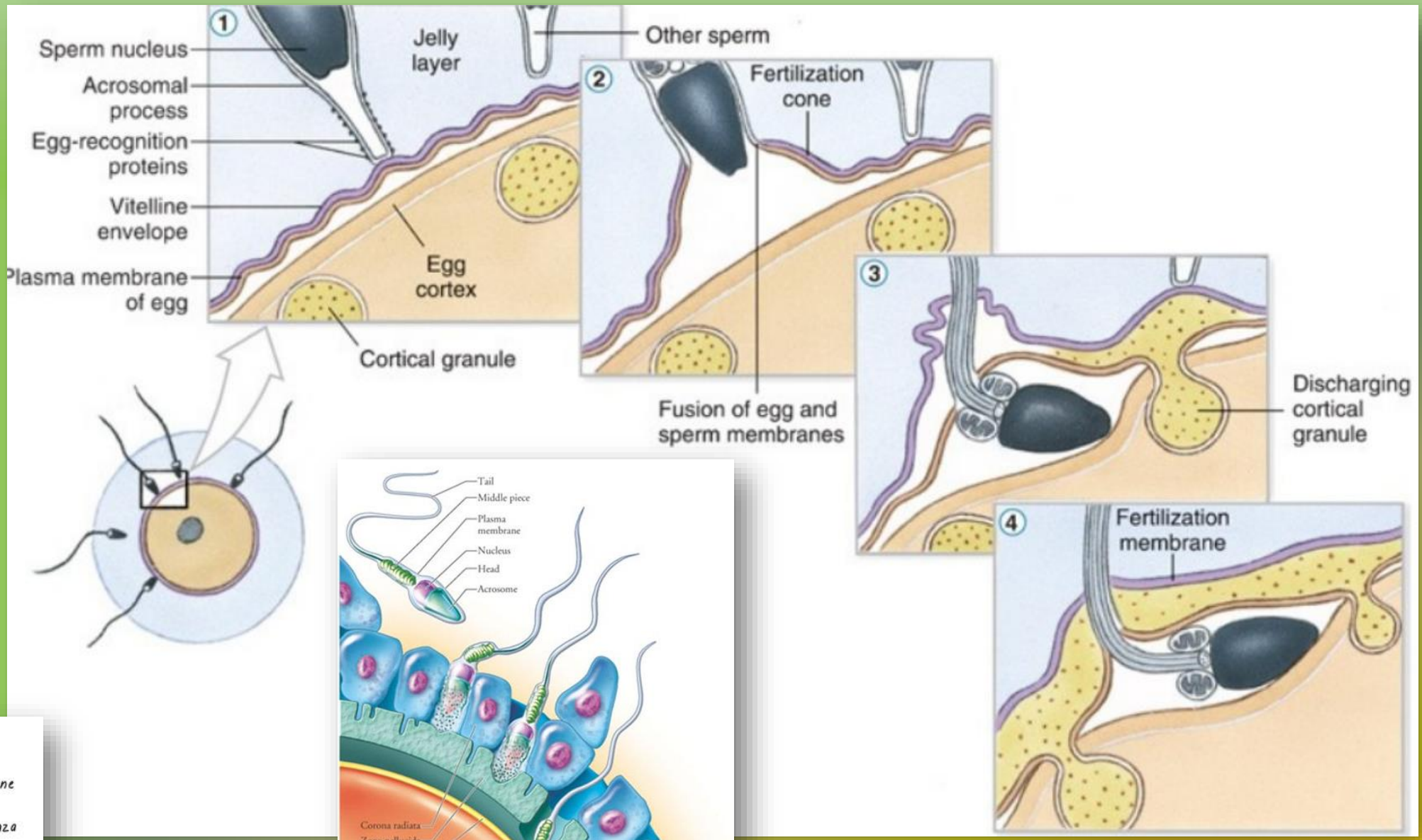
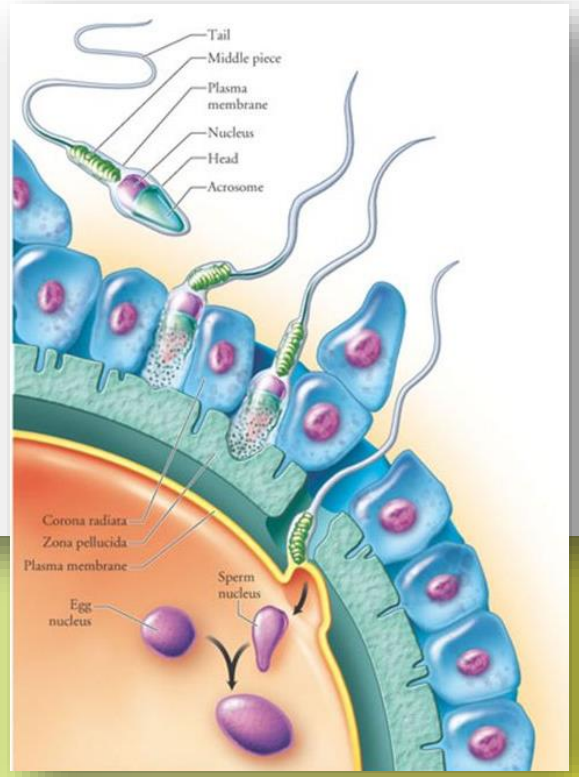
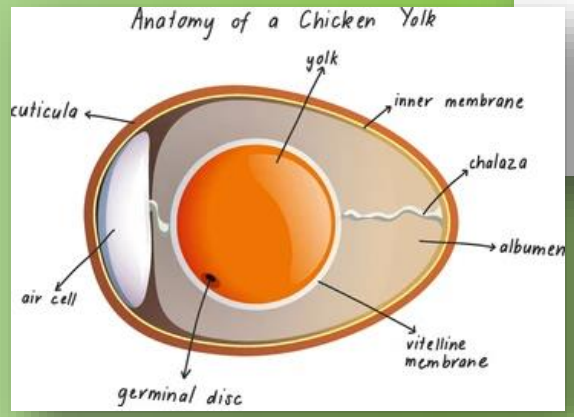
Embryology Primer

ONE

1 .Fertilization
2. Oocyte maturation
3. Germinal vescicle
4. Polyspermy prevention
5. Fast block
6. Slow block
7. Vitelline envelope
8. [Ca++]

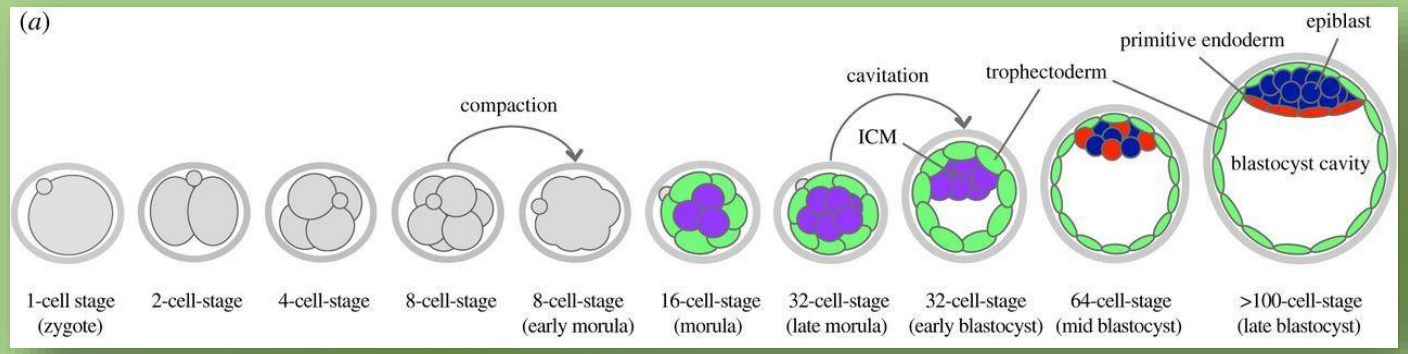

1
Sperm nucleus
Acrosomal process
Egg-recognition proteins
Vitelline envelope
Plasma membrane of egg
Jelly layer
Other sperm
Egg cortex
Cortical granule
2
Fertilization cone
Fusion of egg and sperm membranes
3
Discharging cortical granule
4
Fertilization membrane


Tail
Middle piece
Plasma membrane
Nucleus
Head
Acrosome
Corona radiata
Zona pellucida
Plasma membrane
Egg nucleus
Sperm nucleus

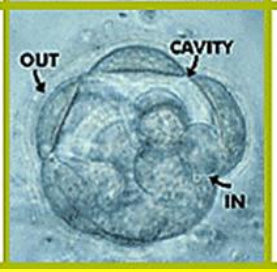

Anatomy of a Chicken Yolk
yolk
cuticula
inner membrane
chalaza
albumen
air cell
vitelline membrane
germinal disc

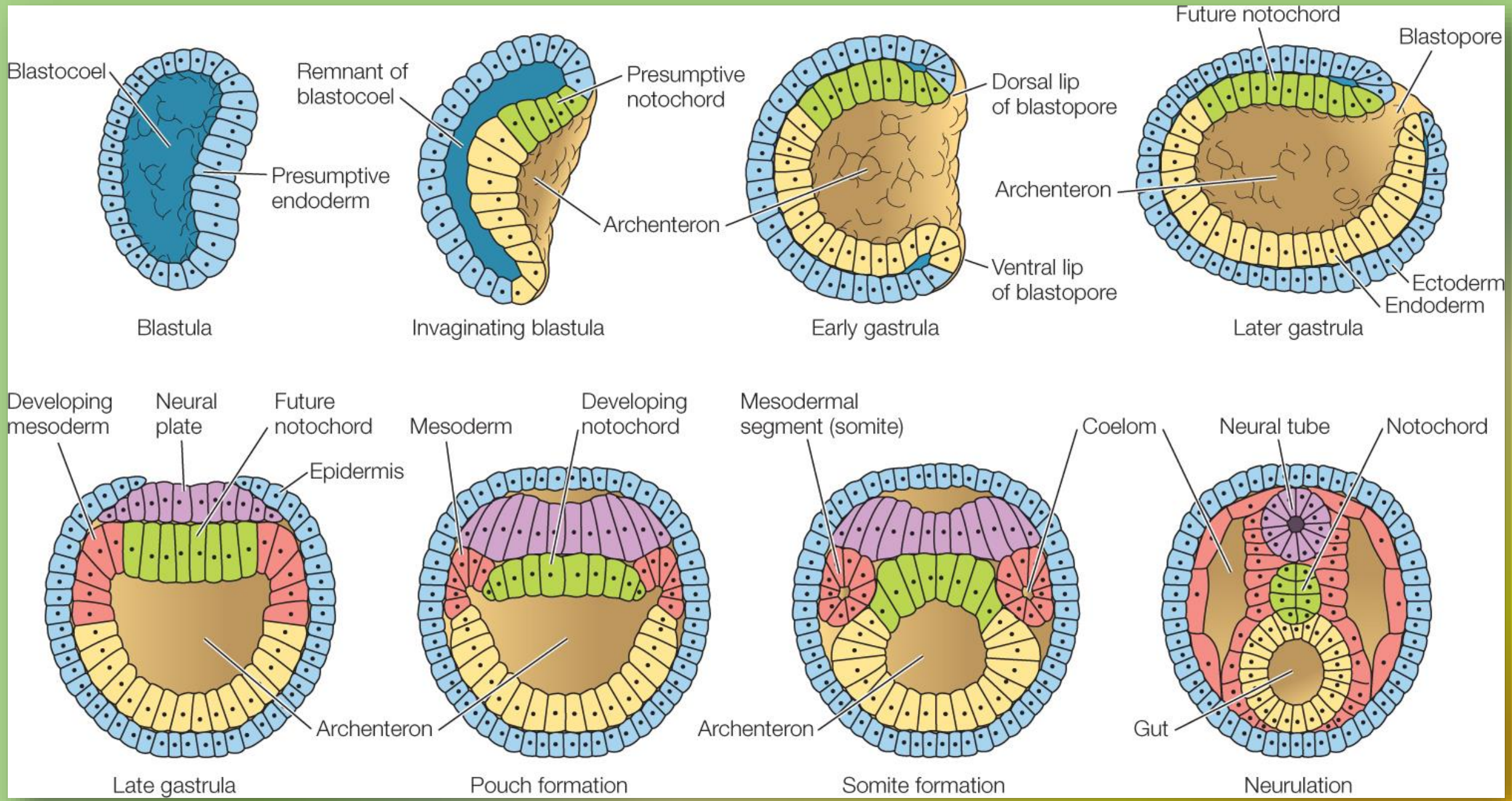
TWO

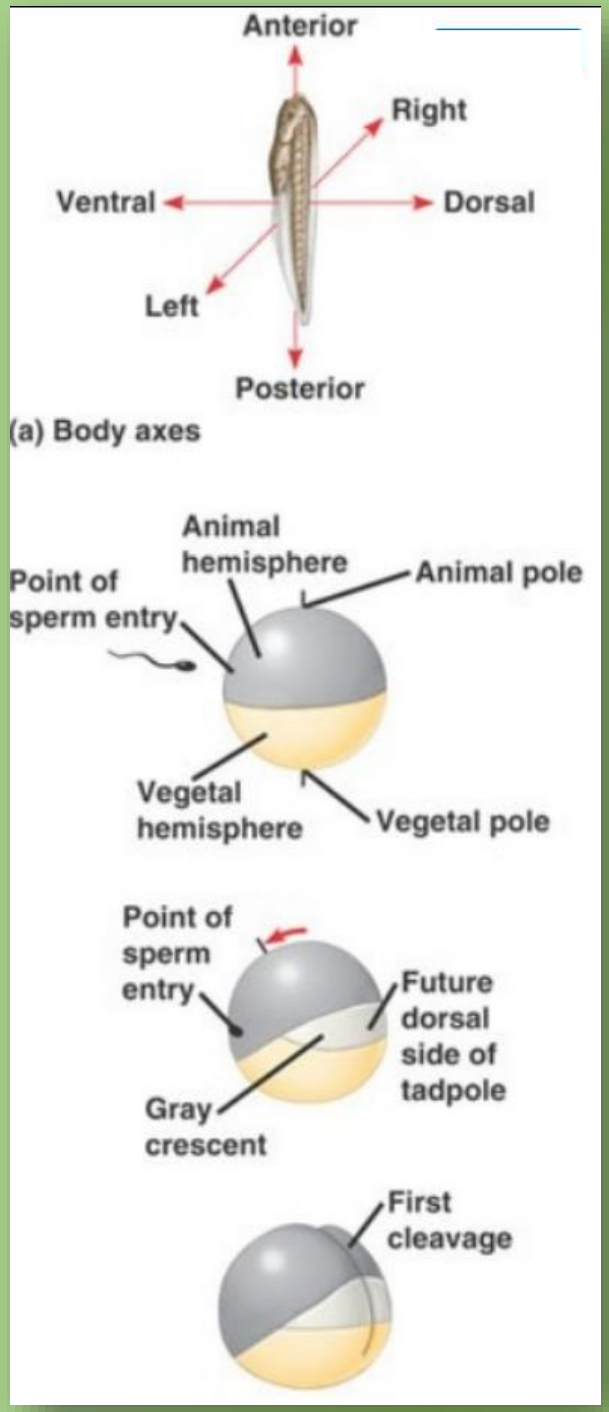
1. Cleavage stages
2. Body axes
3. Dorsal aspect
4. Yolk (amt/position)
5. Polarity (animal/vegetative)
6. Direct v. indirect devel.
7. Archenteron
8. Germ layers
9. Primitive streak

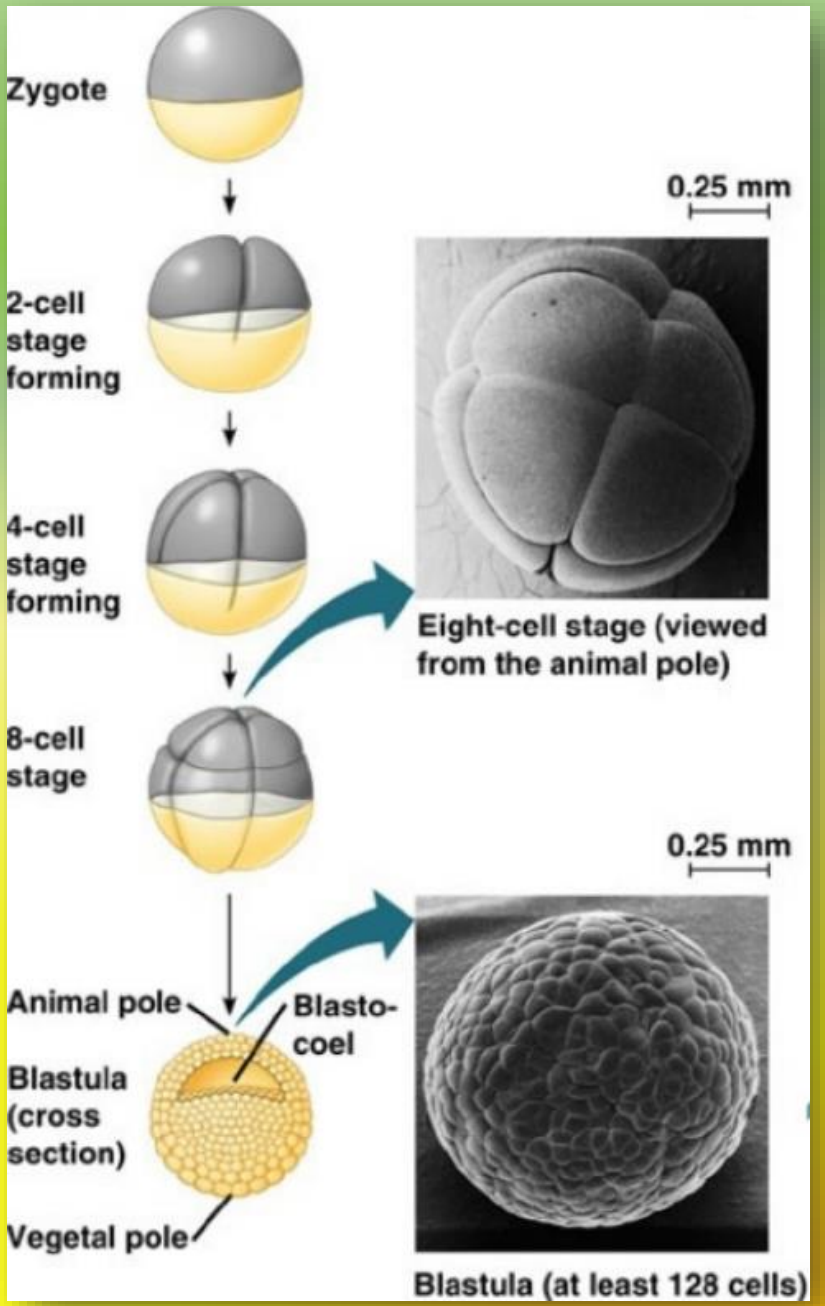


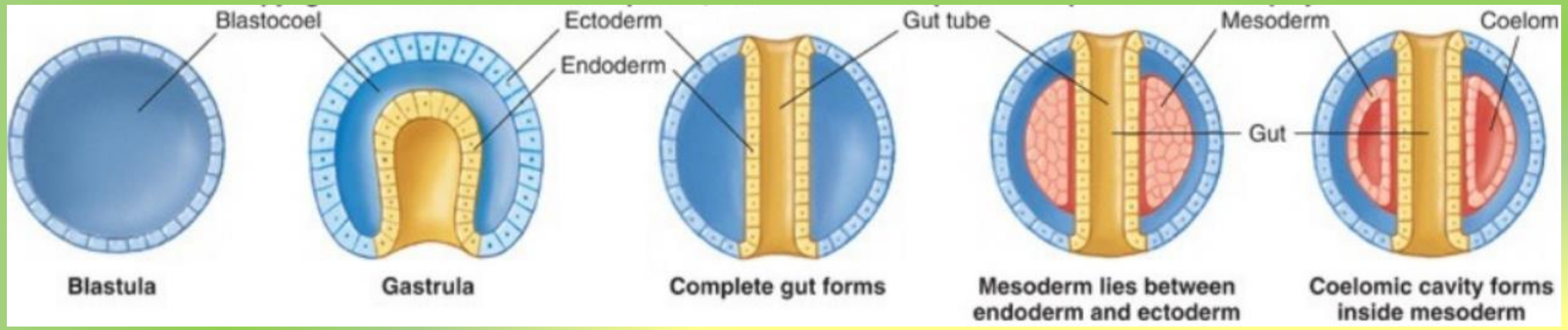
STAGES OF EMBRYO DEVELOPMENT

Fertilized Oocyte		Immediately after fertilization, the egg contains two pronuclei or **2PN**. Each nucleus contains the chromosomal material from one of the genetic parents.
Four Cell Embryo		**Each of these 4 cells is called a blastomere.** The embryo is surrounded by a protein matrix "shell" called the zona pellucida.
Eight Cell Embryo		On the **3rd day after the egg retrieval,** the usual day for embryo transfer, embryos will have around 8 cells. Notice how the cells are beginning to flatten against one another, beginning the process of compaction.
Morula		**At 4 days old, this embryo has reached the morula stage.** The cells are compacted together. The embryo should have between 16 and 32 cells.
Early Blastocyst		Late on the 4th day or early on the 5th day, the morula begins to form a **fluid filled cavity** or cyst. **The morula is becoming a blastocyst.** The cells are becoming organized into 2 distinct groups. The inner cells **(IN)** are round and will become the fetus. The outer cells **(OUT)** are flat and will become the placenta.

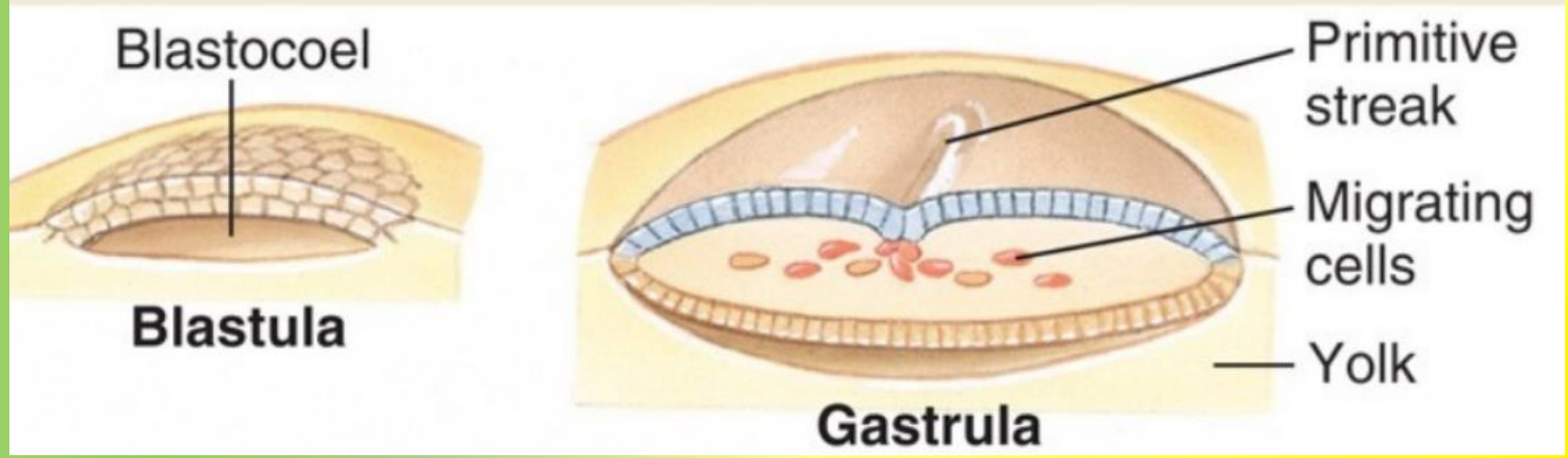

Blastocoel
Presumptive endoderm
Blastula
Remnant of blastocoel
Presumptive notochord
Archenteron
Invaginating blastula
Dorsal lip of blastopore
Archenteron
Ventral lip of blastopore
Early gastrula
Future notochord
Blastopore
Ectoderm
Endoderm
Later gastrula
Developing mesoderm
Neural plate
Future notochord
Epidermis
Archenteron
Late gastrula
Mesoderm
Developing notochord
Pouch formation
Mesodermal segment (somite)
Coelom
Archenteron
Somite formation
Neural tube
Notochord
Gut
Neurulation


Anterior
Right
Ventral
Dorsal
Left
Posterior
(a) Body axes
Animal hemisphere
Animal pole
Point of sperm entry
Vegetal hemisphere
Vegetal pole
Point of sperm entry
Future dorsal side of tadpole
Gray crescent
First cleavage


Zygote
0.25 mm
2-cell stage forming
4-cell stage forming
Eight-cell stage (viewed from the animal pole)
8-cell stage
0.25 mm
Animal pole
Blasto-coel
Blastula (cross section)
Vegetal pole
Blastula (at least 128 cells)


Blastocoel
Ectoderm
Endoderm
Gut tube
Mesoderm
Coelom
Gut
Blastula
Gastrula
Complete gut forms
Mesoderm lies between endoderm and ectoderm
Coelomic cavity forms inside mesoderm

Chick

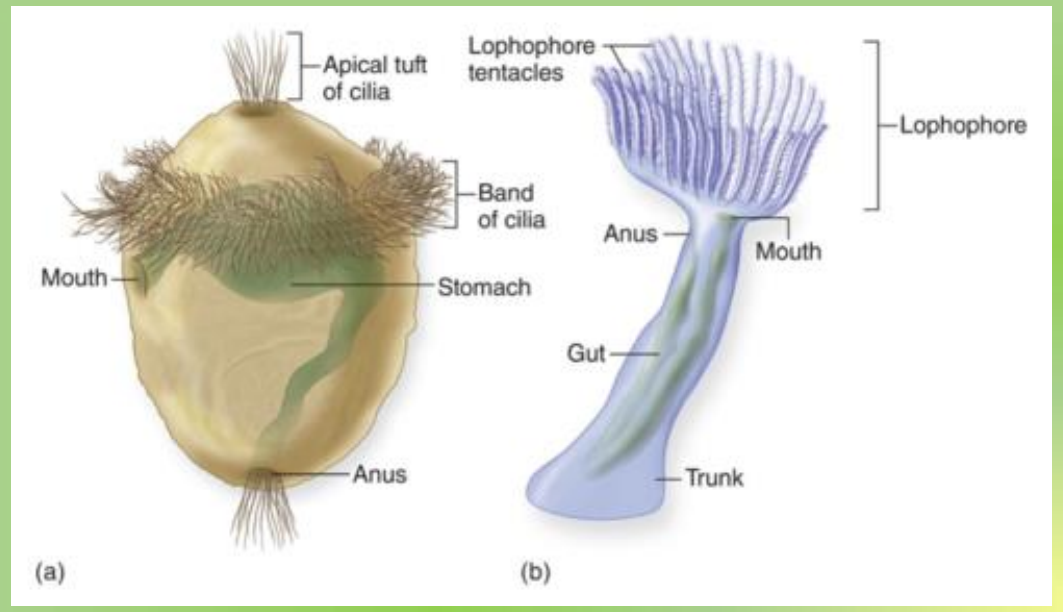

Blastocoel
Blastula
Primitive streak
Migrating cells
Yolk
Gastrula

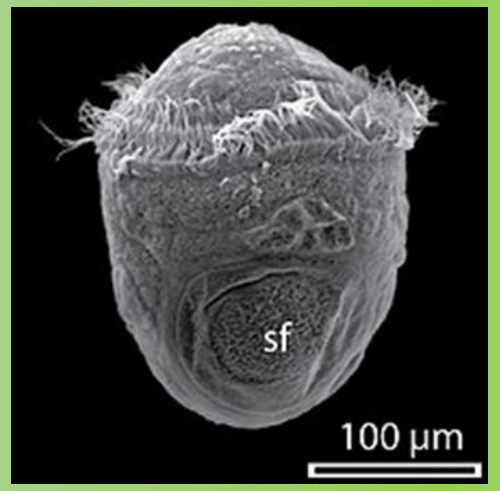
THREE : Developmental Categories

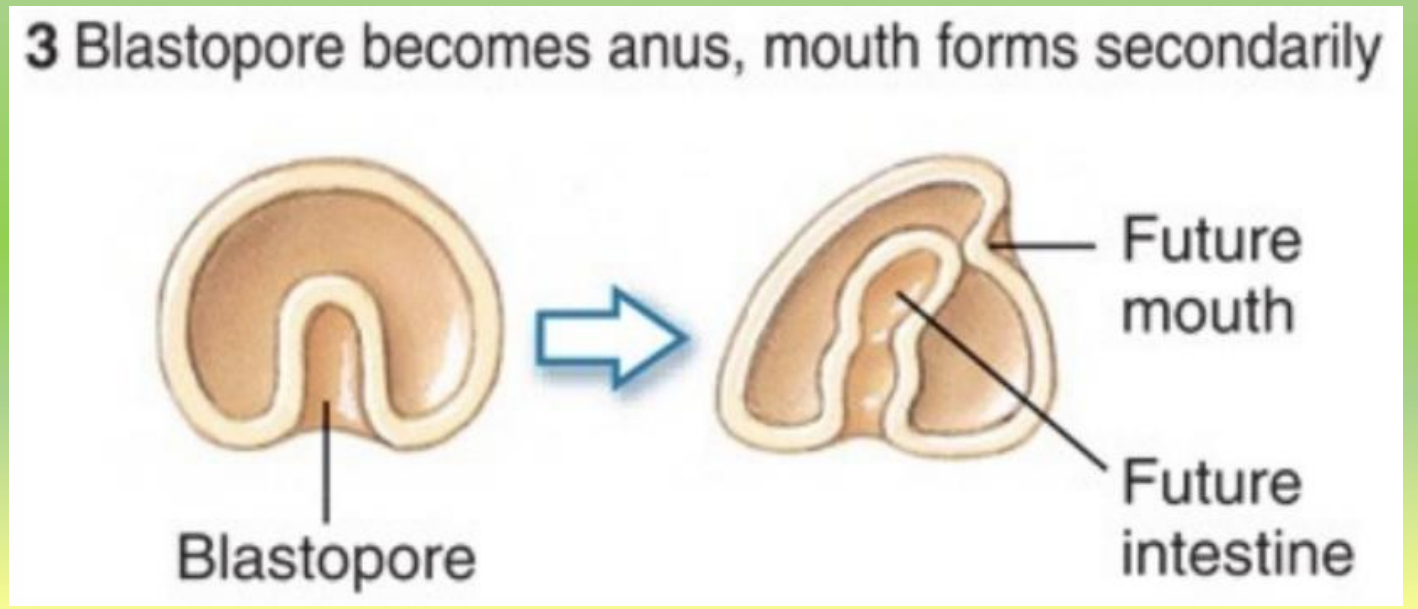
CRITERIA	PROTOSTOMES	DEUTEROSTOMES

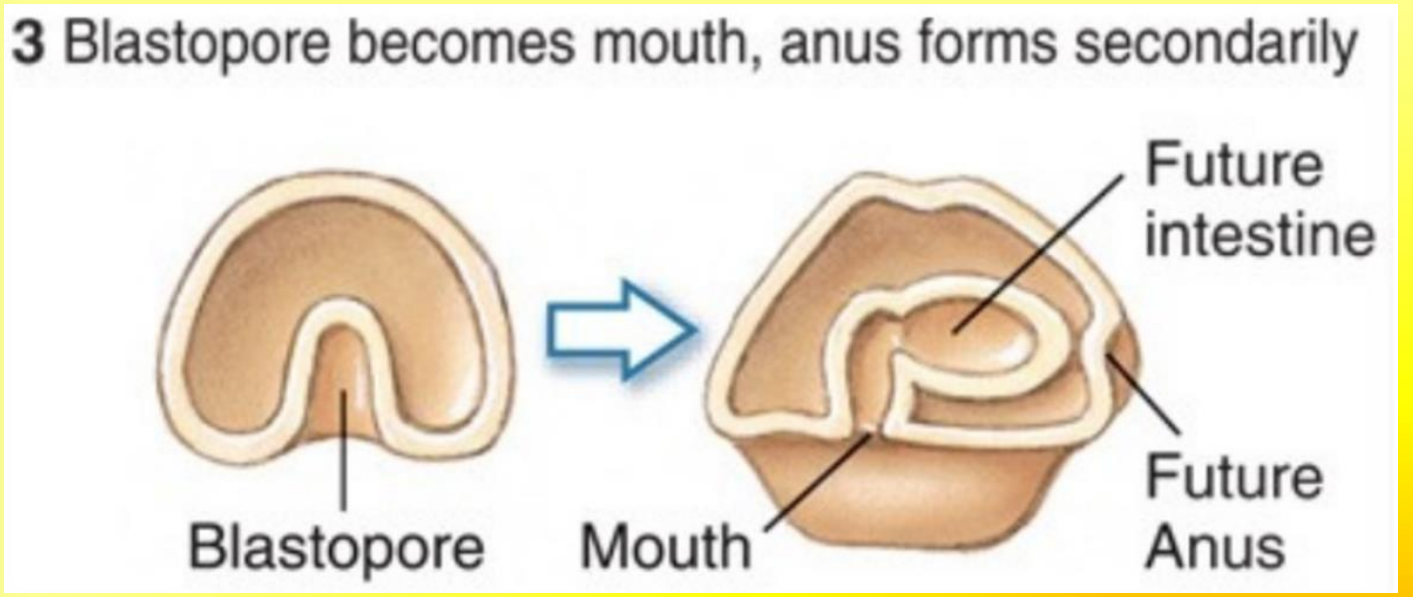
FOUR

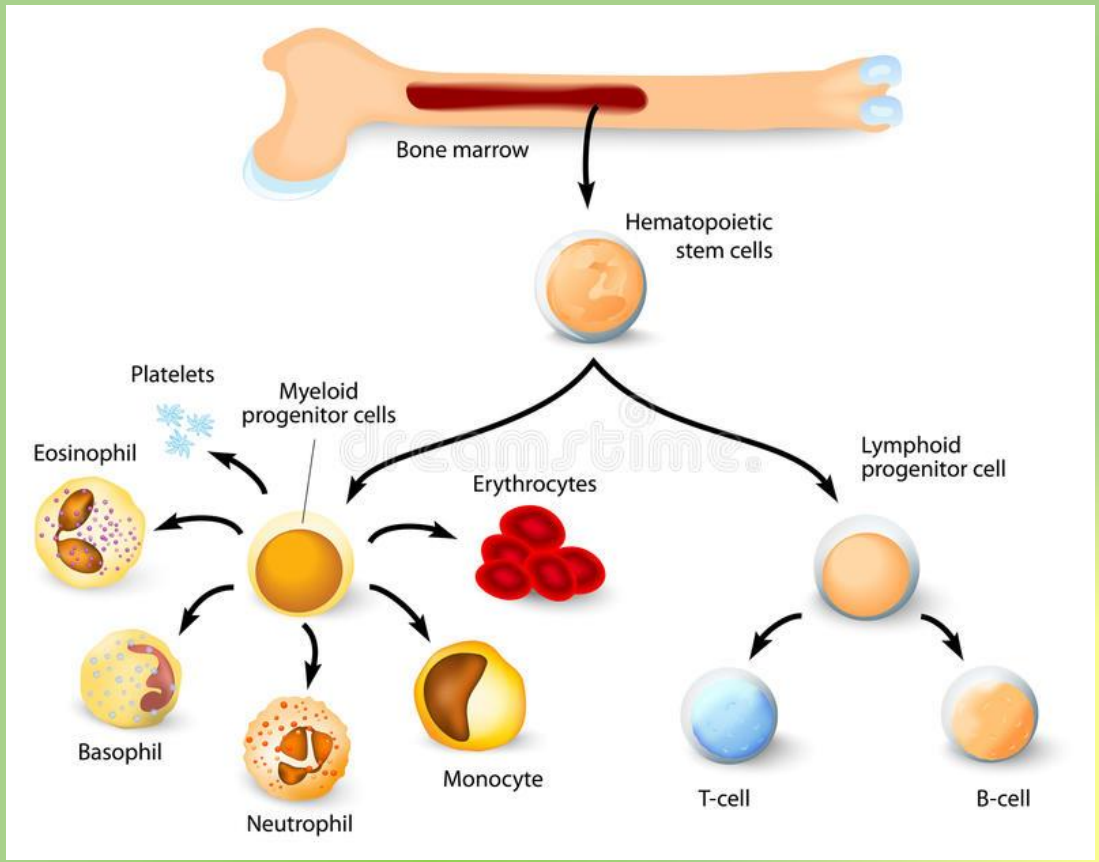
1. Cellular potency
2. Protostome clades
3. Deuterostome clades
4. Cytoplasmic determinants
5. Induction
6. Entercoely vs. schizocoely

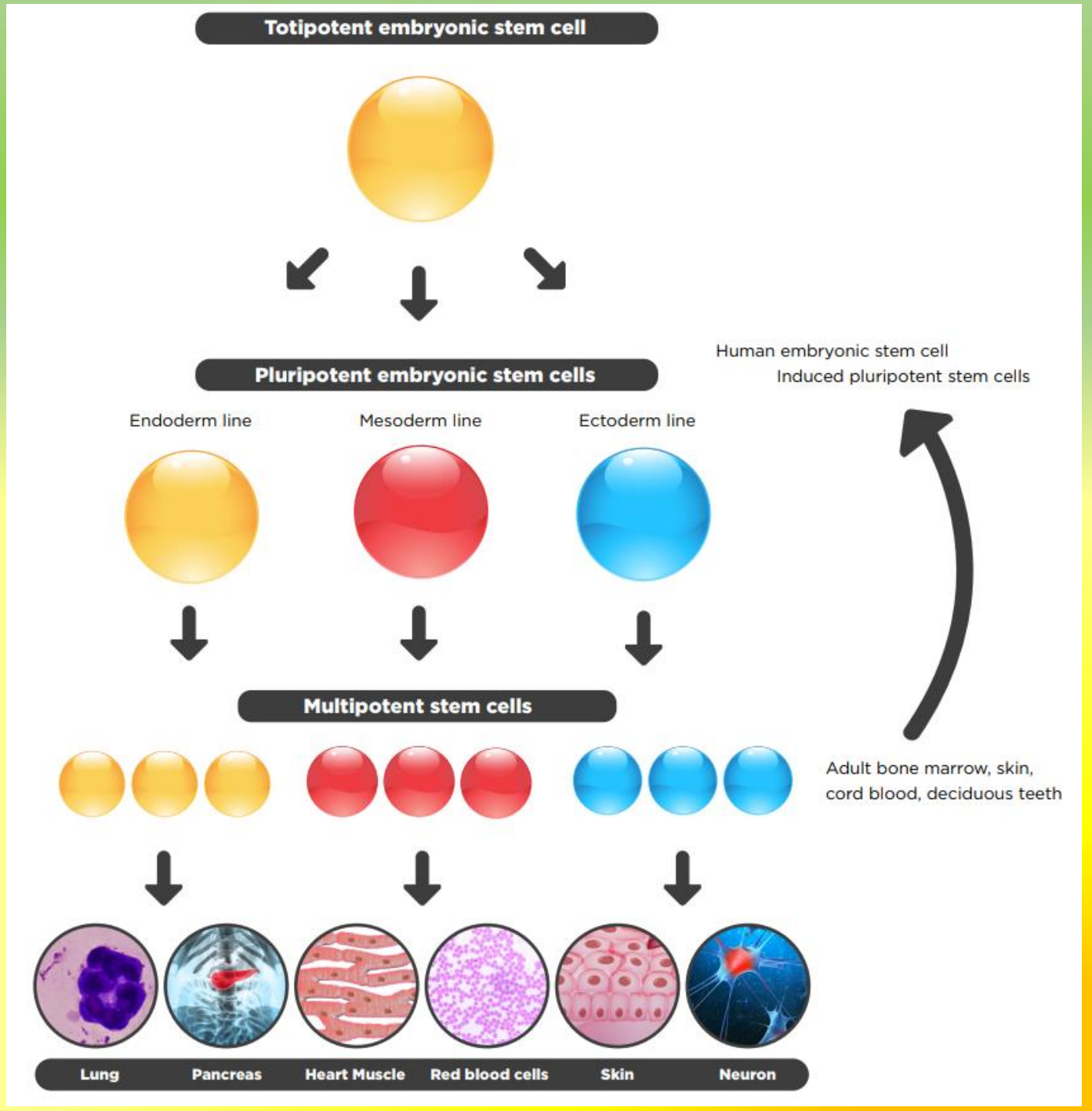

Apical tuft of cilia
Band of cilia
Mouth
Stomach
Anus
(a)
Lophophore tentacles
Lophophore
Anus
Mouth
Gut
Trunk
(b)

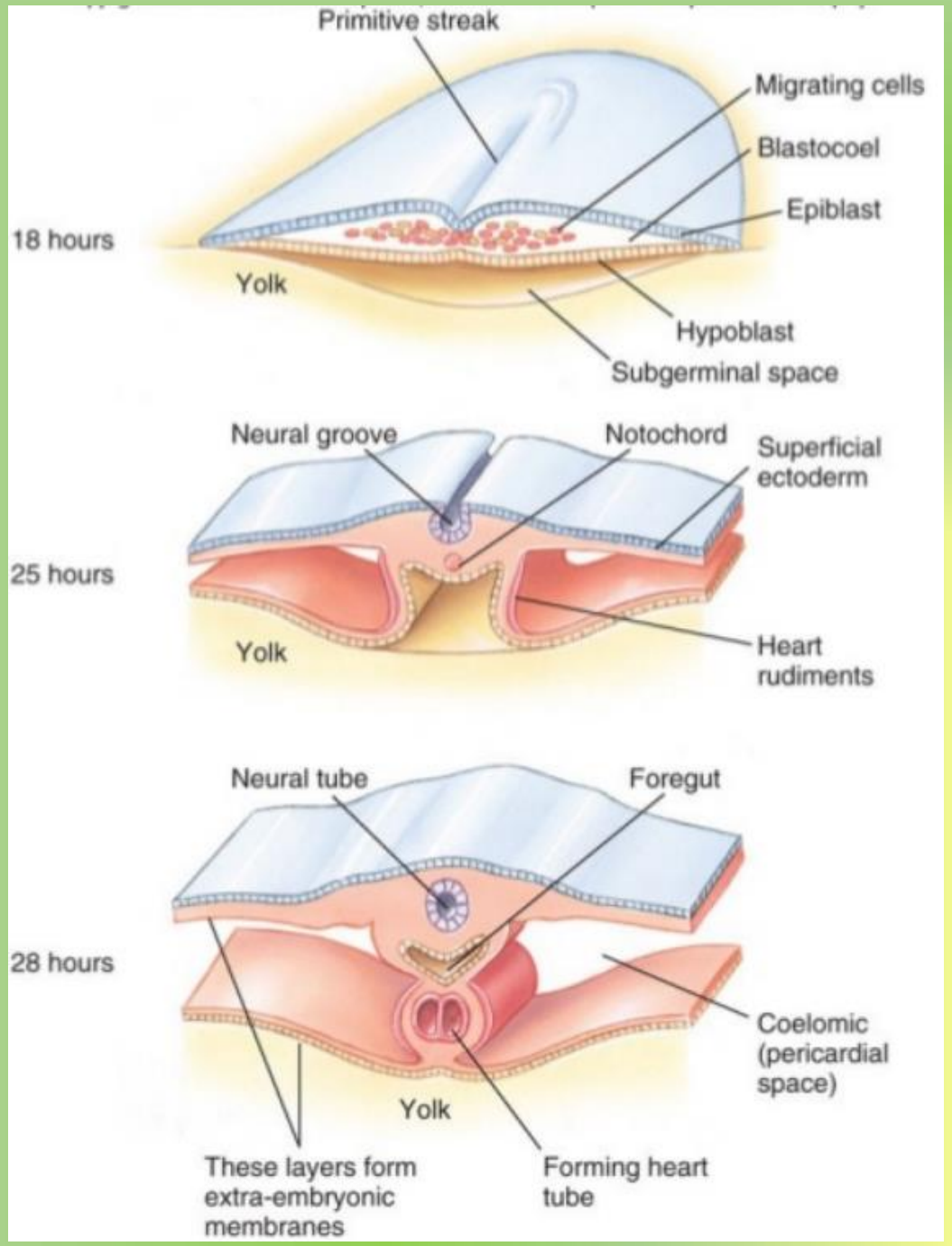

sf
100 µm

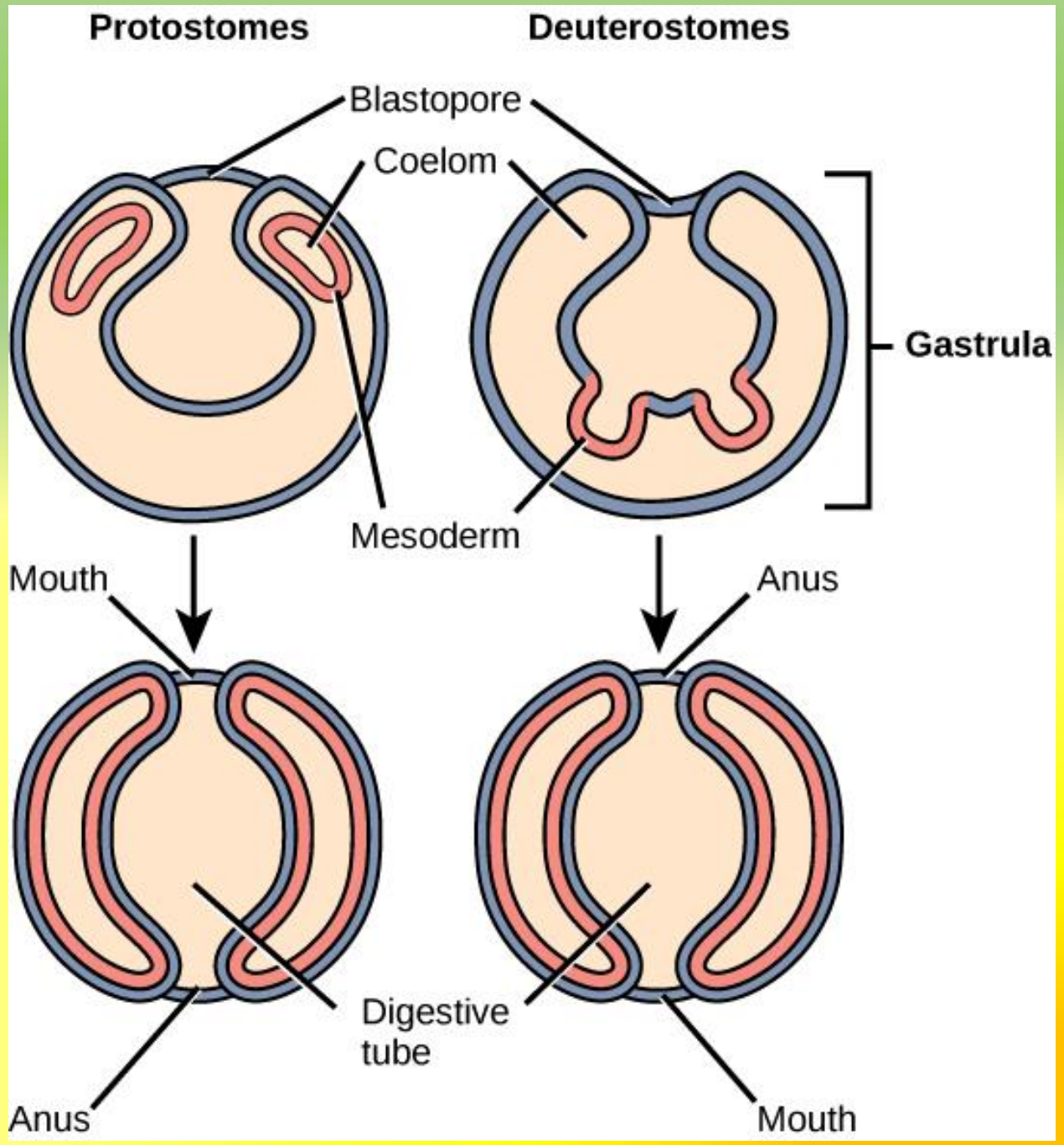

3 Blastopore becomes anus, mouth forms secondarily
Future mouth
Future intestine
Blastopore


3 Blastopore becomes mouth, anus forms secondarily
Future intestine
Blastopore
Mouth
Future Anus


Bone marrow
Hematopoietic stem cells
Platelets
Myeloid progenitor cells
Eosinophil
Erythrocytes
Lymphoid progenitor cell
Basophil
Monocyte
Neutrophil
T-cell
B-cell


Totipotent embryonic stem cell
Pluripotent embryonic stem cells
Endoderm line
Mesoderm line
Ectoderm line
Multipotent stem cells
Lung
Pancreas
Heart Muscle
Red blood cells
Skin
Neuron
Human embryonic stem cell
Induced pluripotent stem cells
Adult bone marrow, skin, cord blood, deciduous teeth


Primitive streak
Migrating cells
Blastocoel
Epiblast
18 hours
Yolk
Hypoblast
Subgerminal space
Neural groove
Notochord
Superficial ectoderm
25 hours
Yolk
Heart rudiments
Neural tube
Foregut
28 hours
Coelomic (pericardial space)
Yolk
These layers form extra-embryonic membranes
Forming heart tube


Protostomes
Deuterostomes
Blastopore
Coelom
Gastrula
Mesoderm
Mouth
Anus
Digestive tube
Anus
Mouth

Enterocoelom vs Schizocoelom

More Information Online WWW.DIFFERENCEBETWEEN.COM

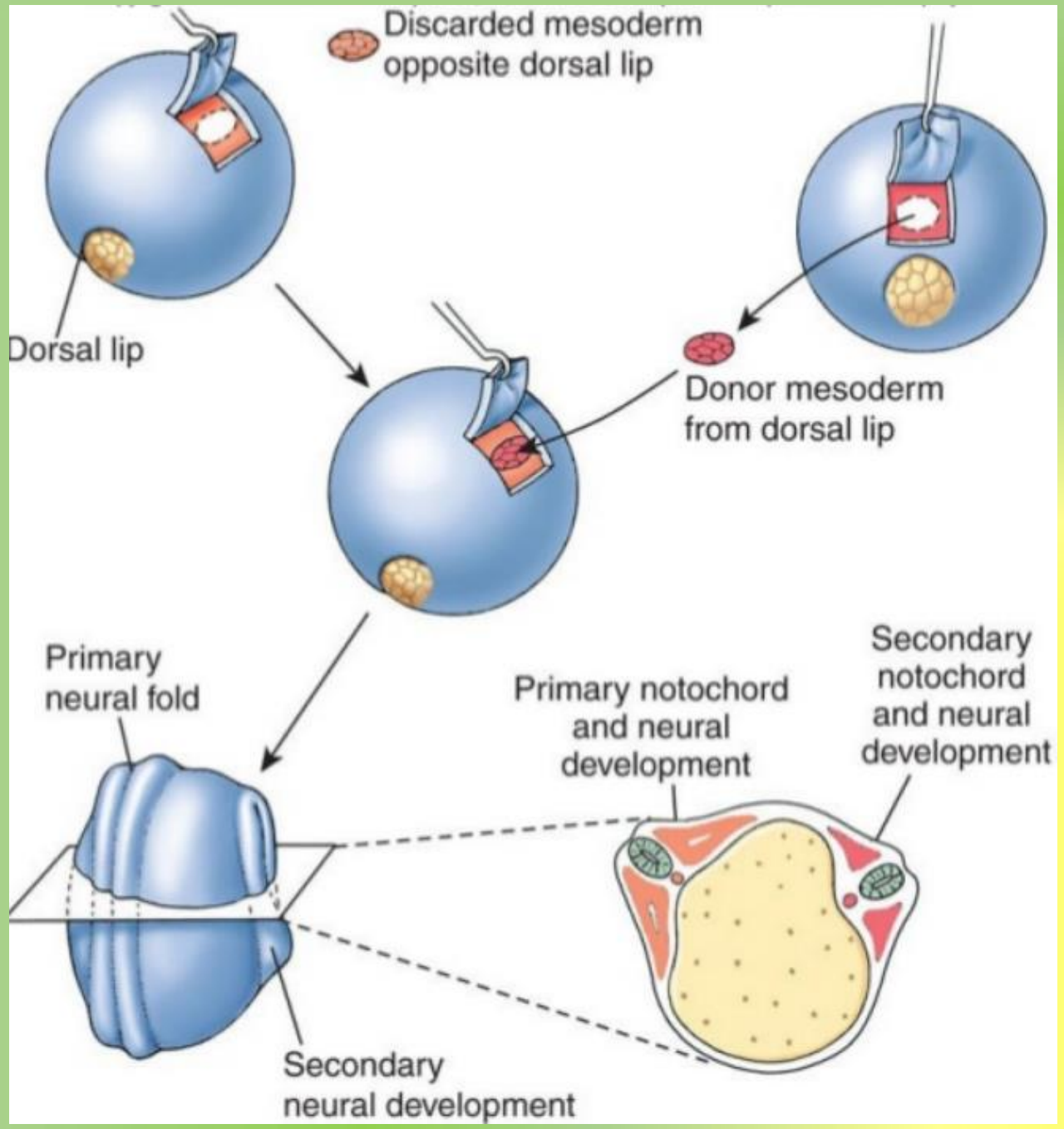
	Enterocoelom	Schizocoelom
DEFINITION	Enterocoelom is a true body cavity formed from outpocketing of the embryonic gut (enteron)	Schizocoelom is a true body cavity formed from the splitting of the mesodermal mass
ARISING FROM	The wall of the embryonic gut or enteron	The splitting of mesodermal embryonic tissues
ORGANISMS	Animals belonging to phyla Echinodermata and Chordata	Animals belonging to phyla Annelida, Mollusca and Arthropoda

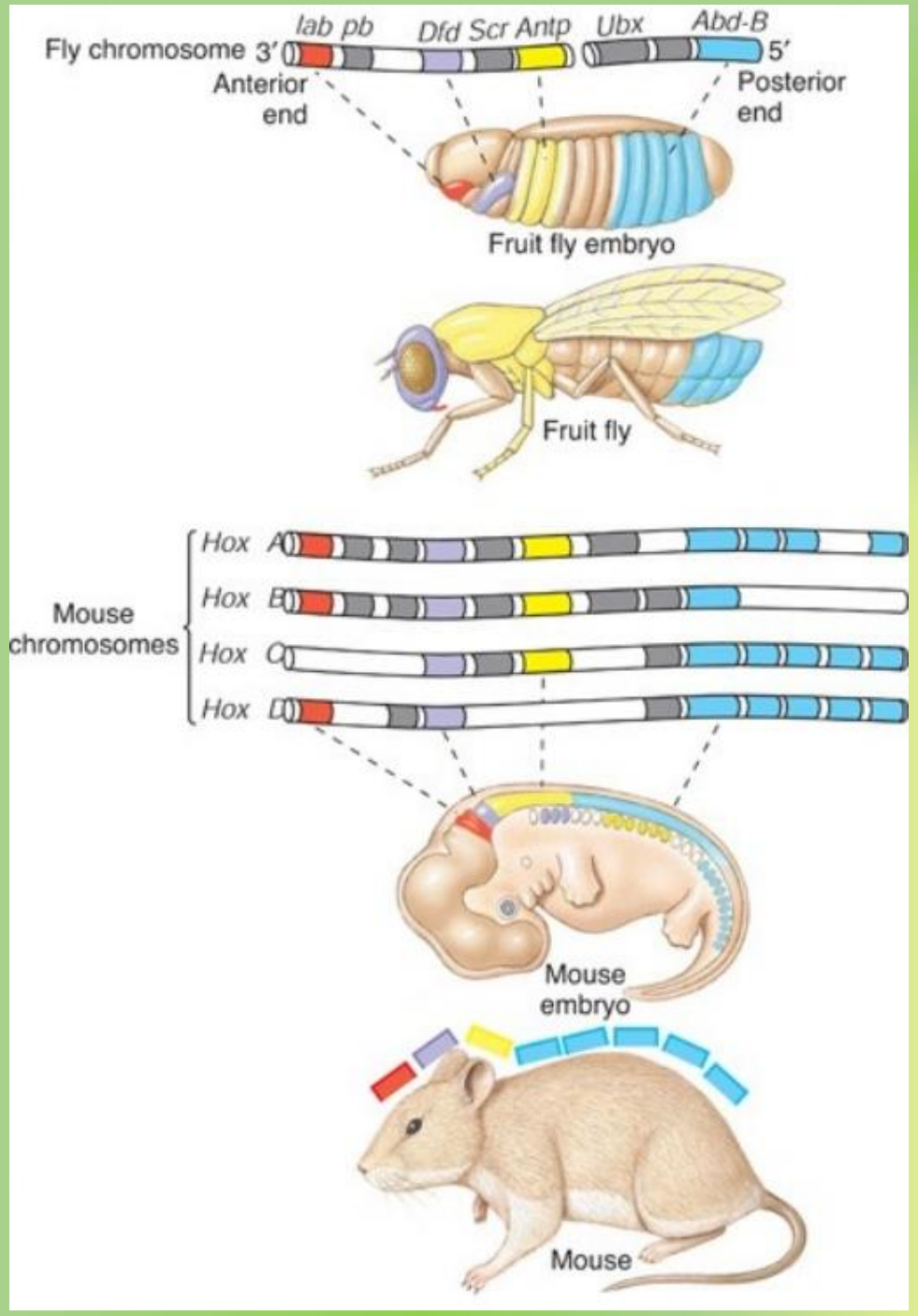
FIVE

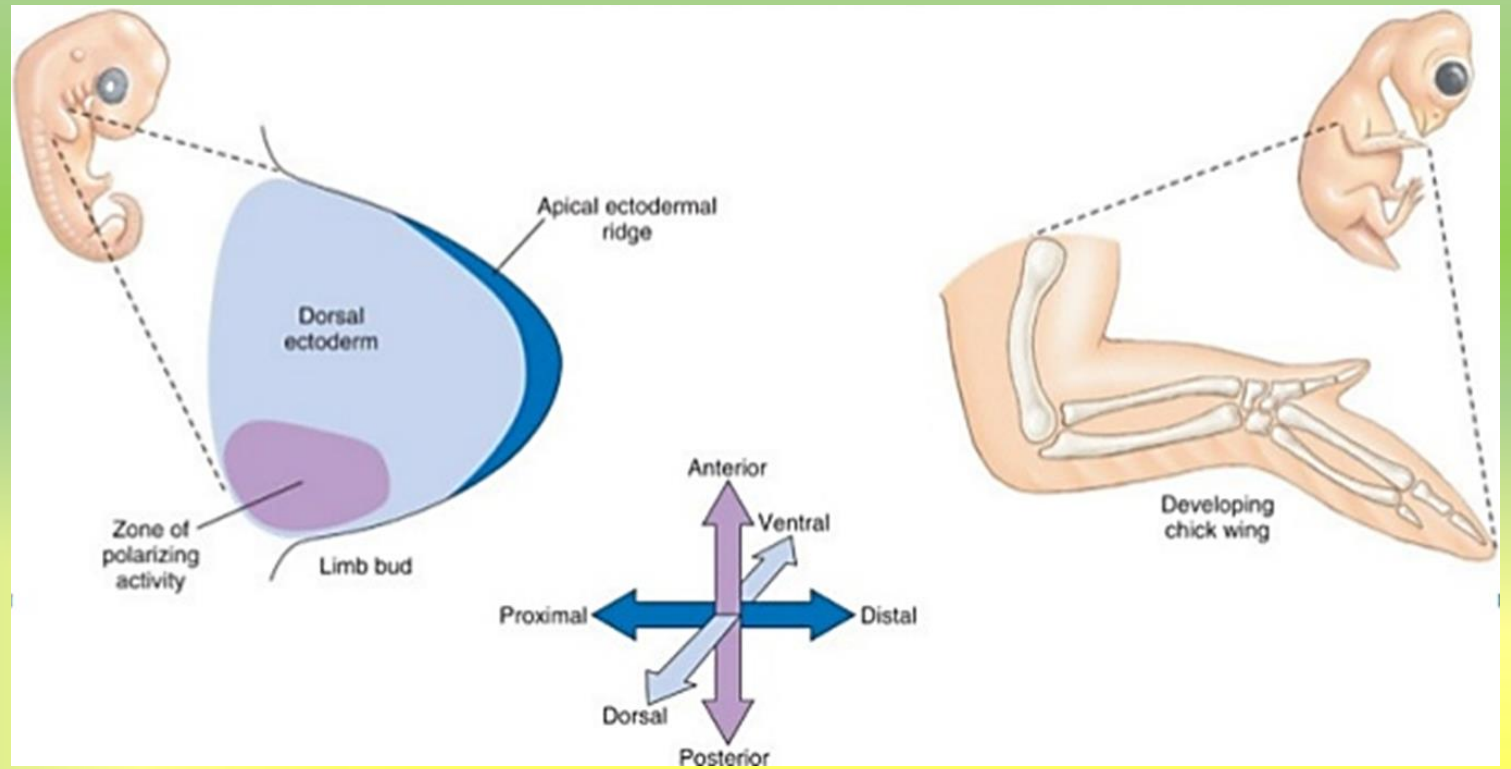
1. Spemann-Mangold Experiment
2. Cell differentiation vs. morphogenesis
3. Body plant development
4. Hox genes
5. Position information
6. Limb bud
7. AER
8. ZPA
9. Cell shape
10. Cell migration

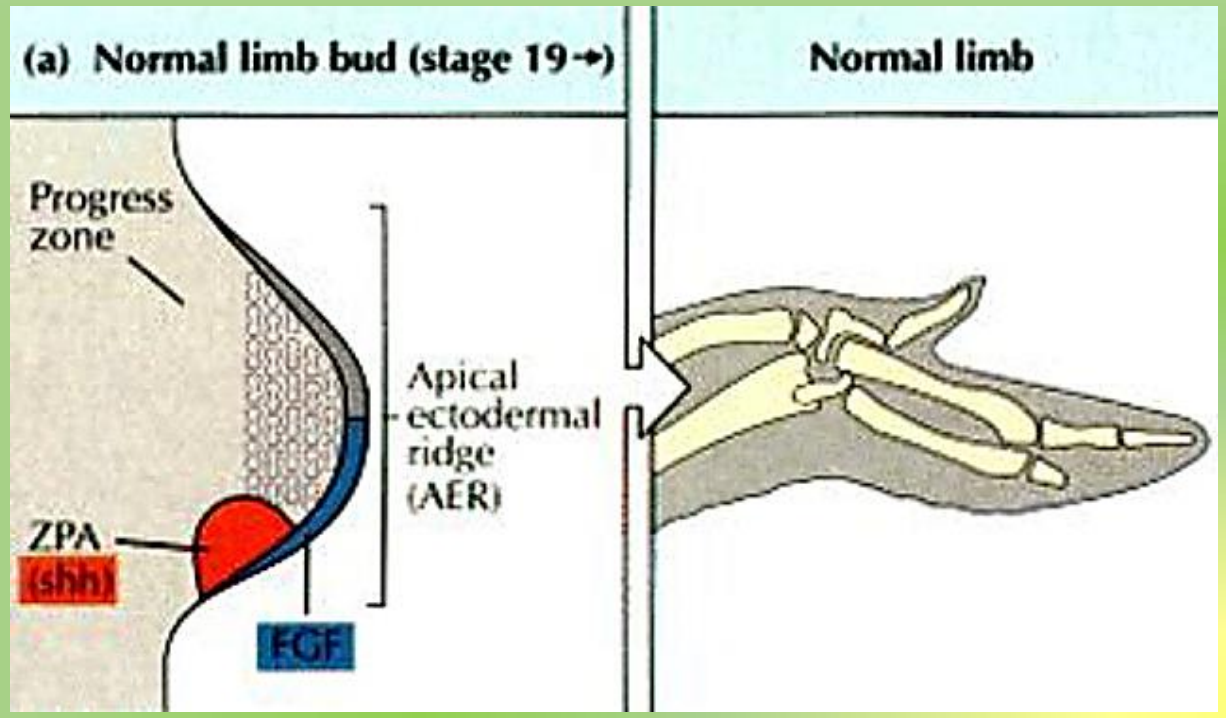
} Mechanics

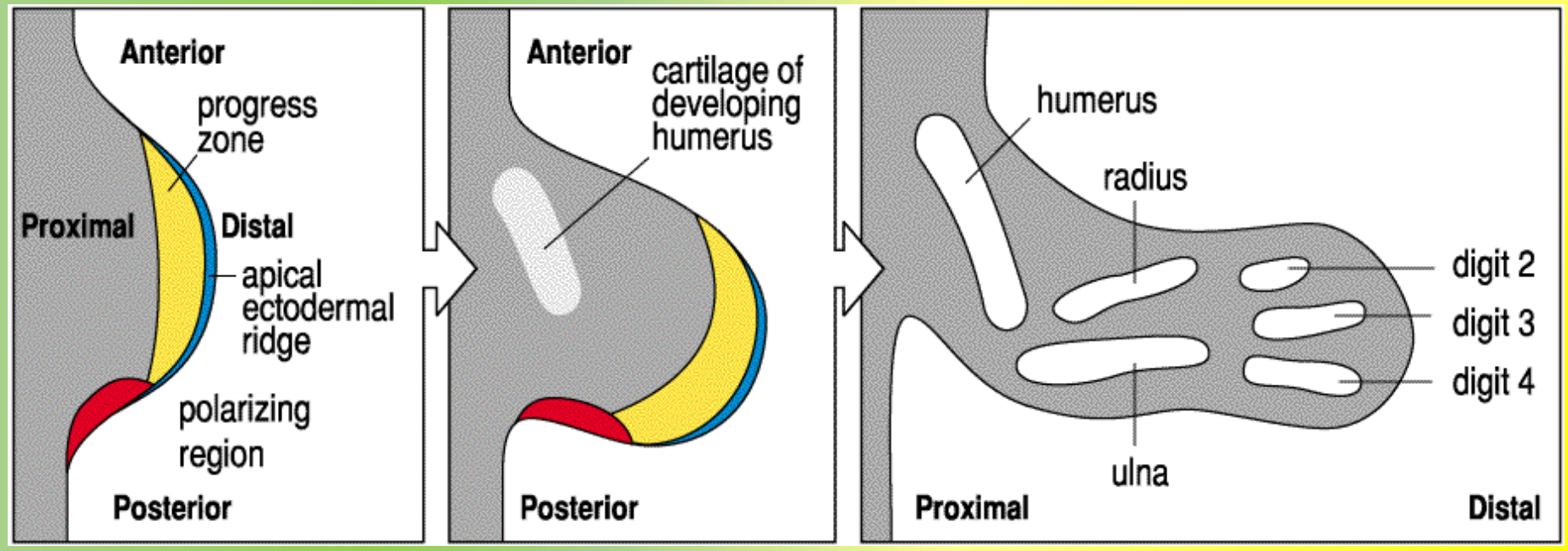
11. Evo-Devo gene view & closure

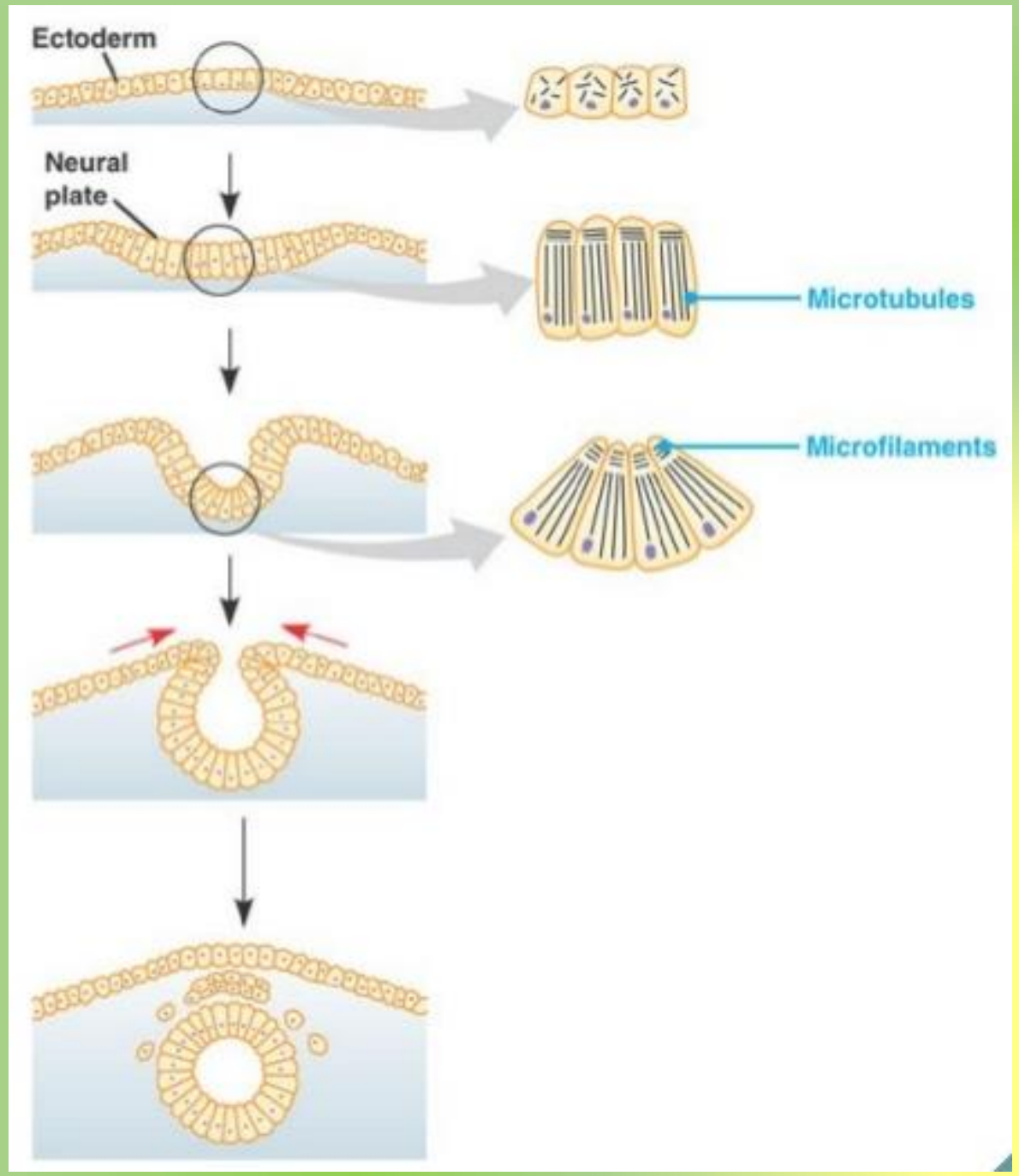

Discarded mesoderm
opposite dorsal lip
Dorsal lip
Donor mesoderm
from dorsal lip
Primary
neural fold
Primary notochord
and neural
development
Secondary
notochord
and neural
development
Secondary
neural development

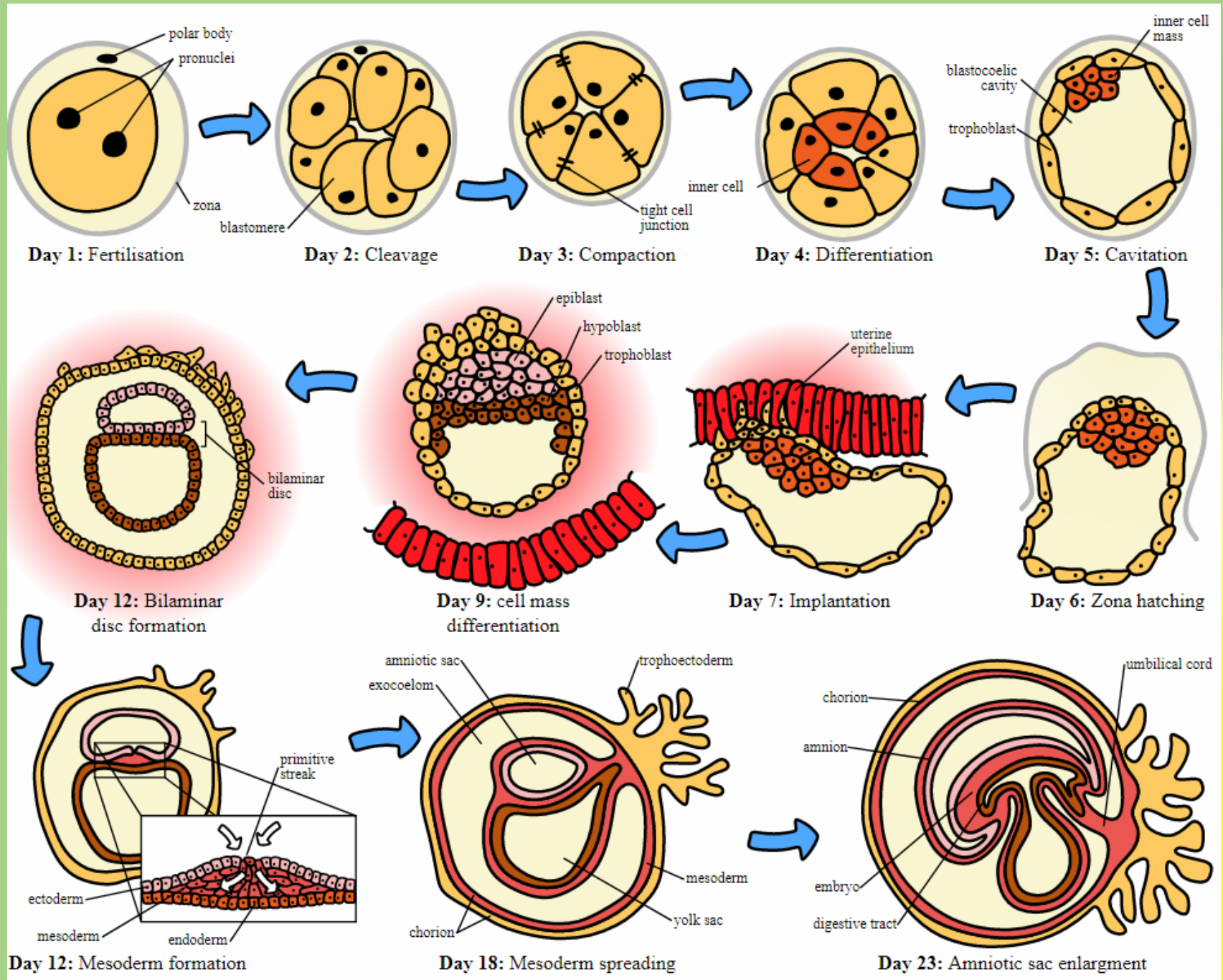

lab pb Dfd Scr Antp Ubx Abd-B
Fly chromosome 3′
5′
Anterior end
Posterior end
Fruit fly embryo
Fruit fly
Mouse chromosomes
Hox A
Hox B
Hox C
Hox D
Mouse embryo
Mouse


Apical ectodermal ridge
Dorsal ectoderm
Zone of polarizing activity
Limb bud
Anterior
Ventral
Proximal
Distal
Dorsal
Posterior
Developing chick wing


(a) Normal limb bud (stage 19→)
Normal limb
Progress zone
Apical ectodermal ridge (AER)
ZPA
(shh)
FGF


Anterior
progress zone
Proximal
Distal
apical ectodermal ridge
polarizing region
Posterior
Anterior
cartilage of developing humerus
Posterior
humerus
radius
digit 2
digit 3
digit 4
ulna
Proximal
Distal


Ectoderm
Neural plate
Microtubules
Microfilaments


polar body
pronuclei
zona
blastomere
tight cell junction
inner cell
inner cell mass
blastocoelic cavity
trophoblast
Day 1: Fertilisation
Day 2: Cleavage
Day 3: Compaction
Day 4: Differentiation
Day 5: Cavitation
Day 6: Zona hatching
uterine epithelium
Day 7: Implantation
epiblast
hypoblast
trophoblast
Day 9: cell mass differentiation
bilaminar disc
Day 12: Bilaminar disc formation
primitive streak
ectoderm
mesoderm
endoderm
Day 12: Mesoderm formation
amniotic sac
exocoelom
trophoectoderm
mesoderm
yolk sac
chorion
Day 18: Mesoderm spreading
chorion
amnion
umbilical cord
embryo
digestive tract
Day 23: Amniotic sac enlargment