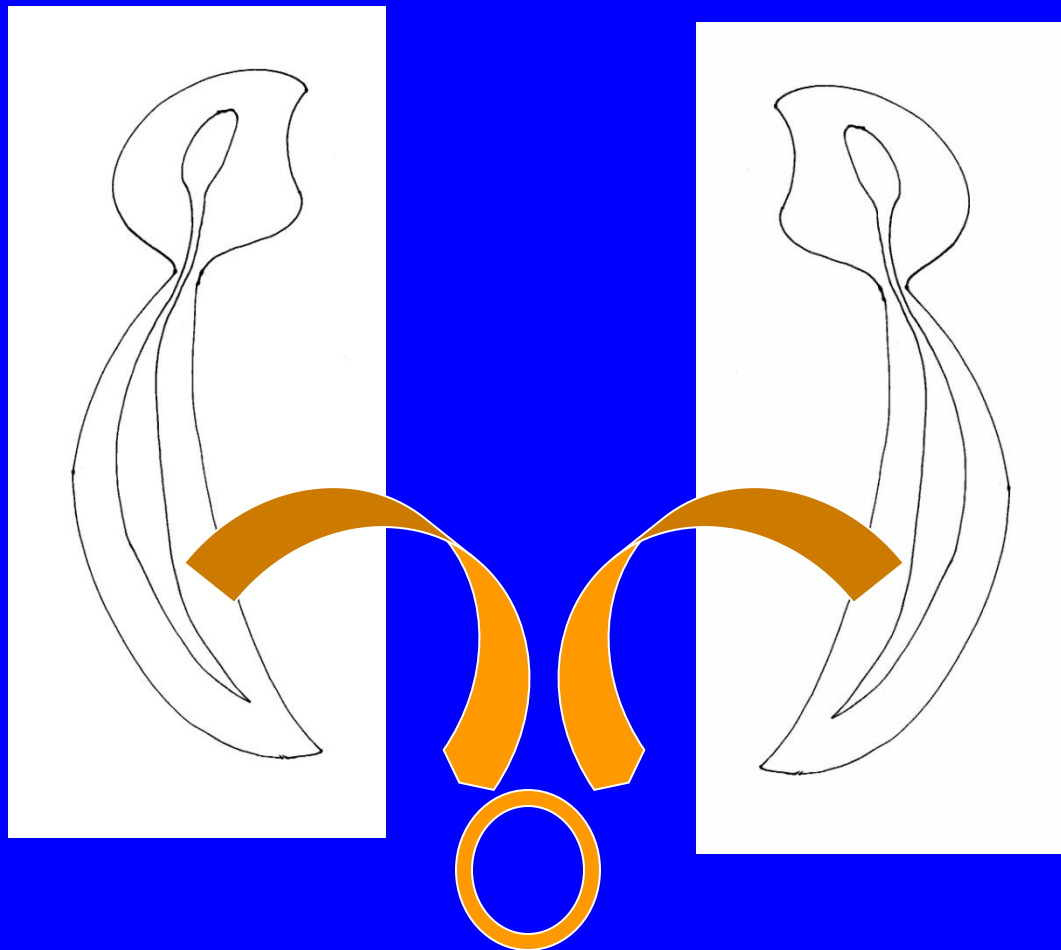
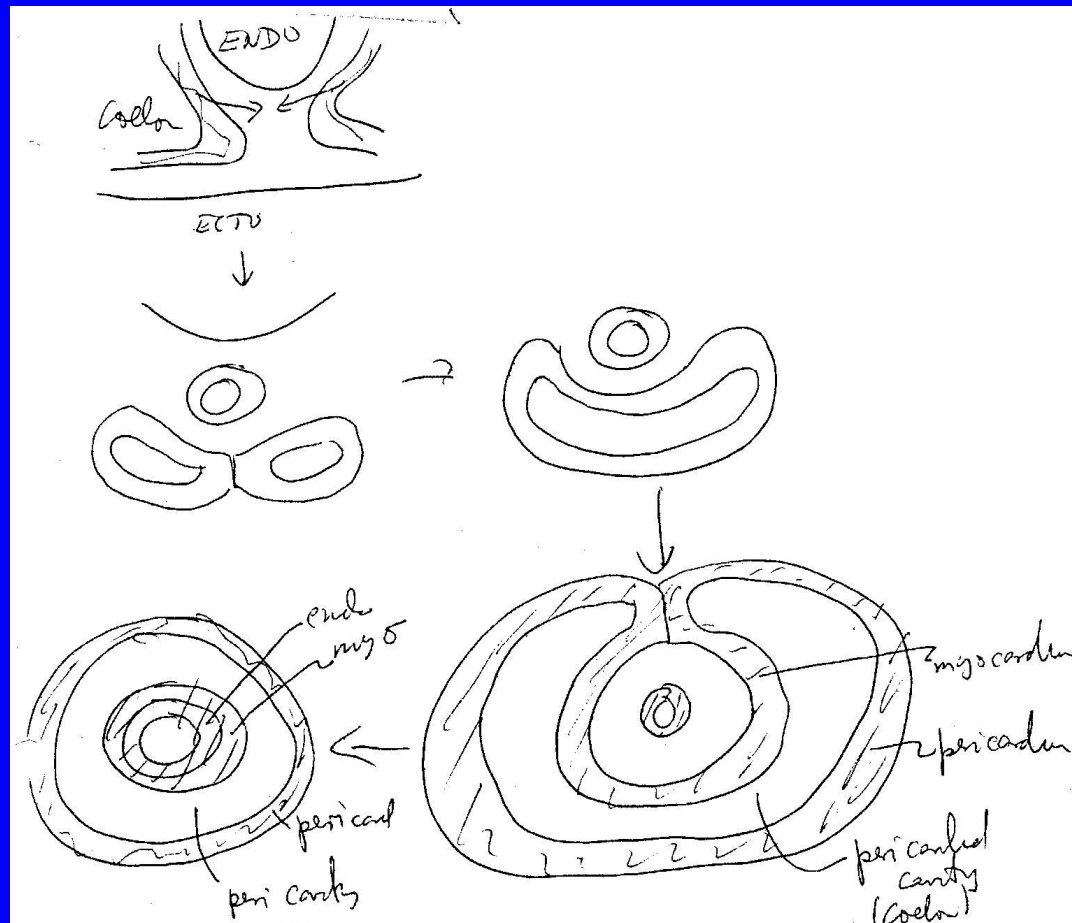


Mesoderm II

Heart: Migration of Splanchnic Mesenchyme → Endocardium



Lateral Mesoderm Fuses and Encircles Endocardium



Heart Formation

- Amphibians
 - forms in pharyngeal region
 - splanchnic mesenchyme migrates
 - aggregates to form central tube: endocardium
 - fusion of lateral mesoderm (in ventral region)
 - encirclement of endocardium (towards dorsal where layer fuses)

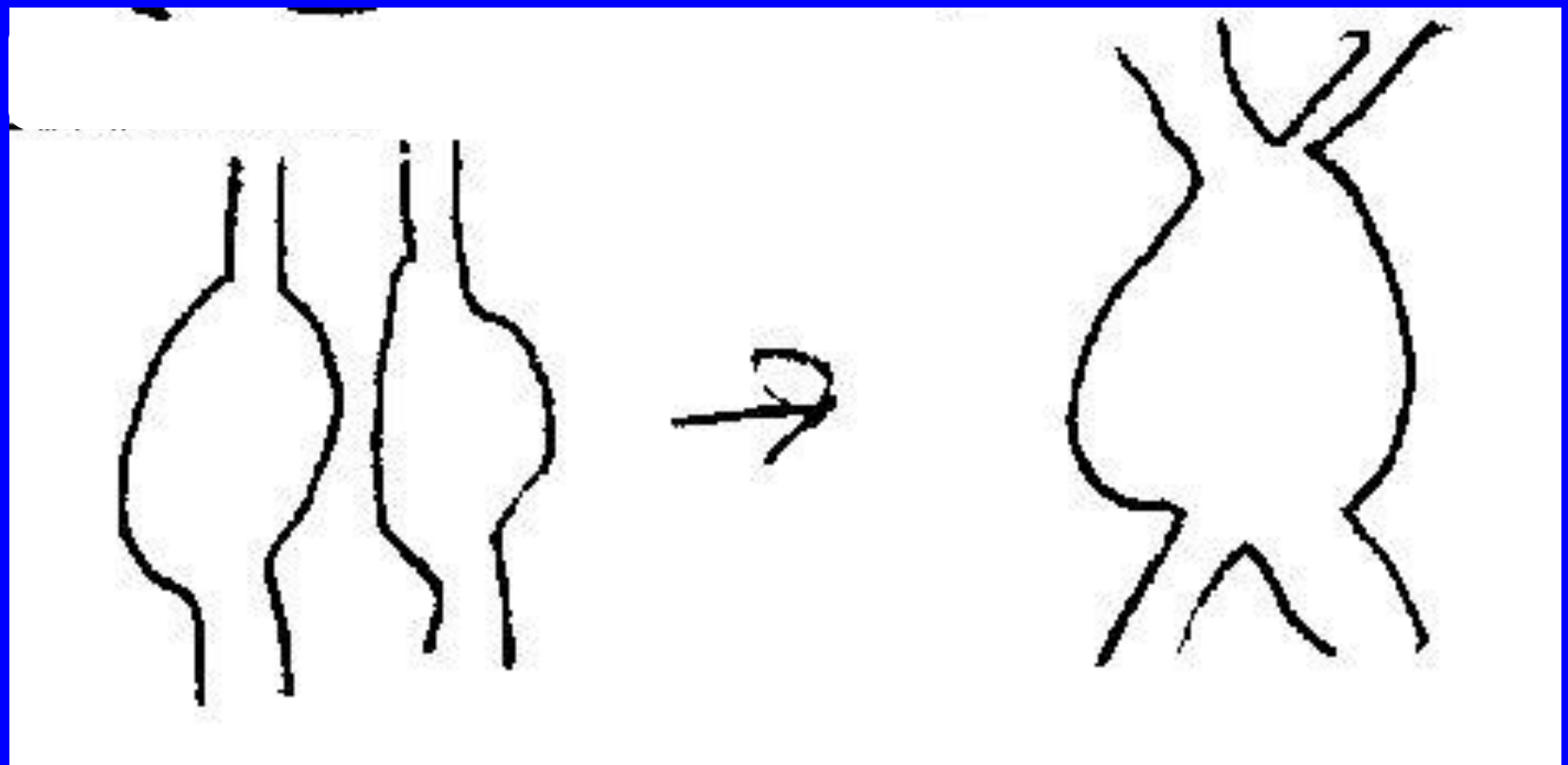
Heart Formation

- Formation of three layers
 - endocardium
 - myocardium
 - pericardium
- Myocardium then adheres to endocardium to create the heart separated from pericardium by pericardial cavity (coelom)

Heart Formation

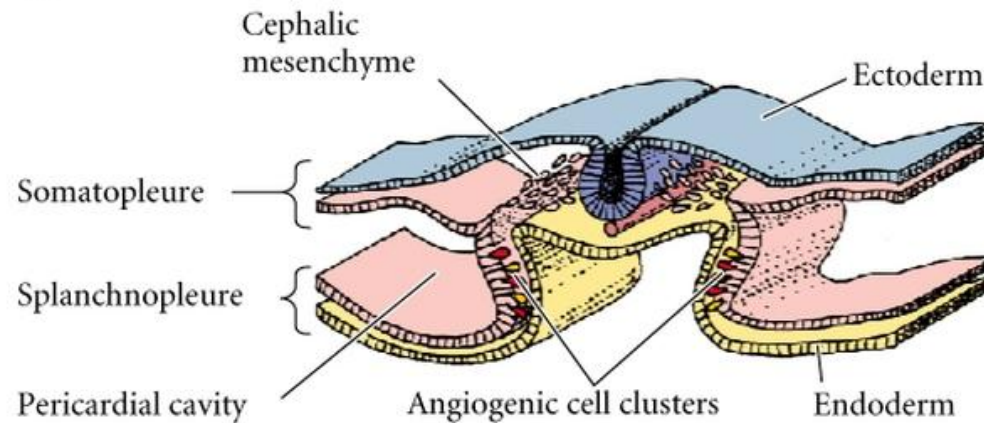
- So splanchnic mesoderm forms endocardium and myocardium
- Somatic mesoderm forms pericardium
- In higher vertebrates. two endocardial tubes form on each side and then fuse laterally

Fusion of Endocardial Tubes

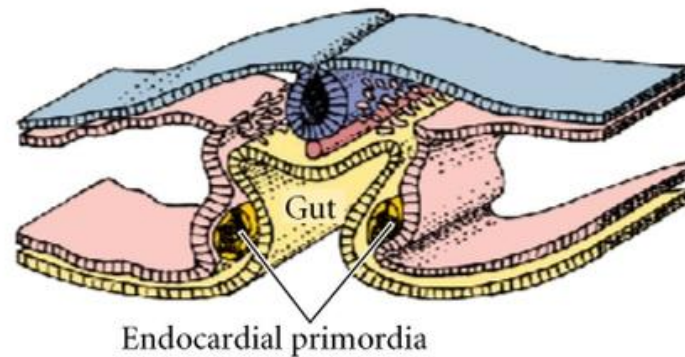


Formation of Chick Heart

(A)

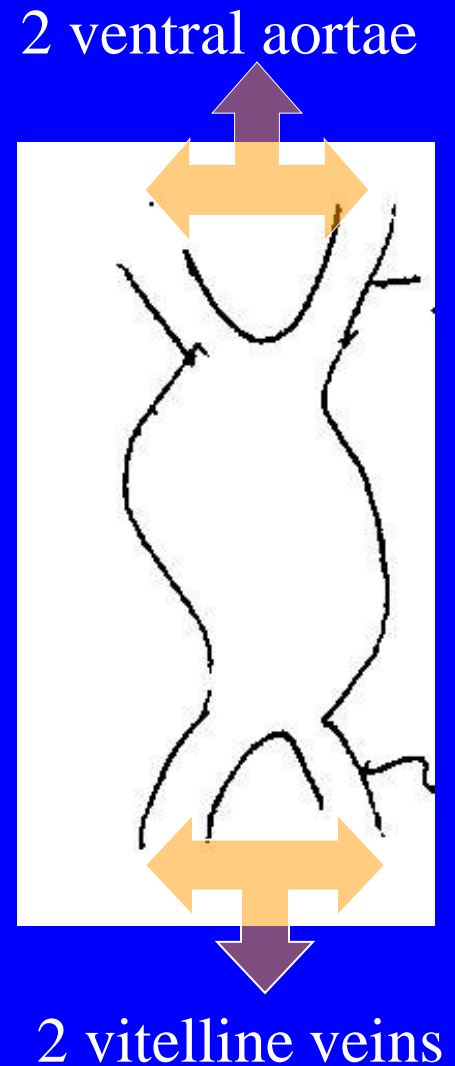


(B)

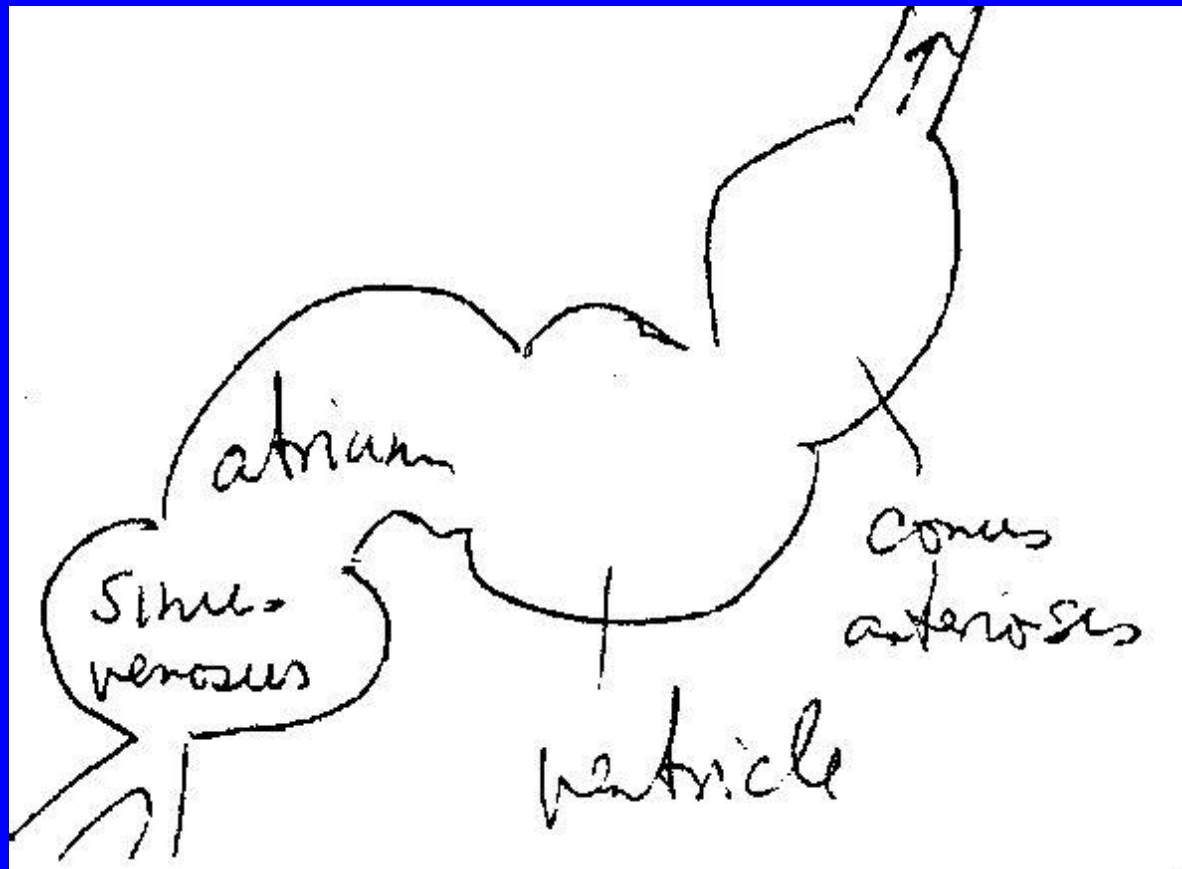


Heart Formation

- Heart tube develops two bifurcations
- Then twists and divides into chambers



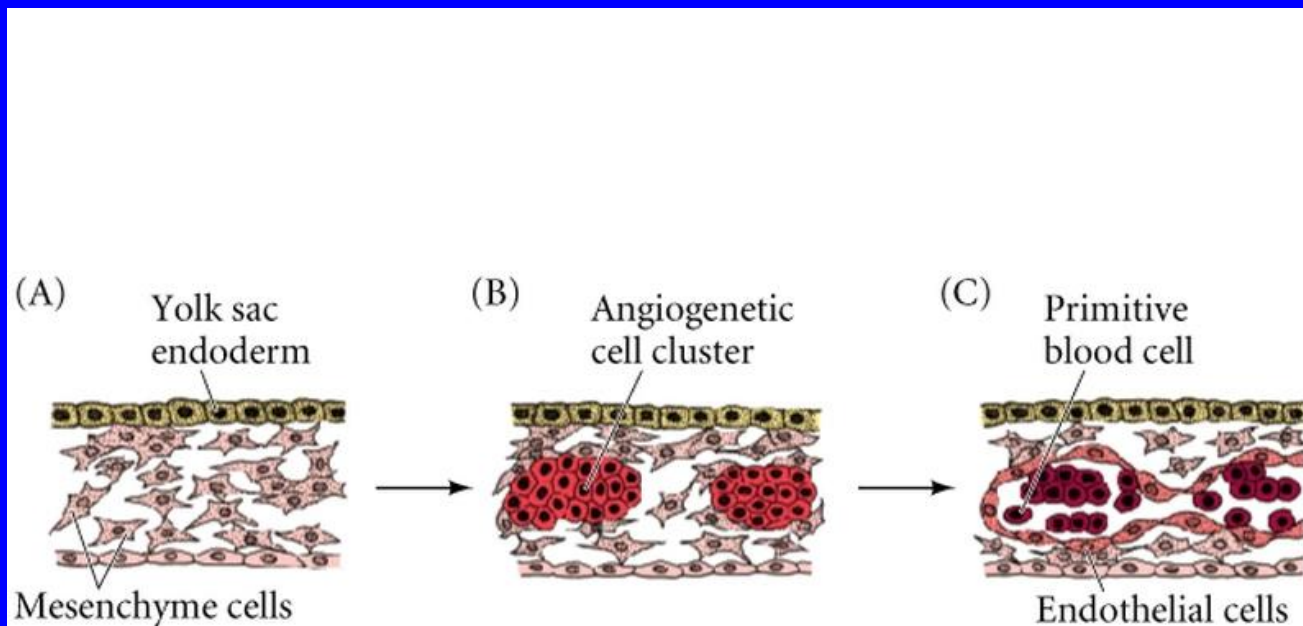
Initial Heart Chambers



Blood Vessels

- A complicated and plastic system
- Forms from
 - aggregation of mesenchymal angioblasts into blood islands
 - peripheral region makes endothelial lining
 - central makes blood cells
 - or aggregation of angioblasts without blood cell formation
- Vessels surrounded by basement lamina and smooth muscle

Embryonic Blood Formation



Blood Cells

- Common lineages of red and white cells
- Red cells from
 - yolk sac blood islands (primitive lineage)
 - only initial blood cells
 - not self-renewing
 - fetal liver (definitive lineage)
 - adult bone marrow and spleen (definitive)

Blood Cells Types

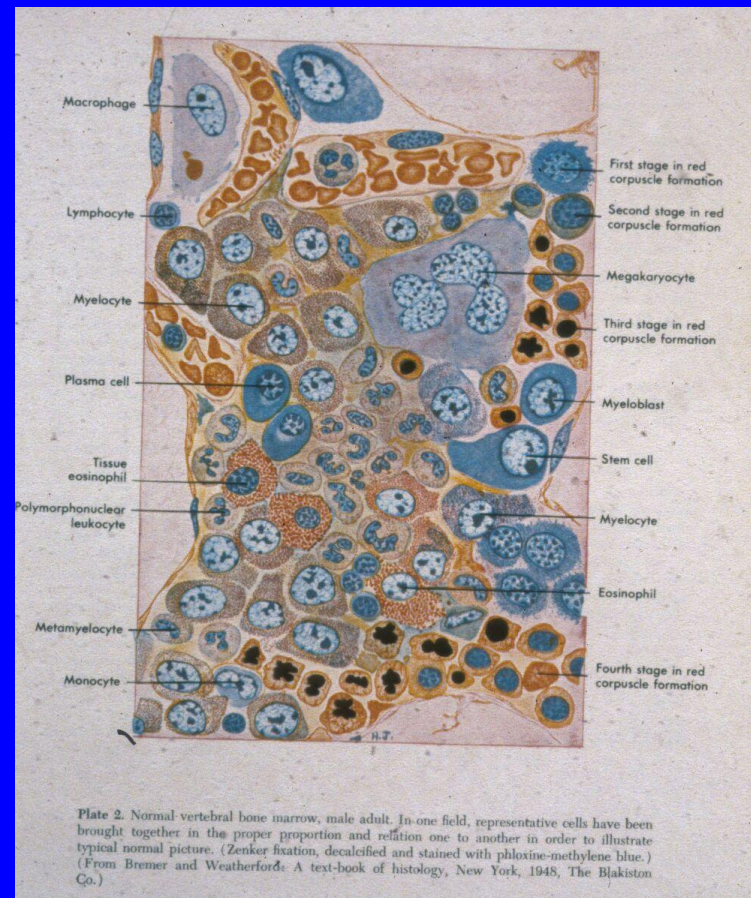
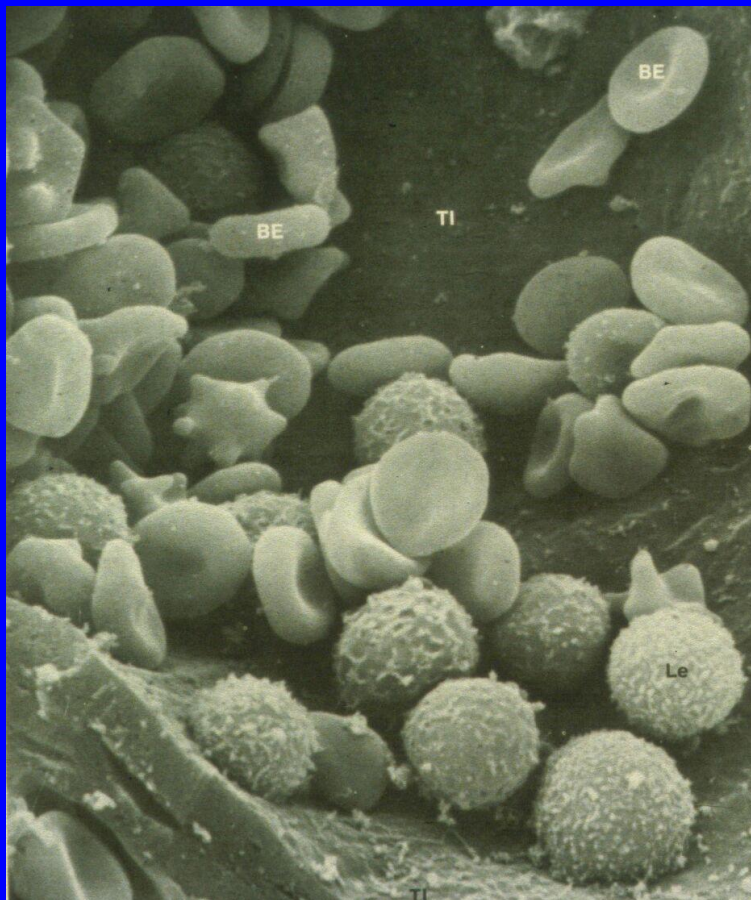


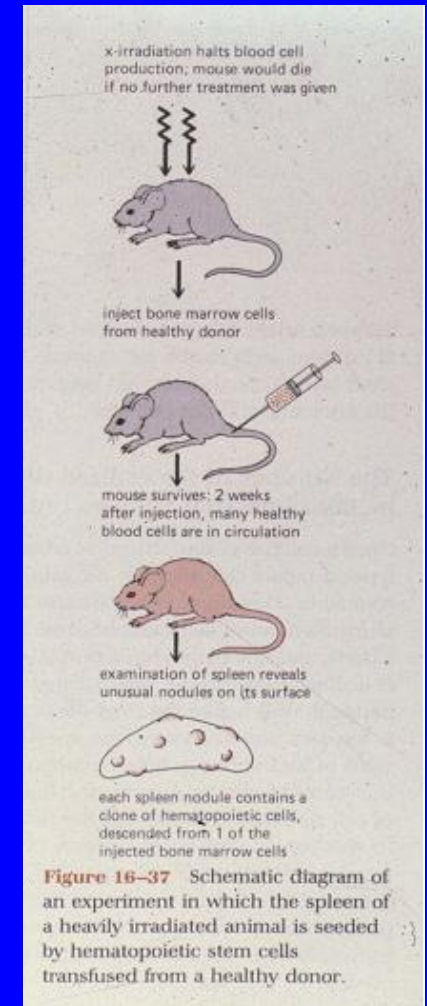
Plate 2. Normal vertebral bone marrow, male adult. In one field, representative cells have been brought together in the proper proportion and relation one to another in order to illustrate typical normal picture. (Zenker fixation, decalcified and stained with phloxine-methylene blue.) (From Brener and Weatherford: A text-book of histology, New York, 1948, The Blakiston Co.)

Stem Cells

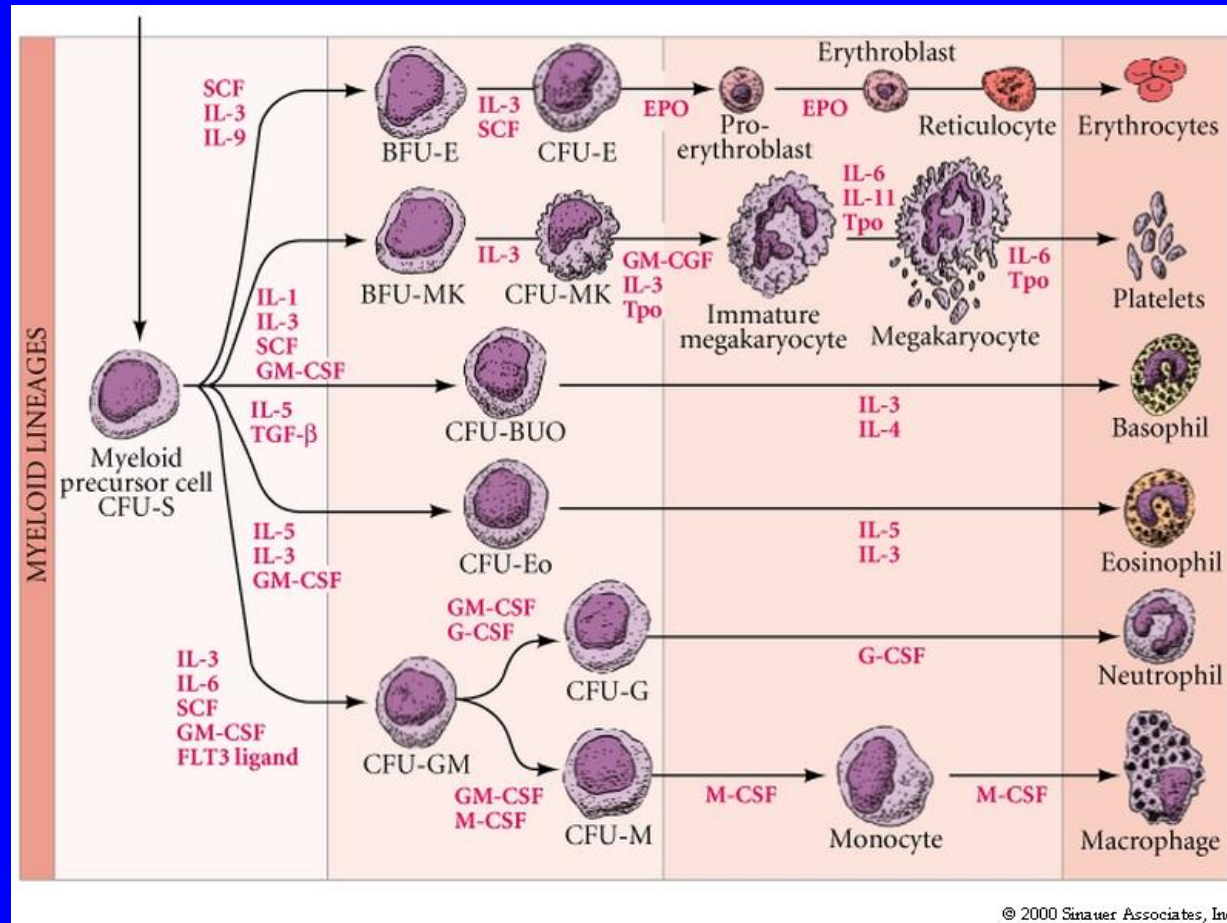
- Stem cells for self-renewing populations
- Several different ones
- How do you sort them out?

Stem Cell: CFU-S

- Experiment 1
 - X-irradiate mouse to kill stem cells
 - inject marked marrow cells from donor
 - each cell forms colony in spleen (clone) = CFU-S
 - include granulocytes, macrophages, platelets, erythrocytes, not lymphocytes



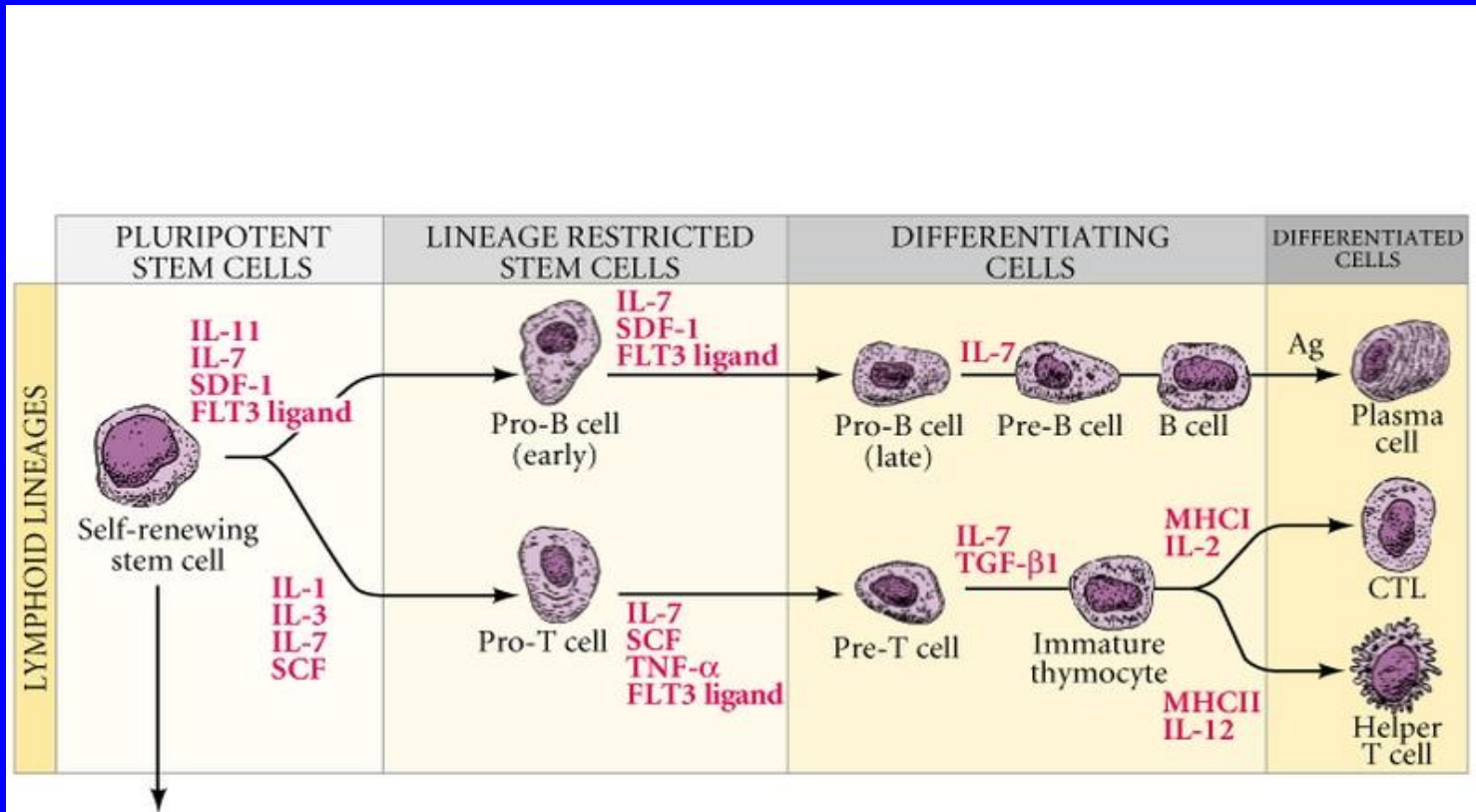
Myeloid Lineage



Stem Cell CFU-L

- Experiment 2
 - inject marked marrow cells in mutant mouse lacking all blood-forming cells
 - rescues mouse and find circulating B and T lymphocytes same abnormality as spleen colonies: clone
 - = CFU-L

Lymphoid Lineage



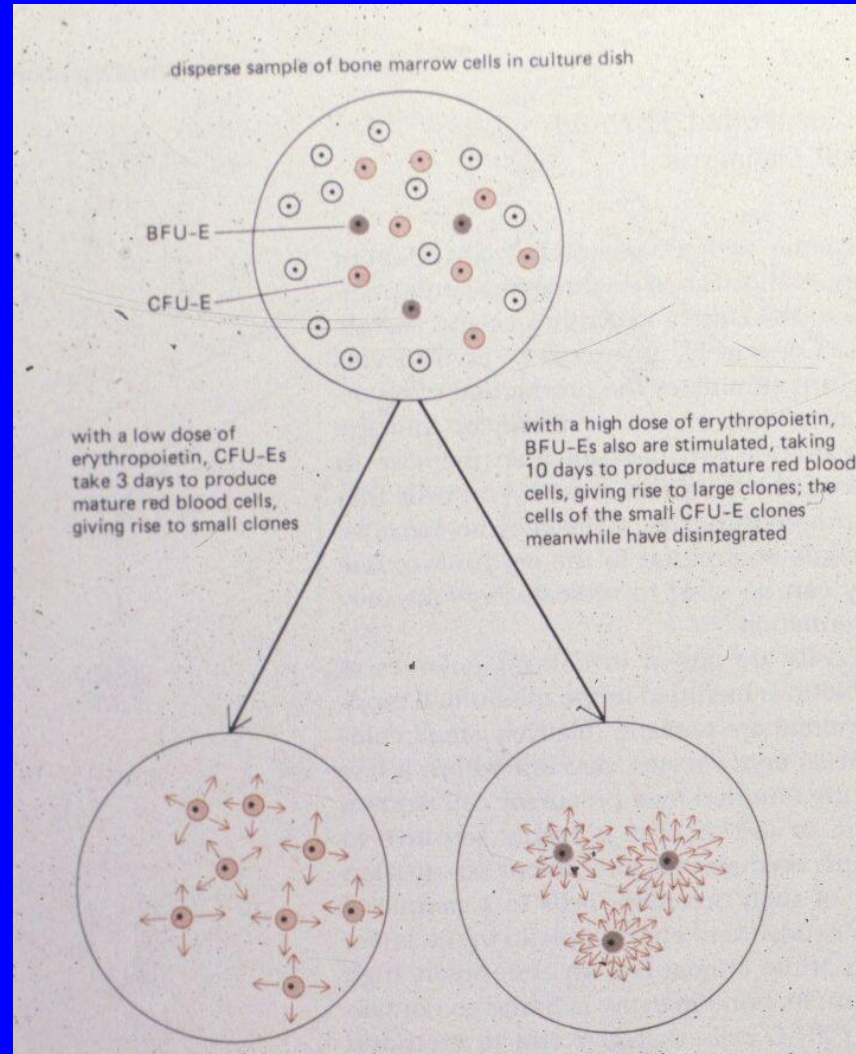
Stem Cell CFU-M,L

- Experiment 3
 - Small number of cells (0.05% of marrow) separated immunologically (unique combination of surface molecules) can give rise to both lymphoid and myeloid cells
 - = CFU-M,L

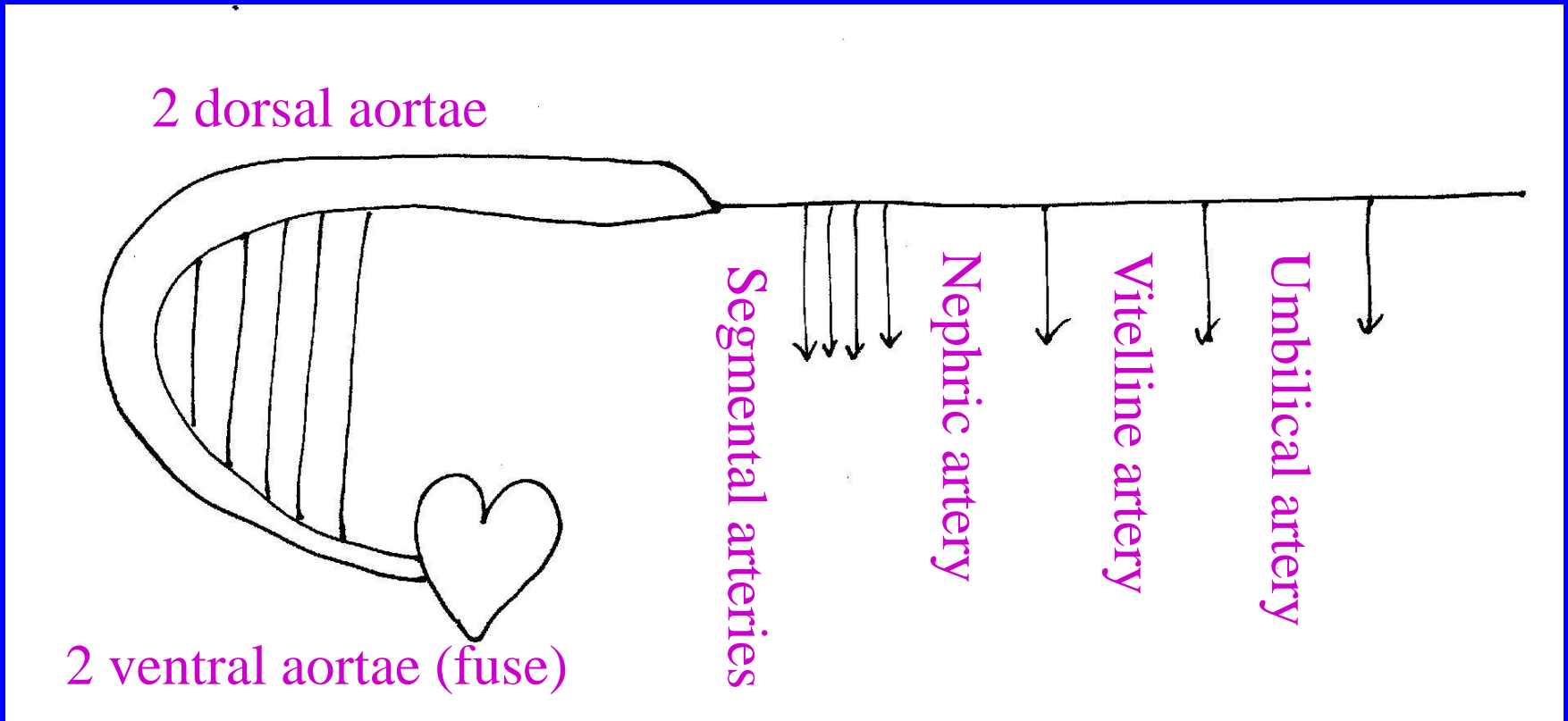
Red Cell Lineage

- Other cells more committed
 - place bone marrow cells in culture with high or low erythropoietin
 - Low: small colonies (ca. 60 cells ca 5 div)
 - High: large colonies (ca. 11-12 divisions)
 - so CFU -> BFU-E (determined) -6-7 div->
 - CFU-E (detm) -5div-> erythrocytes

The BFU-E and CFU-E

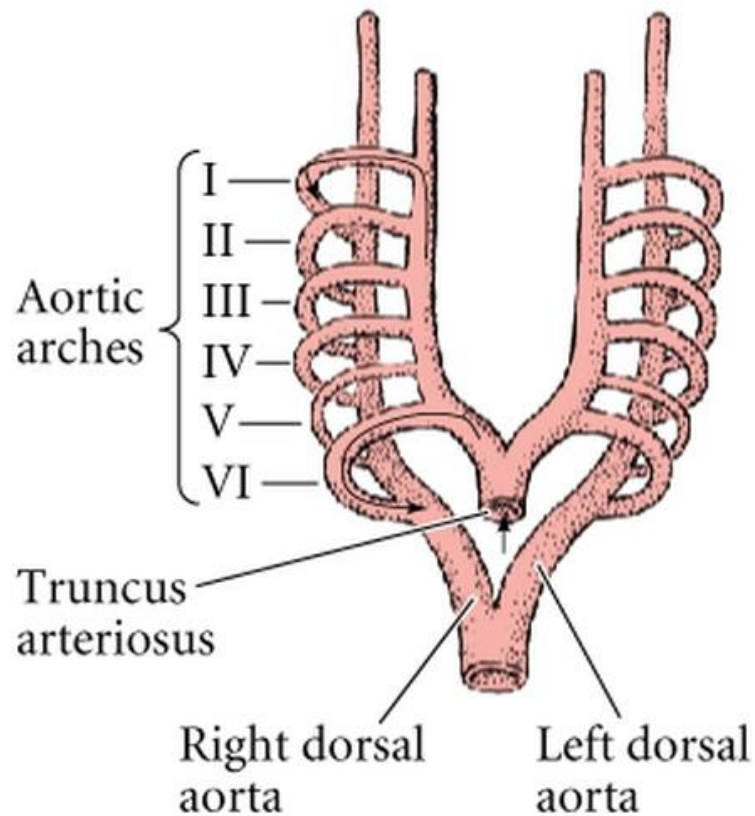


Circulatory System: Arteries



Human Aortic Arches

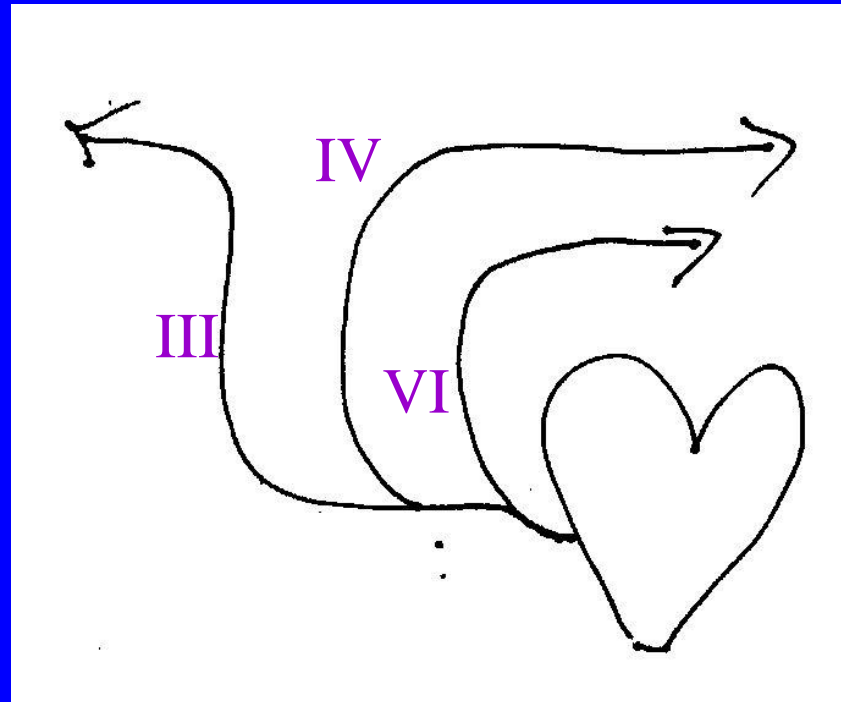
(A) 29 DAYS



Fate of Arches

- I to gills or degenerate
- II to gills or degenerate
- III internal carotids (to brain)
- IV systemic arches through dorsal aorta
- V degenerate
- VI pulmonary arches (to lungs)

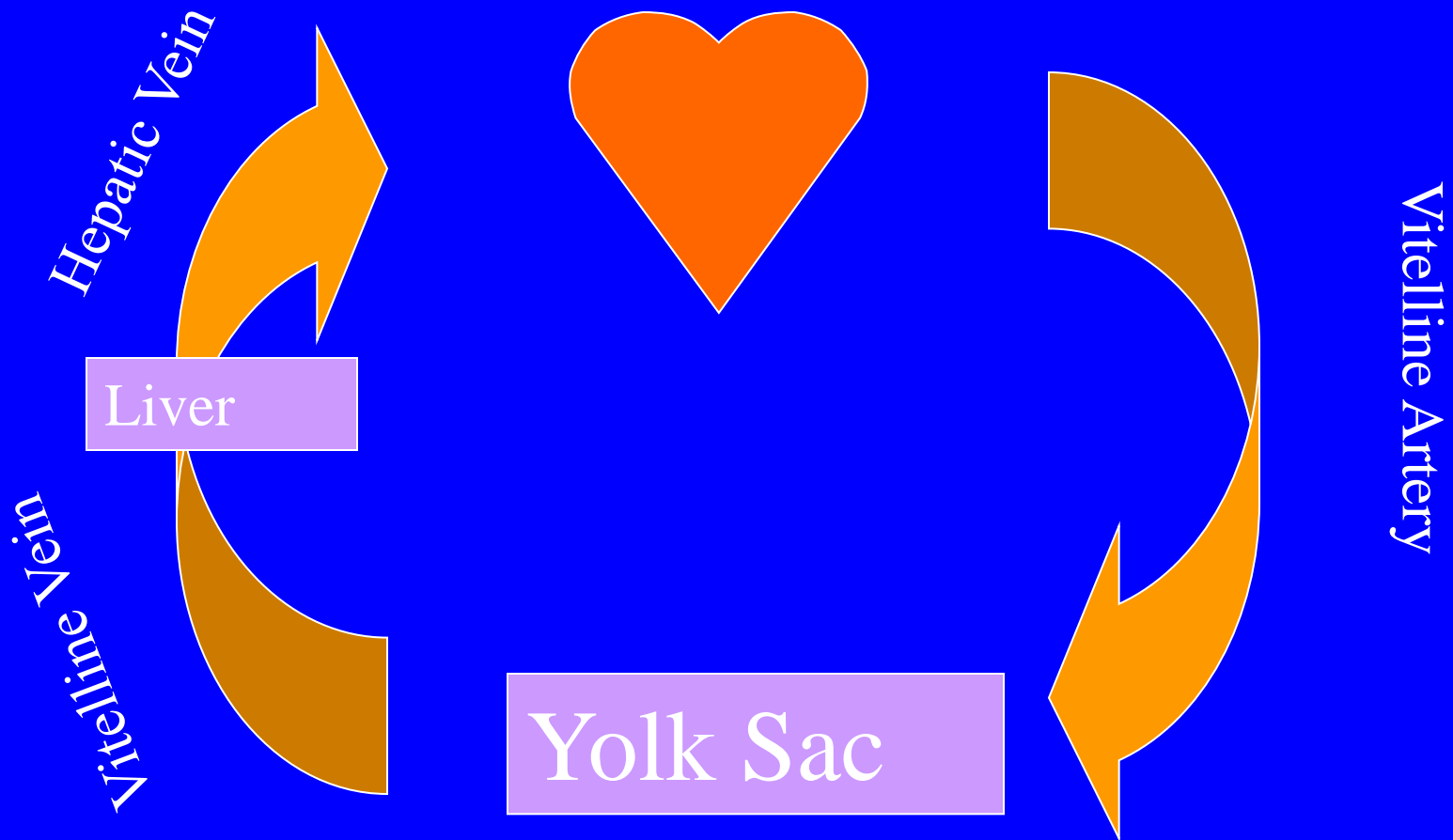
Fate of Arches



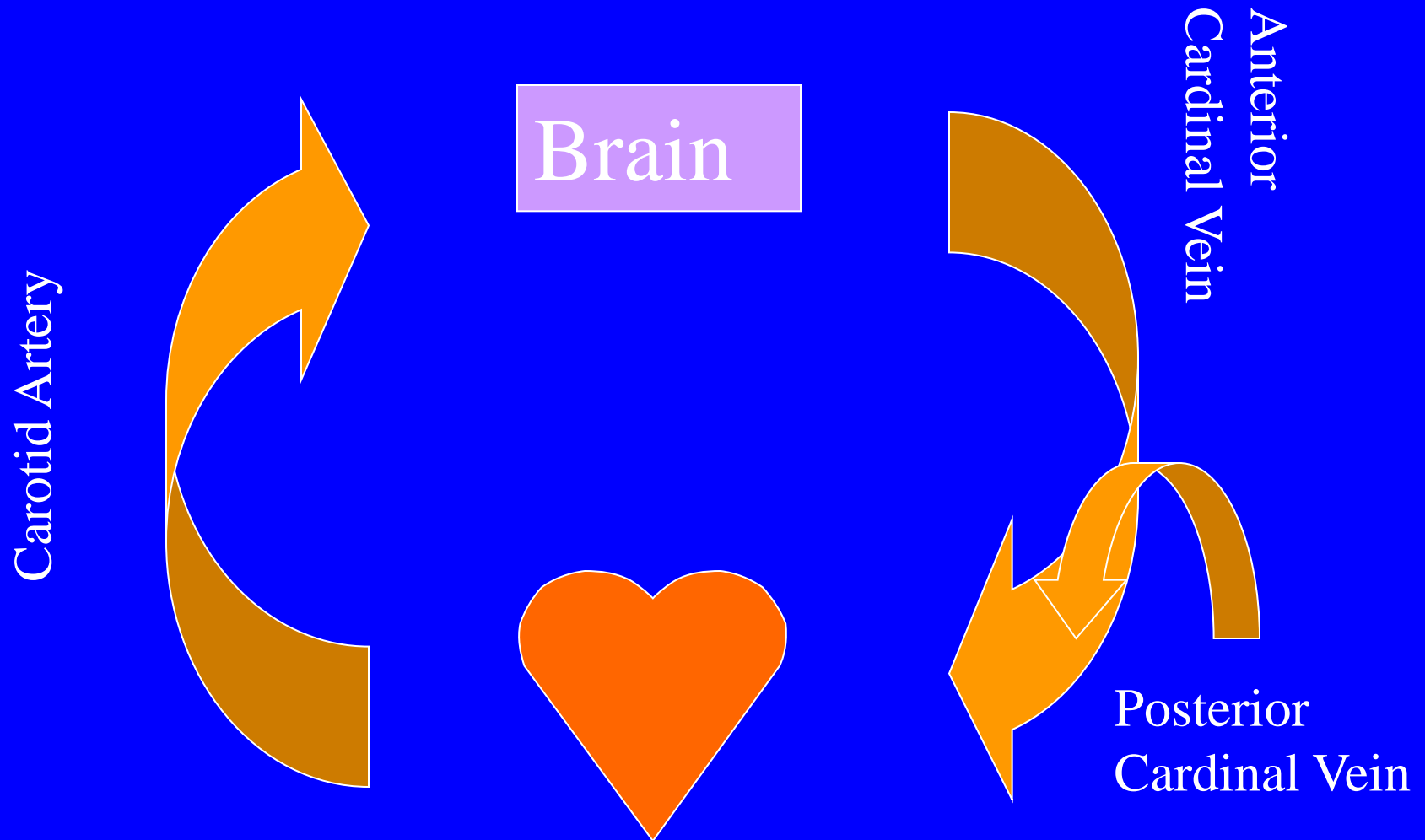
Veins

- *Vitelline*: from yolk, gut, liver (hepatic vein)
- *Posterior cardinal*: from body wall, drains kidneys
- *Anterior cardinal*: from brain
- *Umbilical*: from allantois
- *Pulmonary*: from lungs

1. Vitelline (Splanchnic) Arc



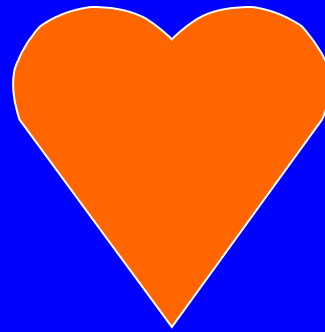
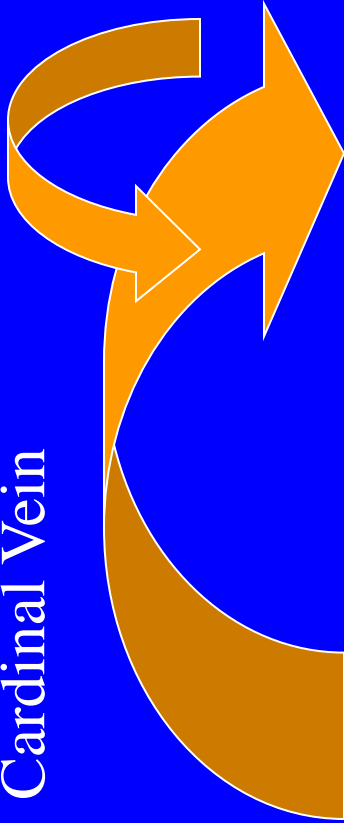
2. Anterior Cardinal (Somatic) Arc



3. Posterior Cardinal (Somatic) Arc

Anterior Cardinal
Vein

Posterior
Cardinal Vein

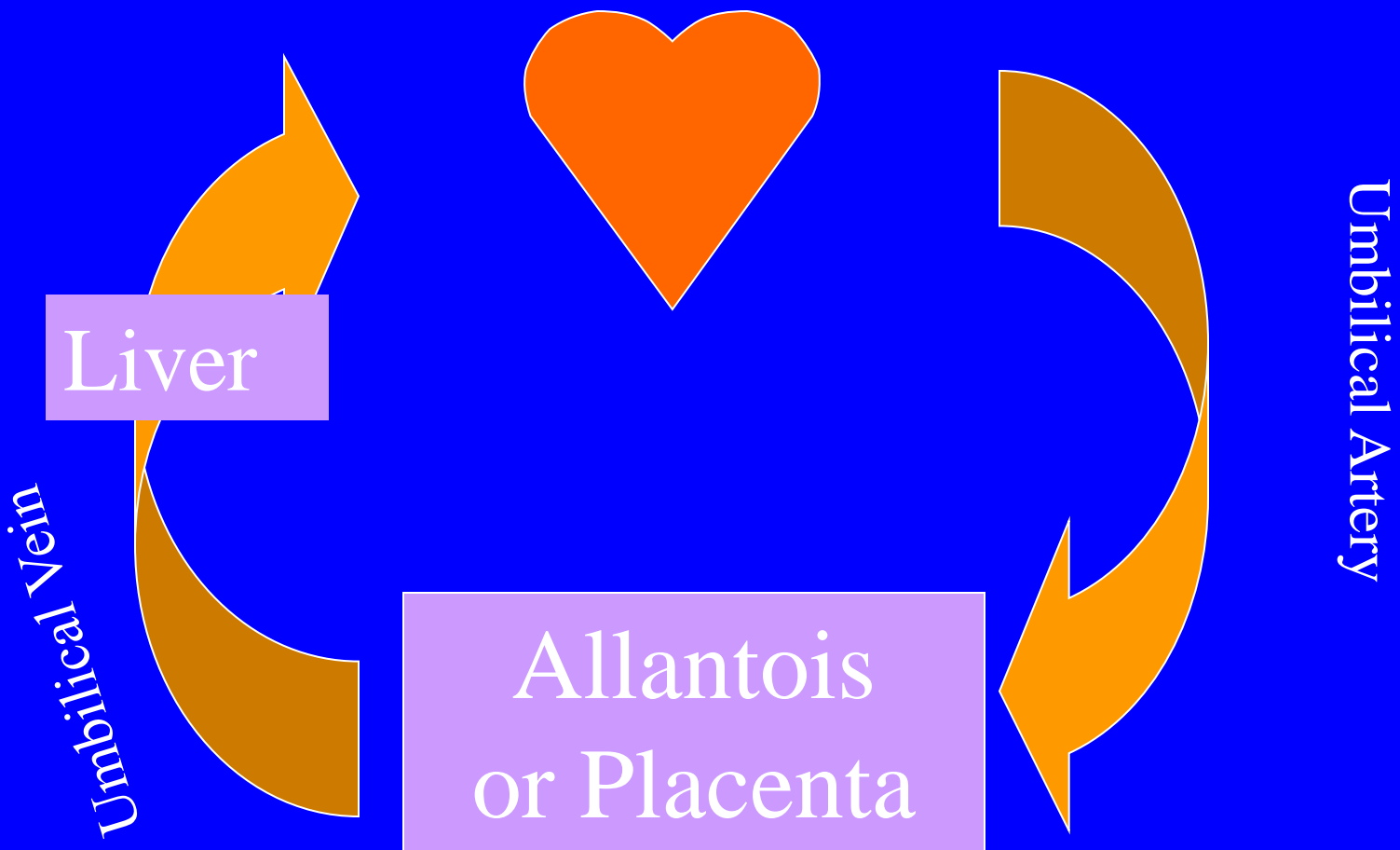


Somites,
Nephros

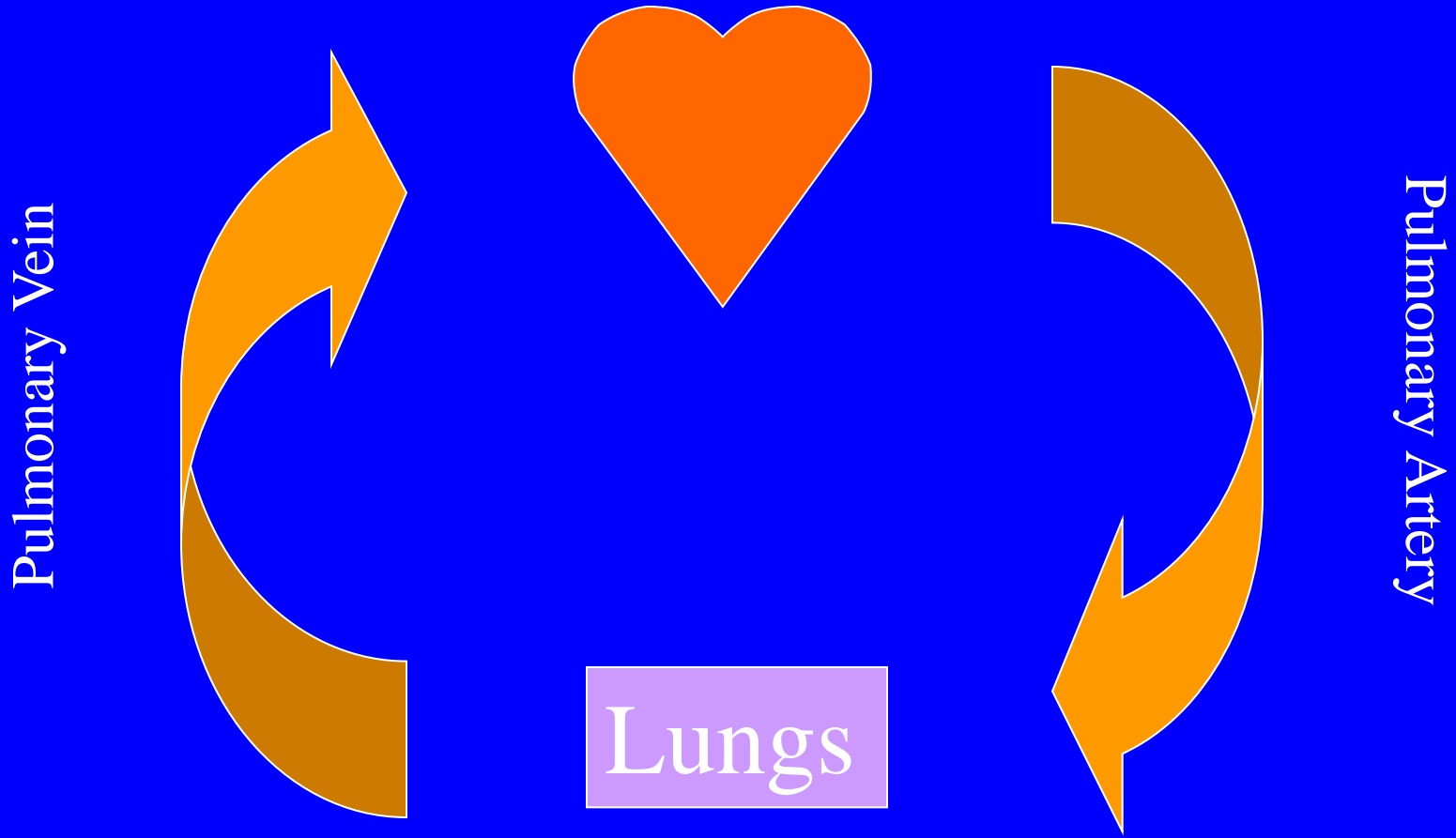


Dorsal Aorta,
Nephric Artery

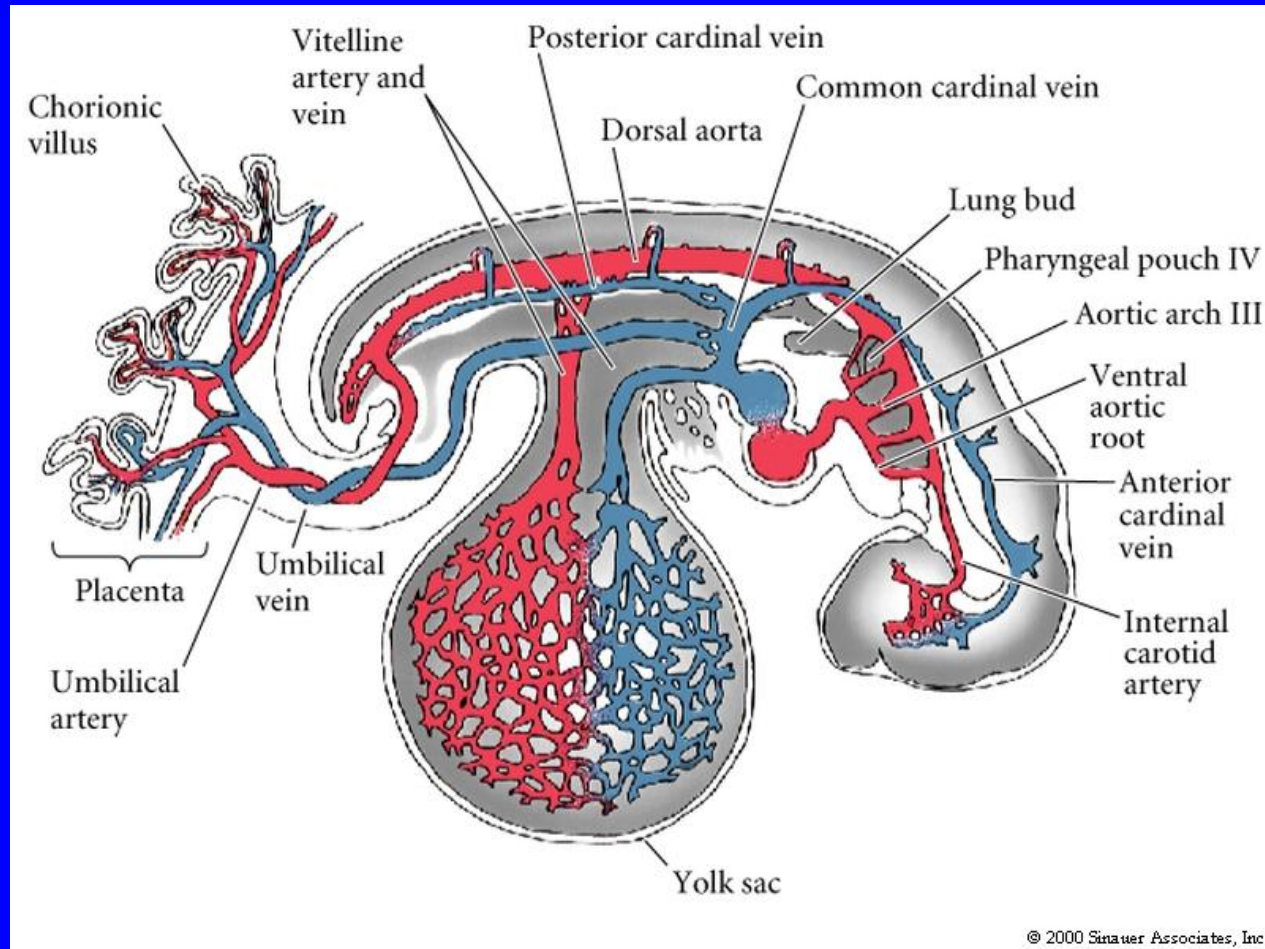
4. Umbilical (Allantoic) Arc



5. Pulmonary Arc



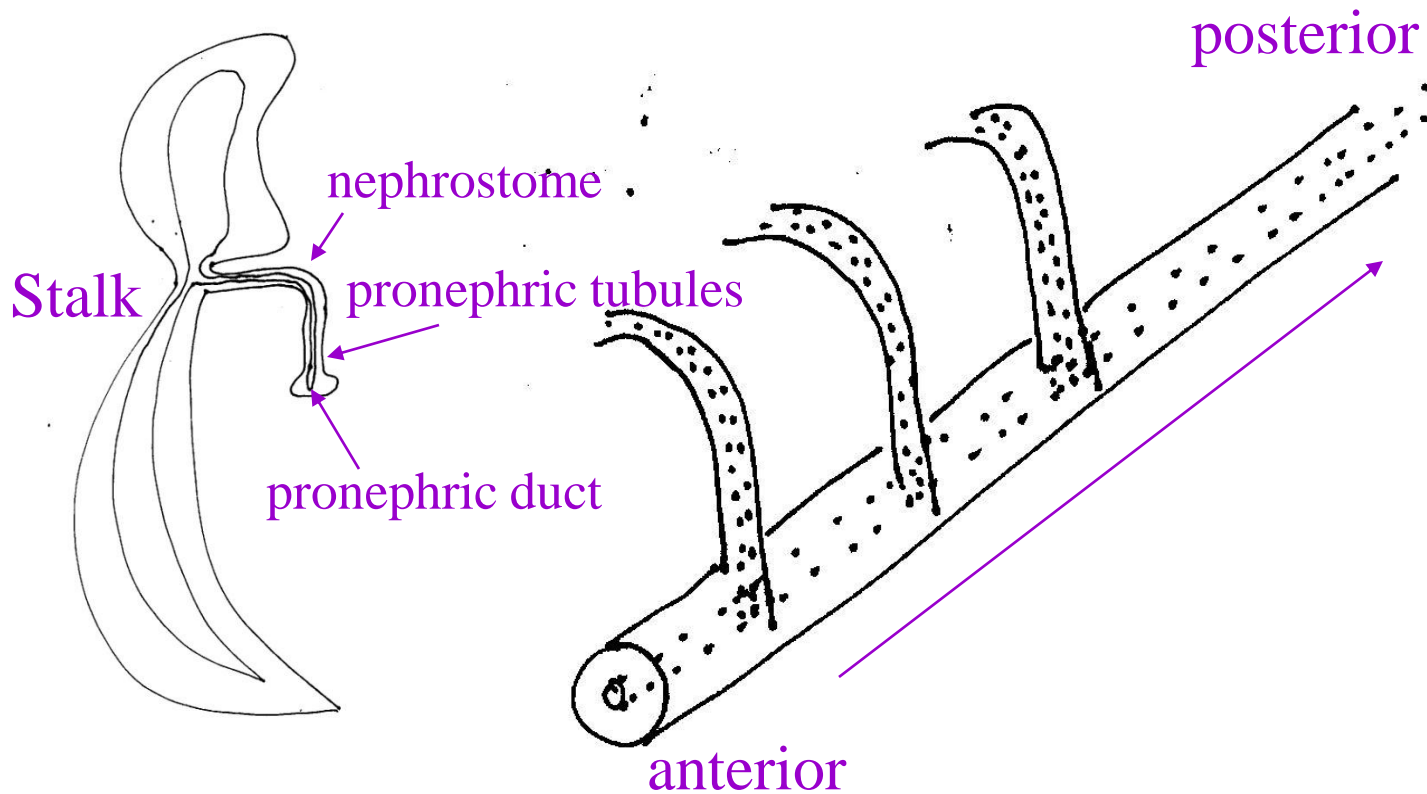
4-Week Human Embryo



Urogenital Formation

- From stalk region
 - pronephros
 - mesonephros
 - metanephros (forms adult kidney)
- Mesonephric duct from pro and mesonephros forms Wolffian duct (male gonadal)
- Female Mullerian (ovi)ducts form separately (paramesonephric ducts)

Kidney Formation



Vertebrate Kidney

