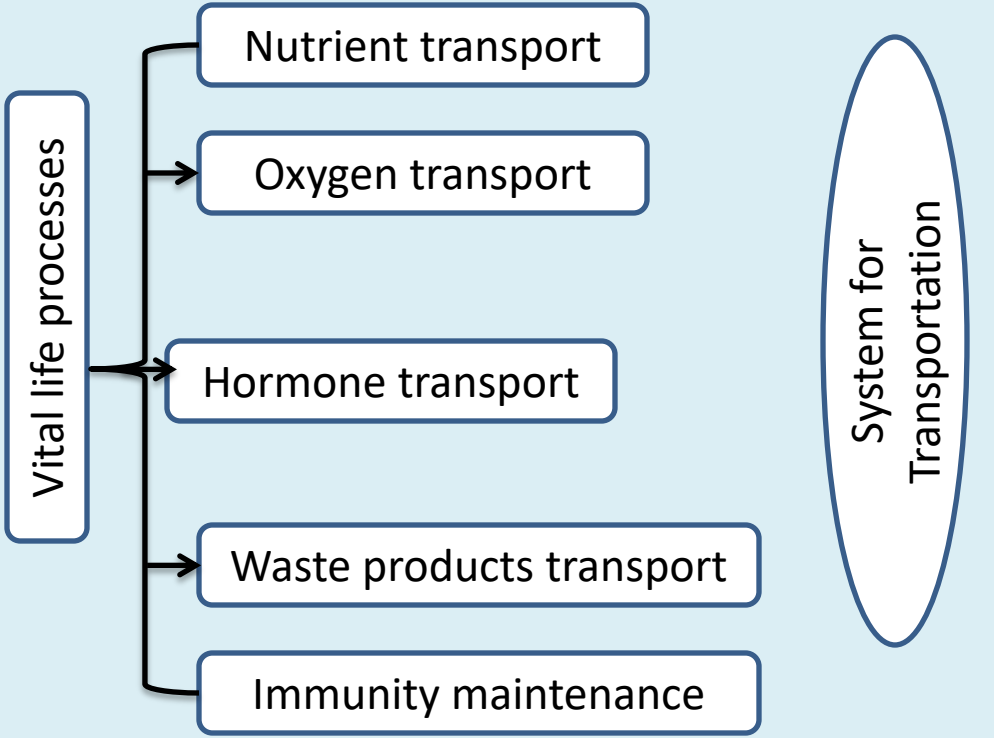
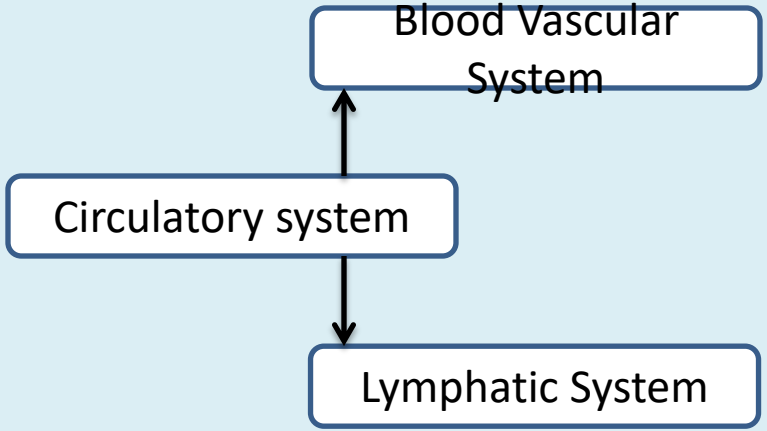
CIRCULATION
TYBSc Paper 1 unit 2

CIRCULATION





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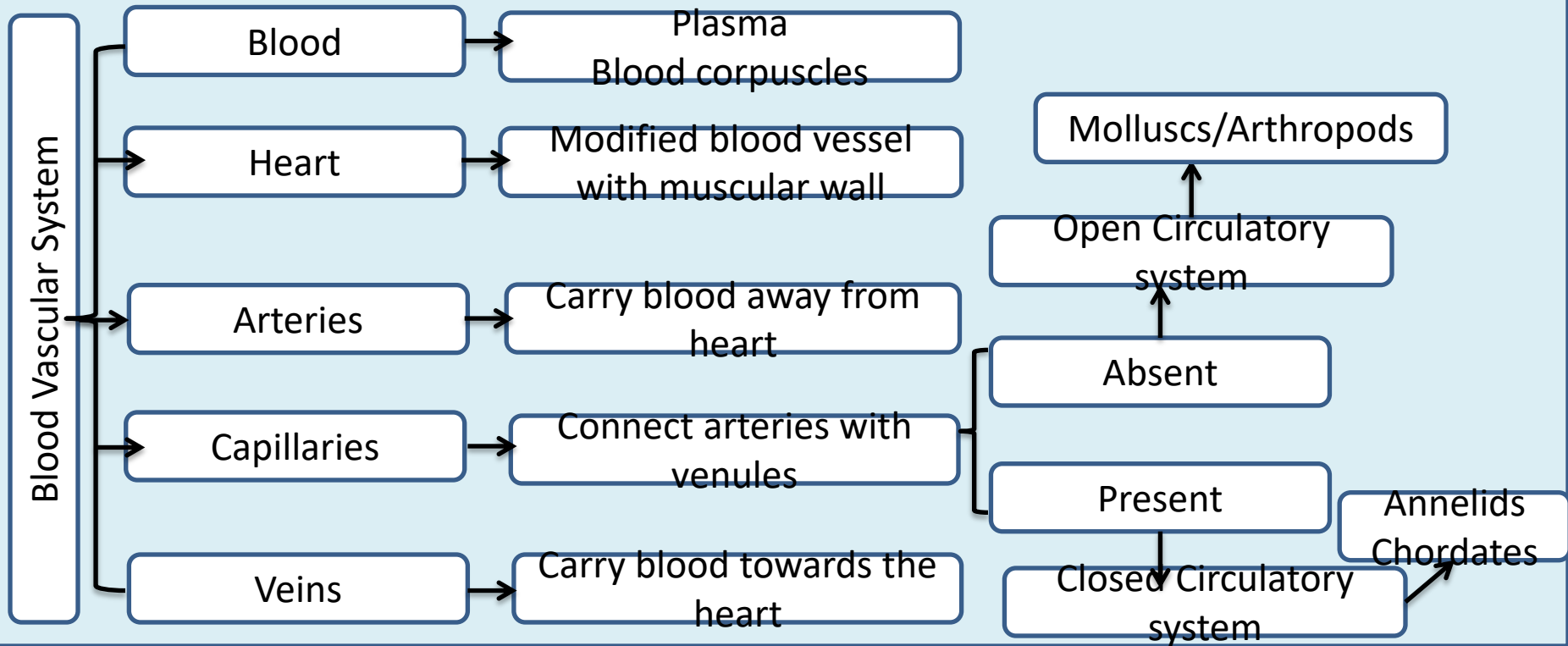

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Lymphatic System

Occurs exclusively in chordates except cyclostomes and chondricthyes

- **Lymph**
  - Tissue fluid
- **Lymph capillaries**
  - Network of minute blind ending channels
- **Lymph vessels**
  - Thin walled vessels, formed by the union of lymph capillaries
    - Empty into veins
- **Lymph nodes**
  - Found only in mammals on lymph vessels.
  - Produces lymphocytes
  - Forms important link in immune system

- Introduction
- BVS---- Heart, Aortic arches, Venous system-→Shark (Blue print of venous system)
- ---- LS--→

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Lymphatic system in fishes

- Lymph vessels -→ well developed
- Present below skin, muscle and viscera
- Run along larger veins and extend into head tail and fins
- Lymph hearts are present in some fishes
- Lymph nodes are lacking

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- Lymphatic system in frogs
  - Subcutaneous Lymph sinuses
    Subvetebral Lymph sinuses
  - Lymph Hearts-→ 2 pairs
- Lymphatic system in reptiles
  - Main lymphatic vessel---subvertebral trunk
  - Lymph Hearts-→ 1 pair
- Lymphatic system in birds
  - Thoracic ducts--→ Pre caval
  - Lymph Heart present in embryonic stage but lost in adults

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Lymphatic system in mammals

Lymphatic system is highly developed

Larger lymphatic vessels are interrupted by lymph nodes

Head, neck, armpit, groin, tonsils, Payer's patches in intestine

Lacteals-→ transports emulsified fat-→ chyle

No lymph hearts

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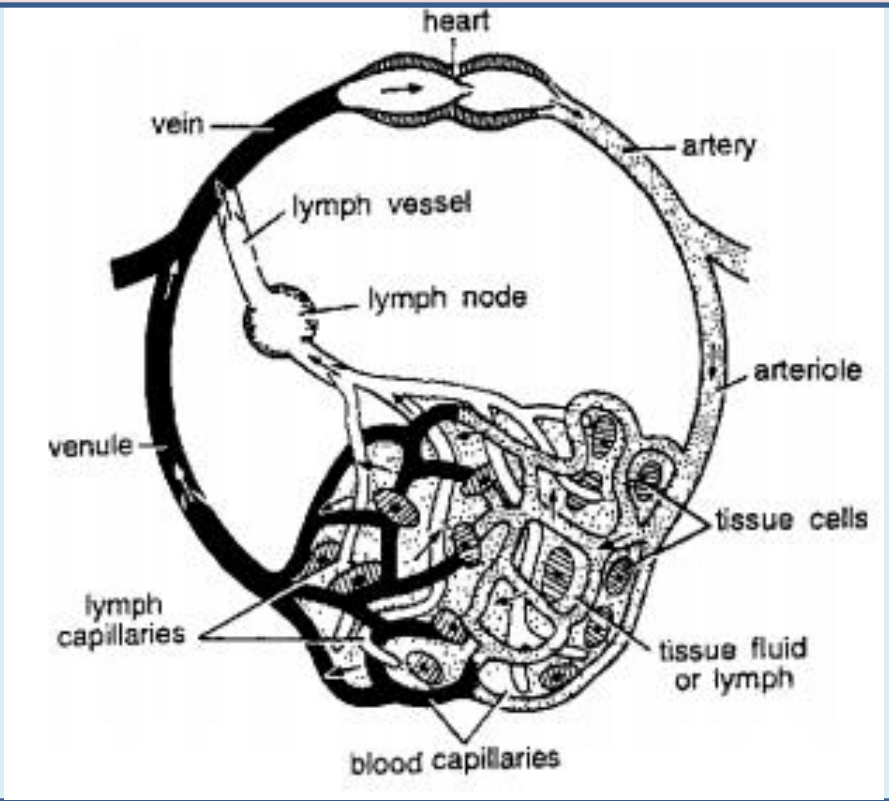
Fundamental structure of typical mammalian circulatory system



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Modification of Heart

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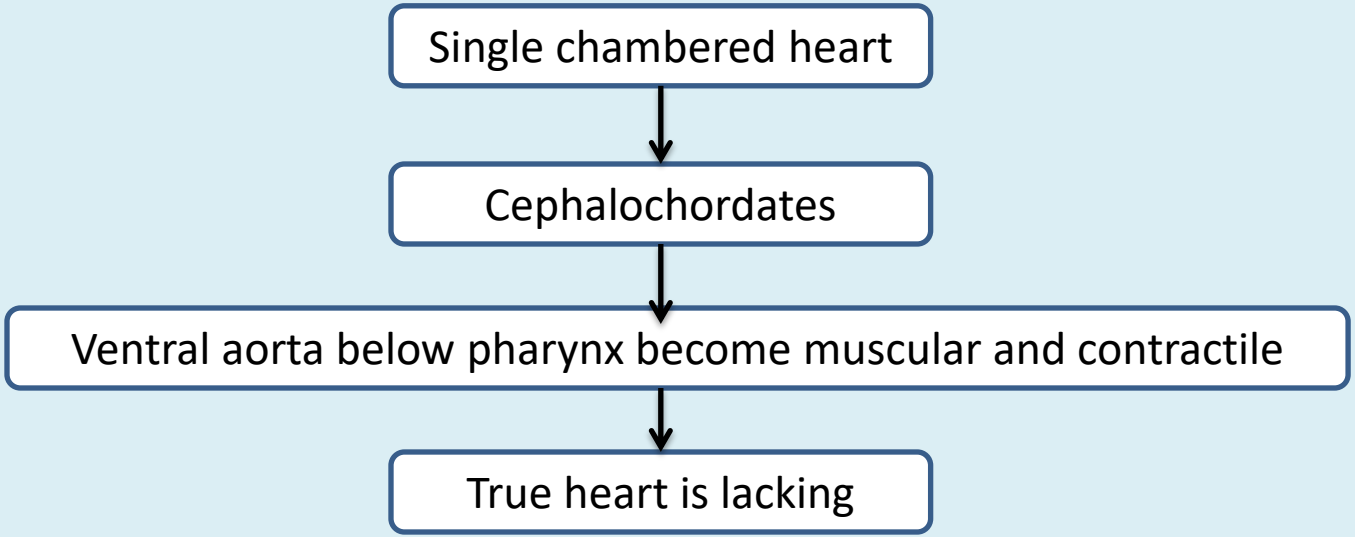


CIRCULATION

Progressive modifications of heart from primitive to higher chordates occurs on the following lines :

Cardiac tube forms chambers due to constriction

↓

Each chamber tends to divide into two separate chambers due to formations of partitions

↓

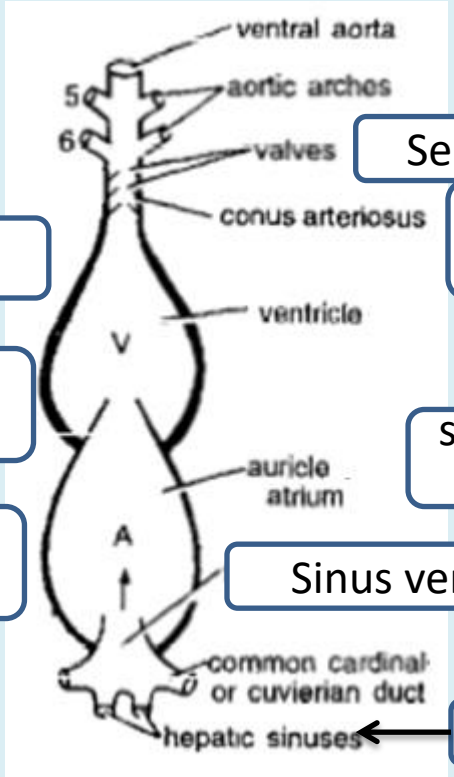
Heart gradually shifts from just behind head (fishes, amphibians) near gills into thoracic cavity (amniotes) with elongation of neck and development of lungs

Heart of Cartilagenous fish

2 chambered heart in Pisces

Muscular and dorso-ventrally bent, S-shaped tube

4 chambers arranged in a linear sequence



Semi lunar valves

Muscular tube of narrow diameter

Ventricle
Thick muscular walls

Auricuoventricular opening

sino-atrial aperture guarded by a pair of valves.

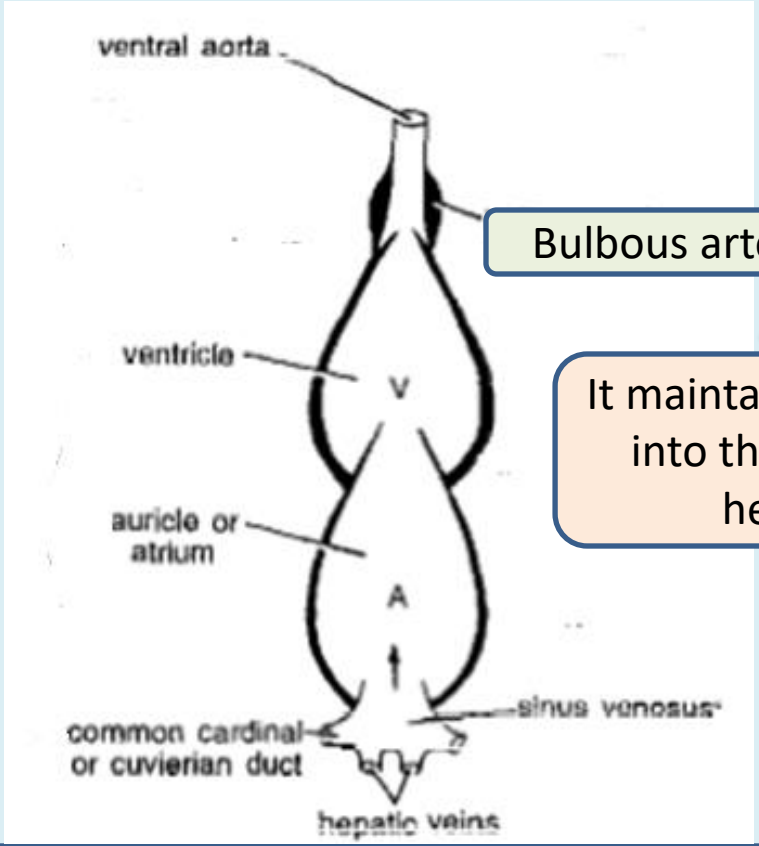
Auricle--Thin-walled, elastic and muscular chamber

Sinus venosus→Thin-walled

Venous blood

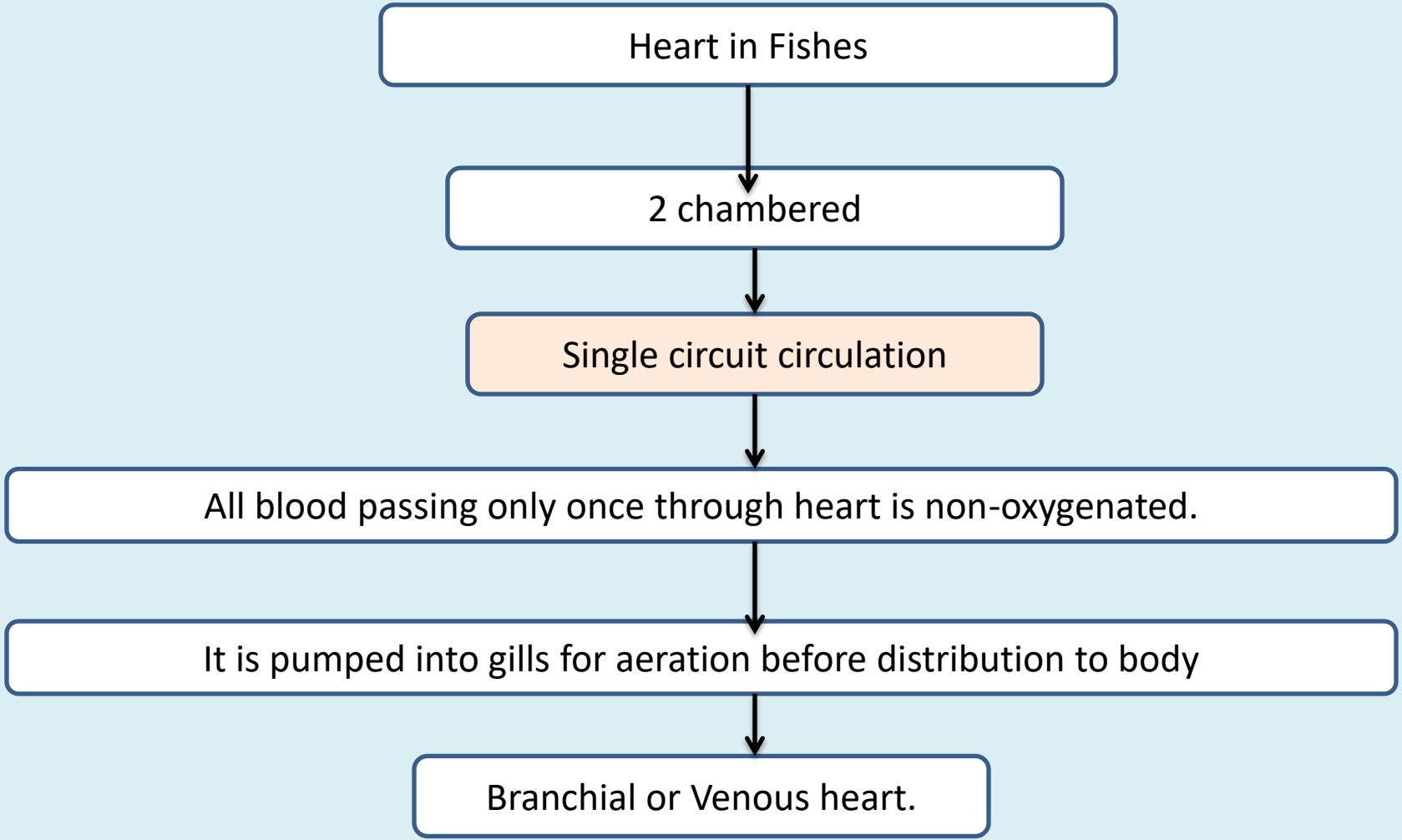
2 chambered heart in Pisces

Heart of Teleost fish



Bulbous arteriousus

It maintains a steady blood flow into the gill system through heart contraction.


Heart in Fishes
2 chambered
Single circuit circulation
All blood passing only once through heart is non-oxygenated.
It is pumped into gills for aeration before distribution to body
Branchial or Venous heart.

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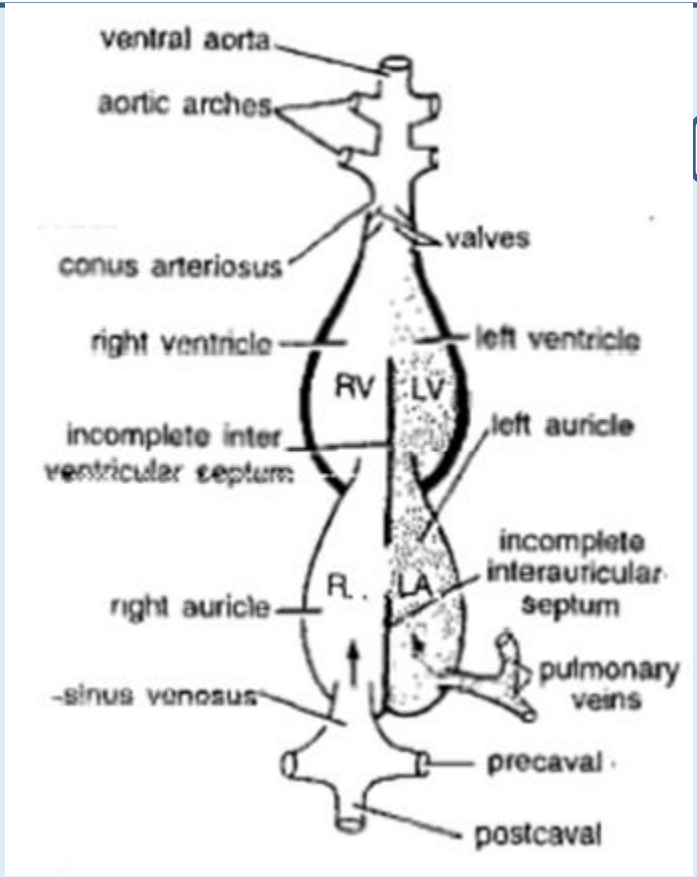

Heart of Dipnoi fish

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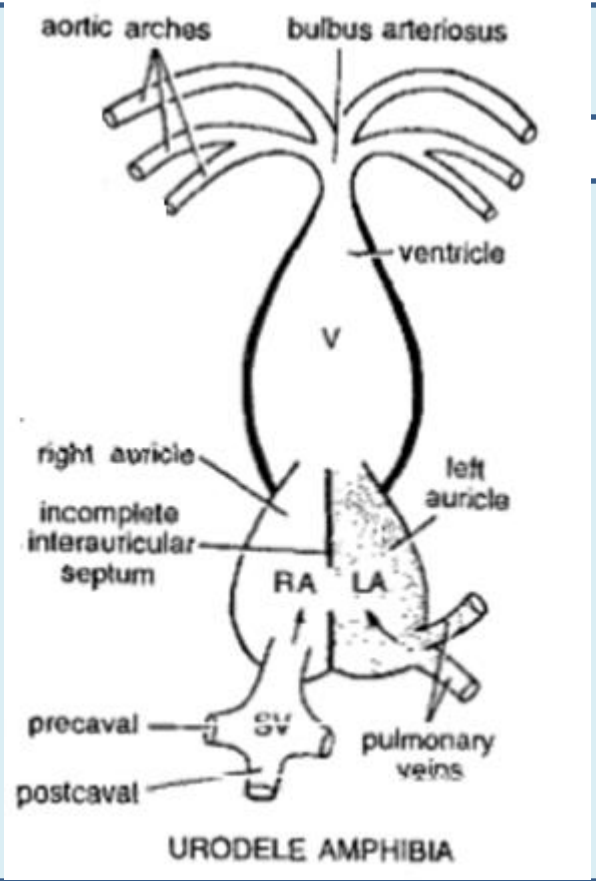

Heart of Urodele

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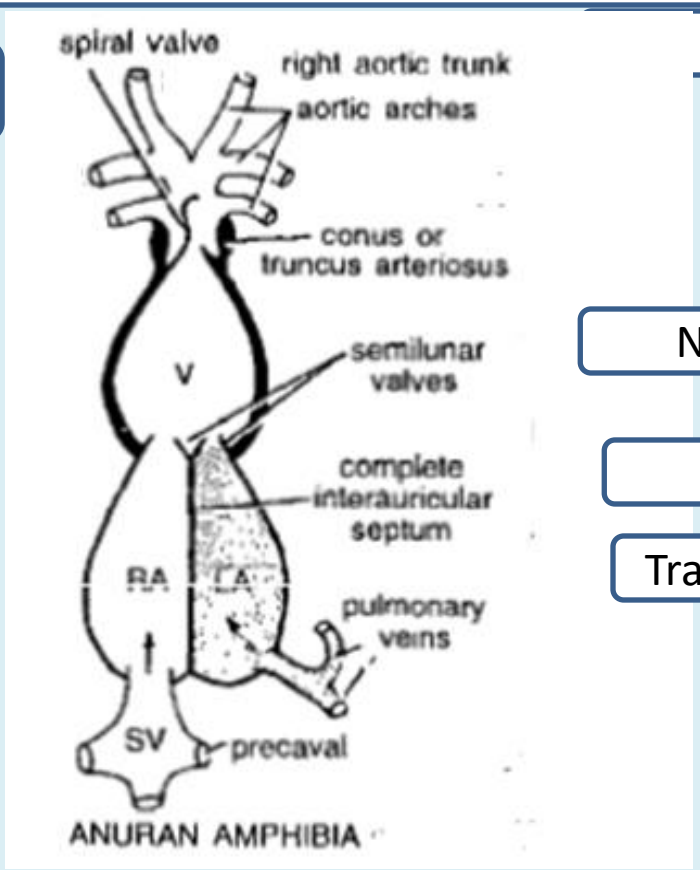
Lumen of Conus arteriosus

Pylangeum

Spiral valve/ Septum bulbi

- Cavum pulmocutaeneum
- Cavum aorticum



Heart of Anura

No Interventricular septum

Ventricle is thick walled

Trabeculae→ less mixing of blood

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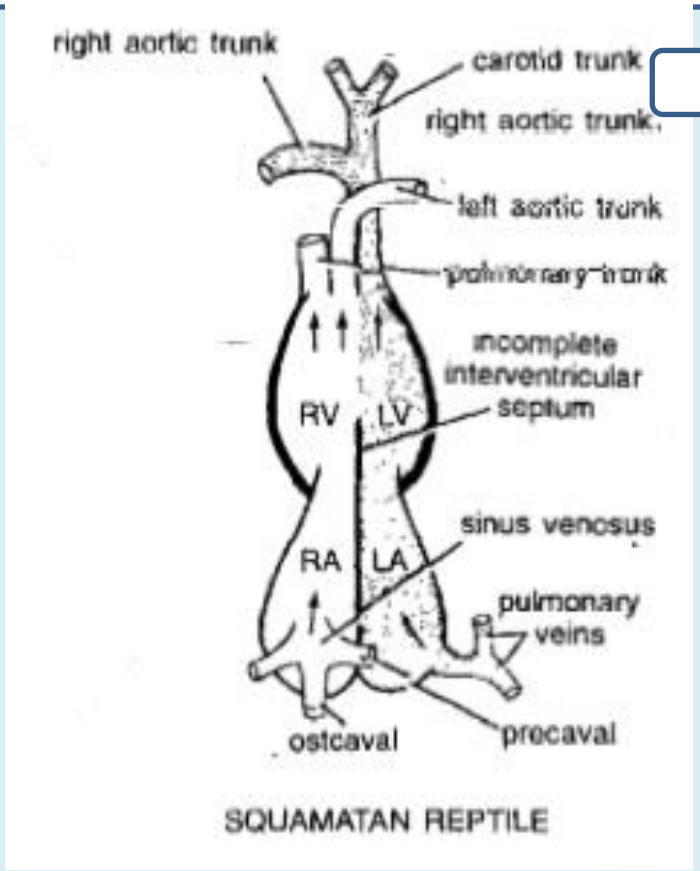

Heart of Squamatan reptile

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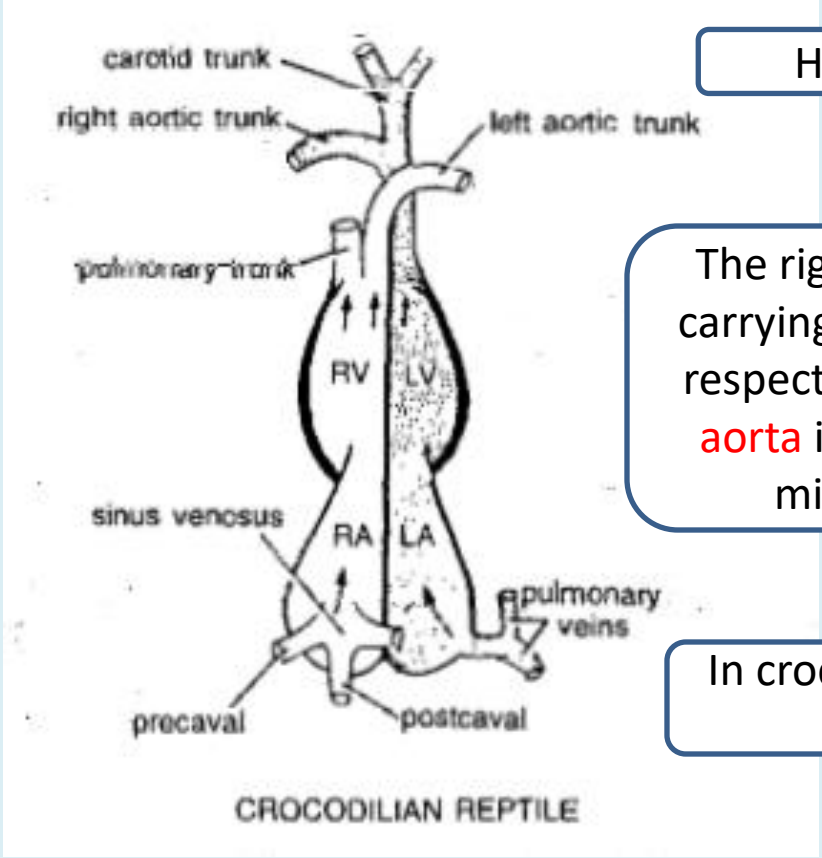

CROCODILIAN REPTILE

Heart of Crocodilian reptile

The right and left systemic aortae, carrying arterial and venous bloods, respectively, join to form the dorsal aorta in which the two bloods get mixed before distribution.

In crocodiles foramen of panizza becomes obliterated

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Amphibian heart with only 3 major chambers (2 auricles, 1 ventricle)

Reptilian heart with partially 4 chambers (2 auricles, 2 incomplete ventricles)

Permit a partial mixing of arterial and venous bloods before distribution

Transitional hearts

Showing a midway condition between 2-chambered heart of fishes with a single circulation and 4-chambered hearts of birds and mammals with double circulation and complete separation of arterial and venous bloods.

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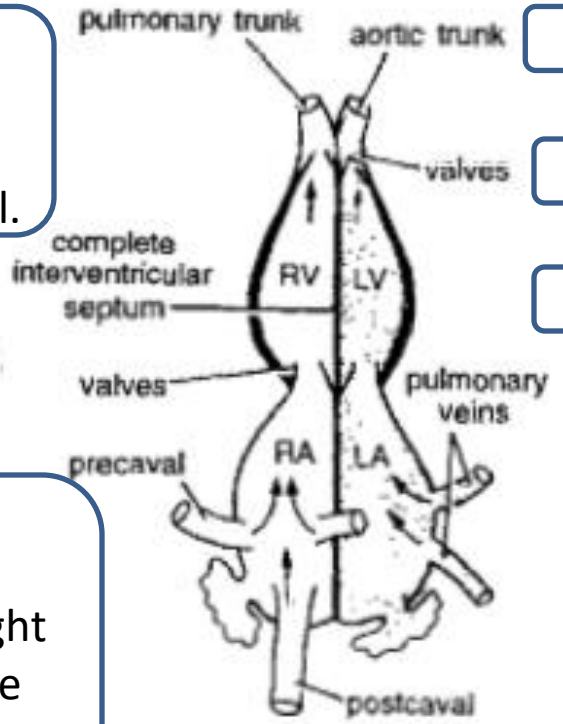
Sinus venosus →absent →completely incorporated into right auricle which directly receives two precavals, postcaval.

sulcus terminalis

crista terminalis

Primitive conus arteriosus is completely replaced by a pulmonary aorta leaving the right ventricle for lungs, and a single systemic aorta leaving the left ventricle for body.



Heart of Birds and Mammals

Double Circulation

Pulmonary heart

Thebsian valve/Coronary valve

Fossa ovalis
Annulus ovalis

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Aortic Arches in Vertebrates

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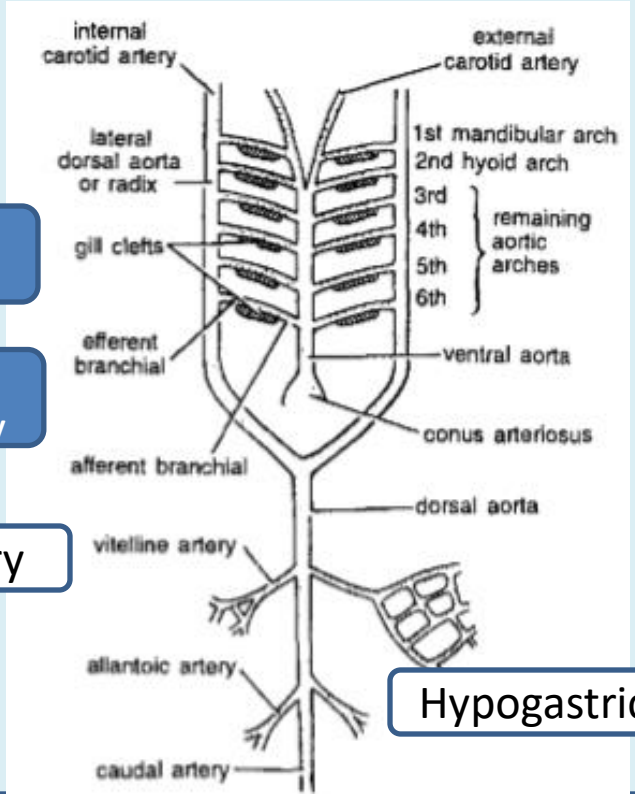
Basic Plan of Aortic Arches in Vertebrates



Ventral afferent Branchial artery

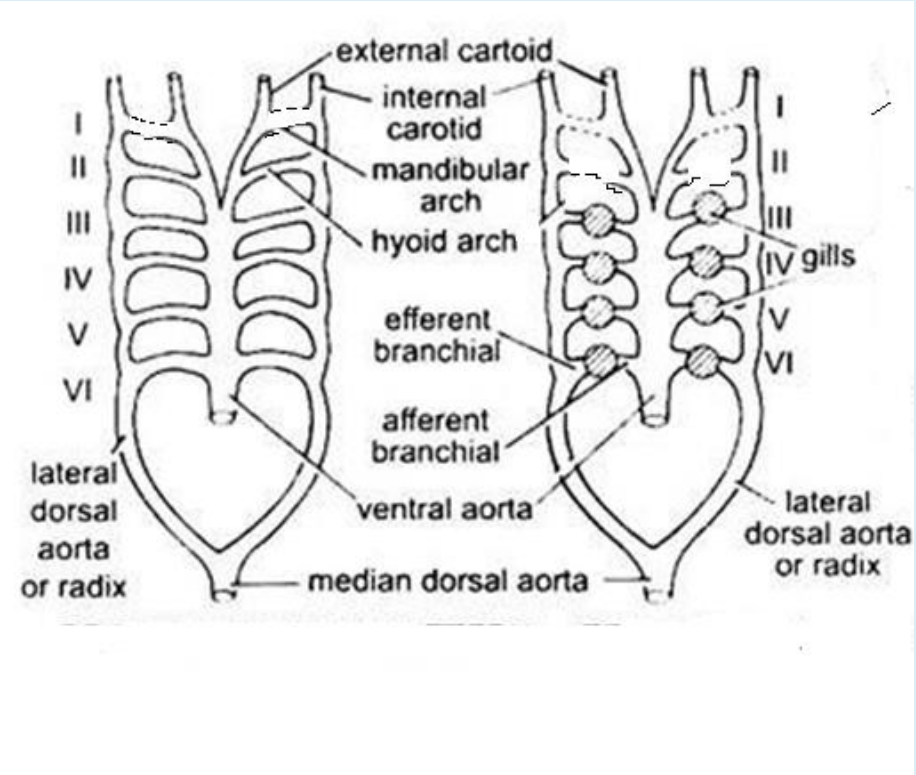
Dorsal efferent Branchial artery

Mesentric artery

Hypogastric artery

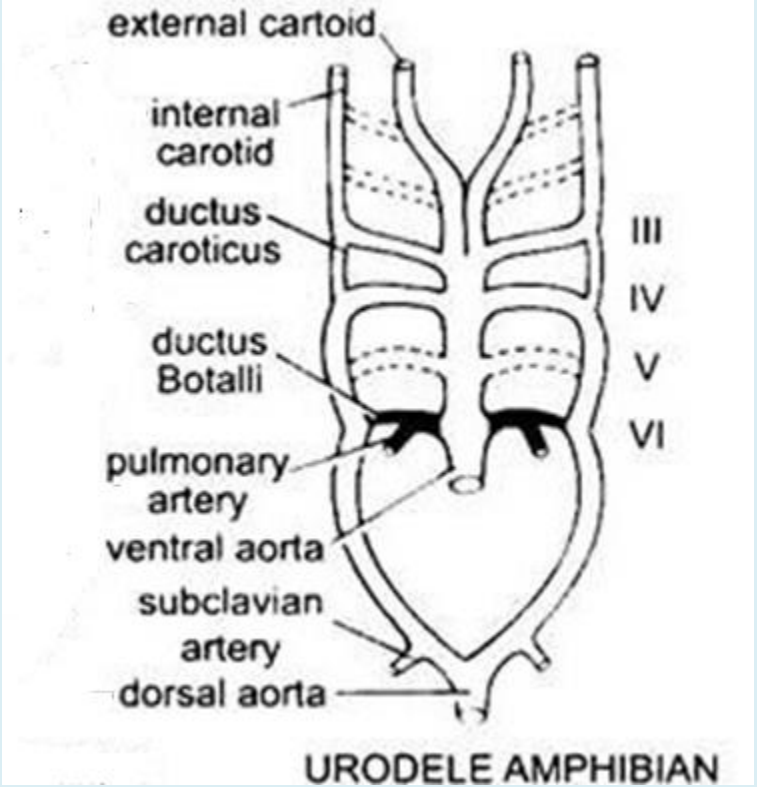
Internal Iliac artery

CIRCULATION

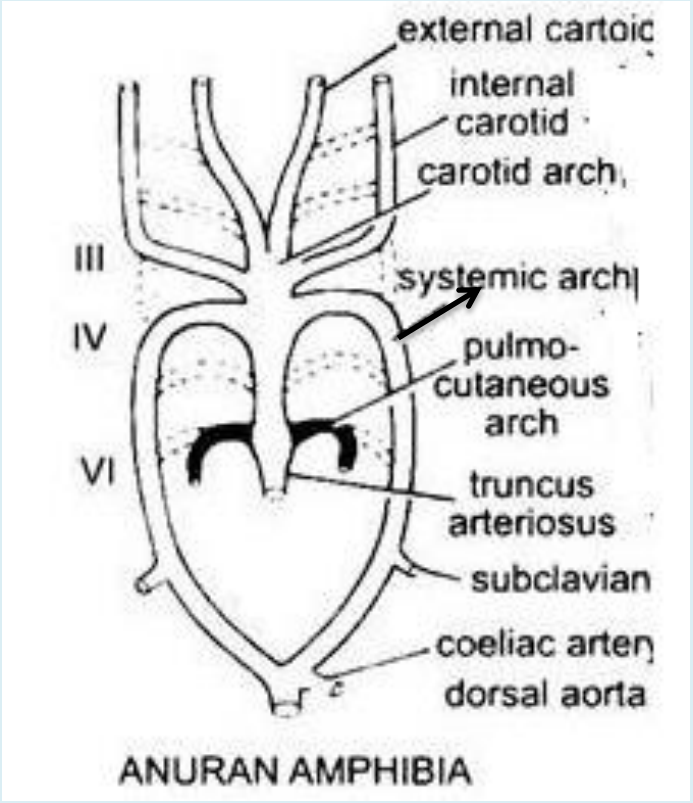


- Reduction in number of aortic arches
- Primitive elasmobranch--- 7pairs
- Fish embryos----6
- Adult----- 4-5
- Sharks---5 pairs----II, III,IV,V, VI--- functional
- First gill slit-→ spiracle, mandibular arch absent
- Bony fishes----- III, IV, V, VI (4 pairs)
- Lung fishes---gills are poor---Pulmonary artery-→efferent part of 6 arch----

CIRCULATION



URODELE AMPHIBIAN



ANURAN AMPHIBIA

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Reptiles

Fully terrestrial

Gills disappear

Lungs appear

3 Functional aortic arches

III, IV &VI arch

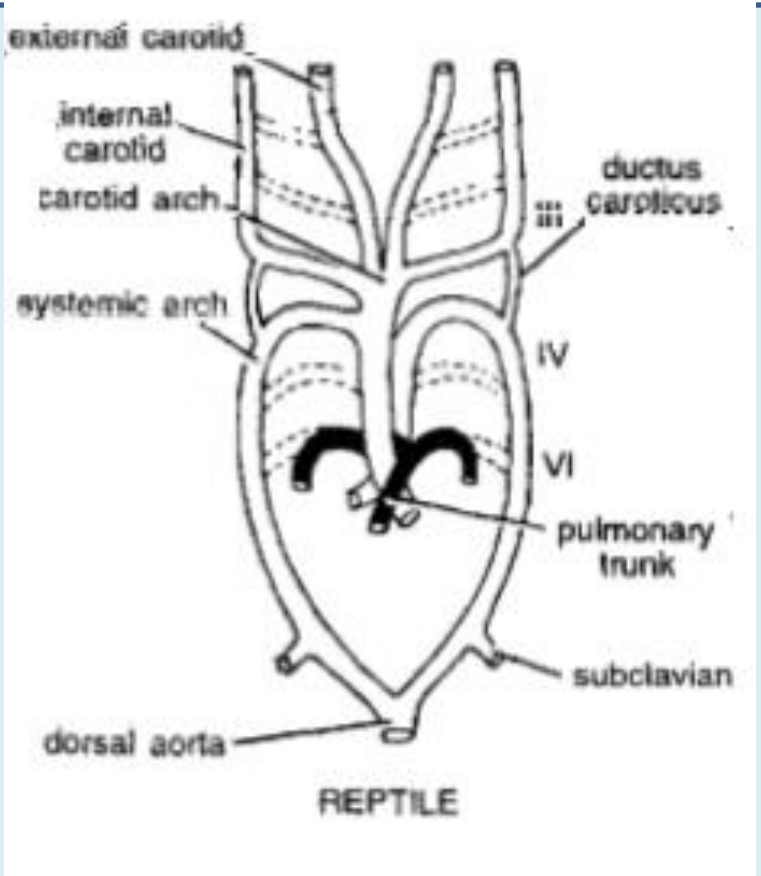
Elongation of neck

Posterior shifting of heart

Partial division of ventricles

Modifications of Aortic arches

CIRCULATION



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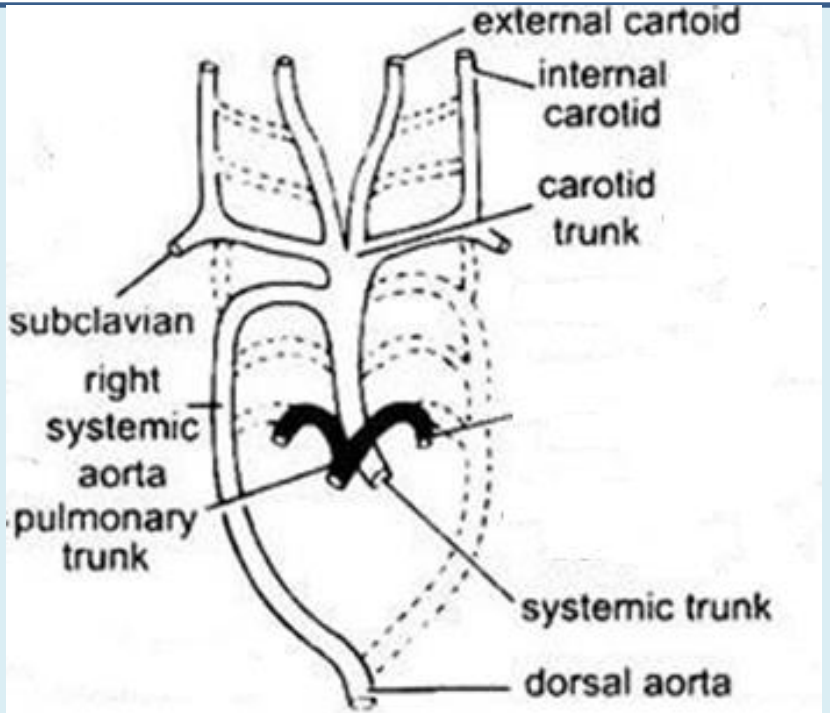

BIRD

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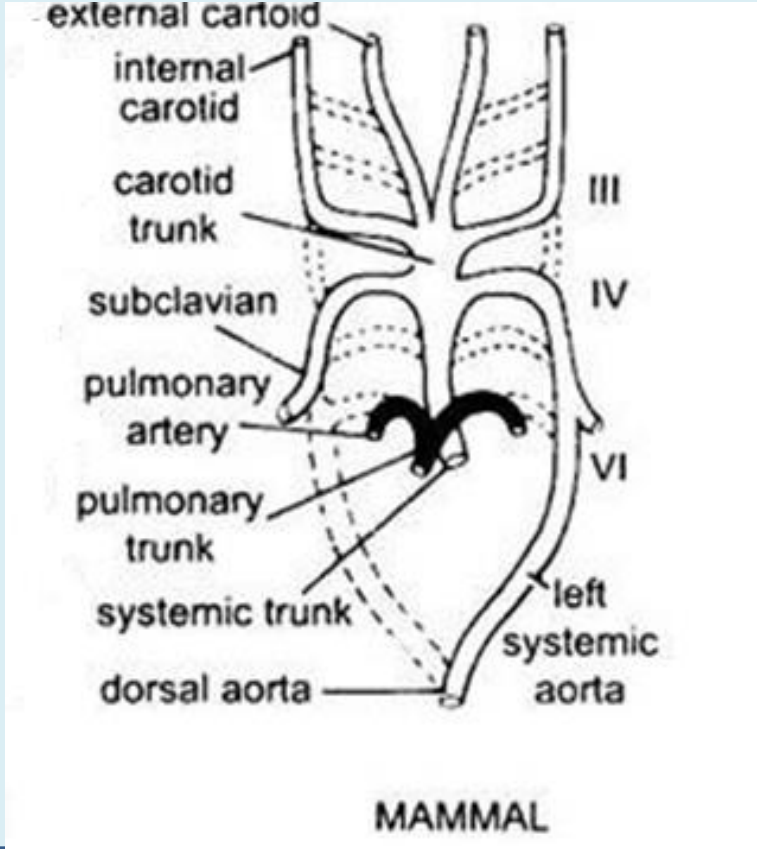

- Aortic arches
- Embryo (Primitive forms)---- 6 pairs ----1arch--- Mandibular arch, Hyoid arch, 3,4,5,6
- Fishes---- Cartilagenous--- 5 pairs, Bony fish--- 4 pairs
- Mandibular arch is absent, Hyoid arch is absent
- Amphibians--- 3 pairs (3,4,6 arch functional Urodele anura--- ductus aorticus
- Reptiles 3 pairs (3,4,6 arch functional)

- Birds 3 pairs(3,4,6 arch functional)

- Mammals 3 pairs (3,4,6 arch functional)

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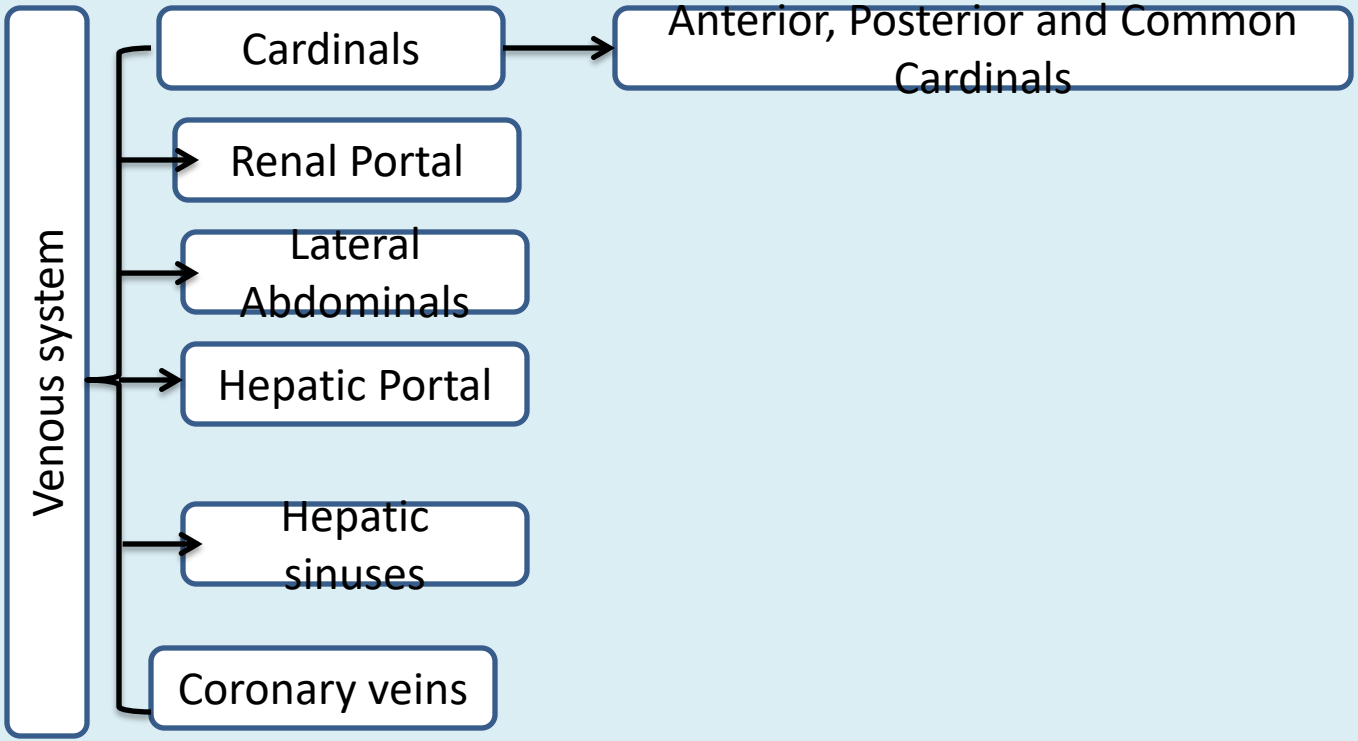
Deoxygenated or venous blood from different parts of the body is returned to the heart via veins.



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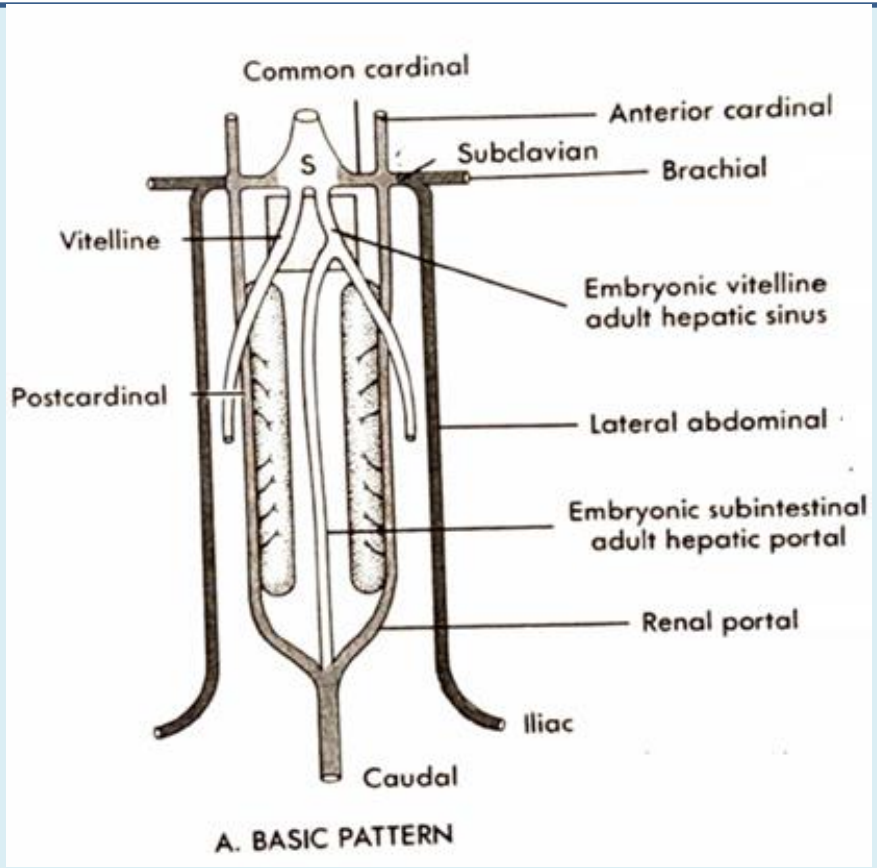

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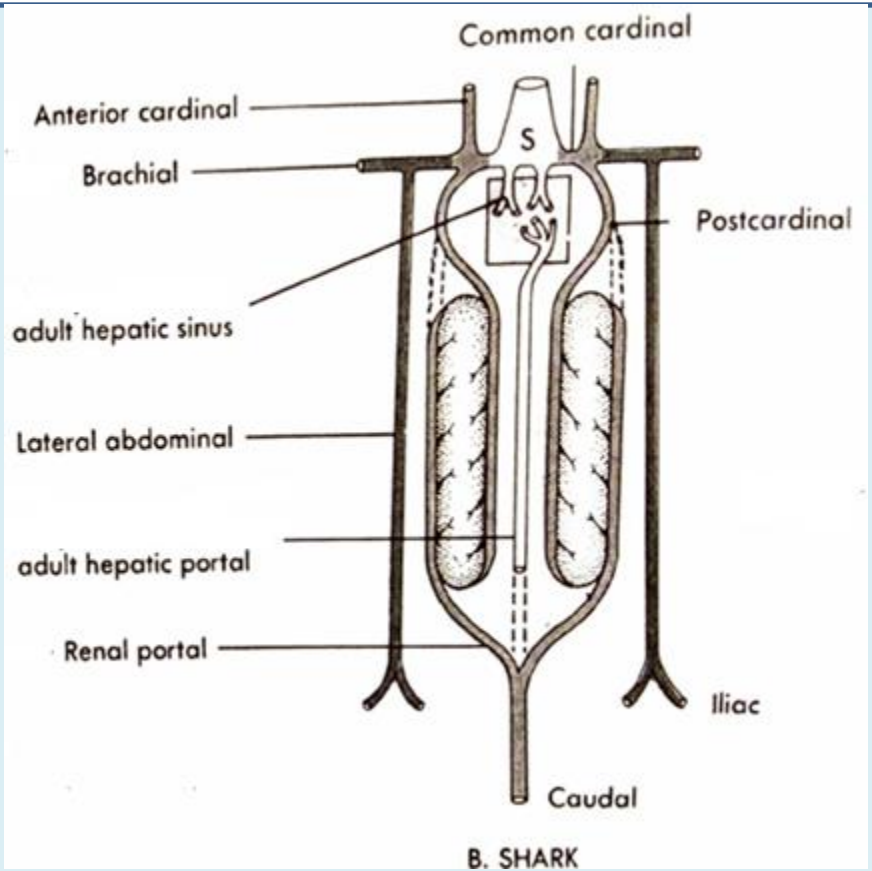

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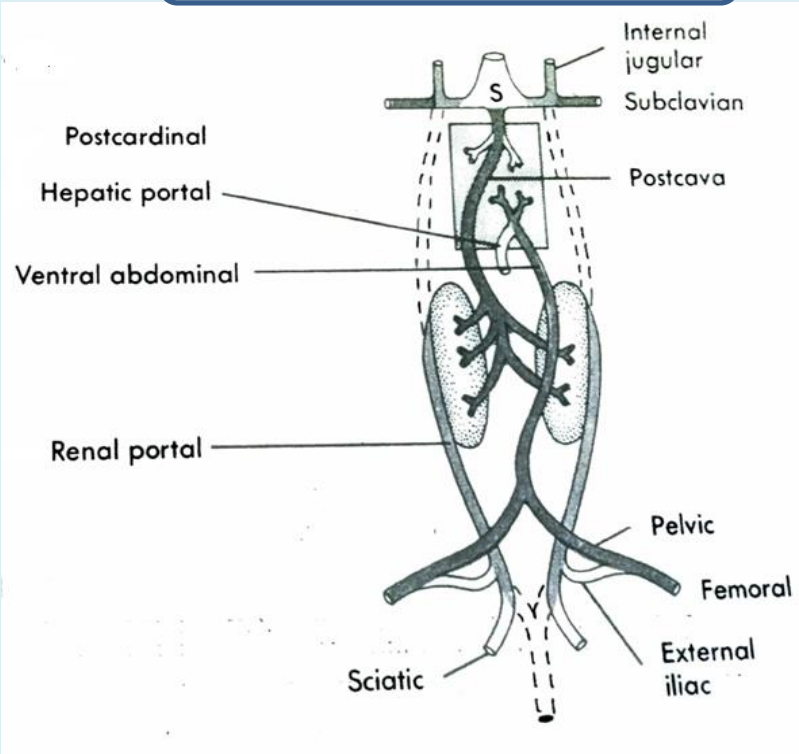
Venous system in frog



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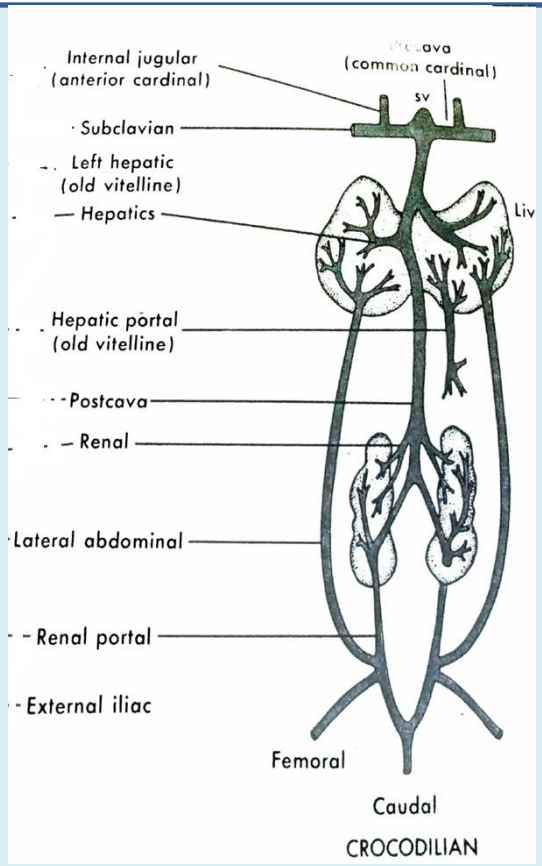

Venous system of Crocodile

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Venous system of Pigeon

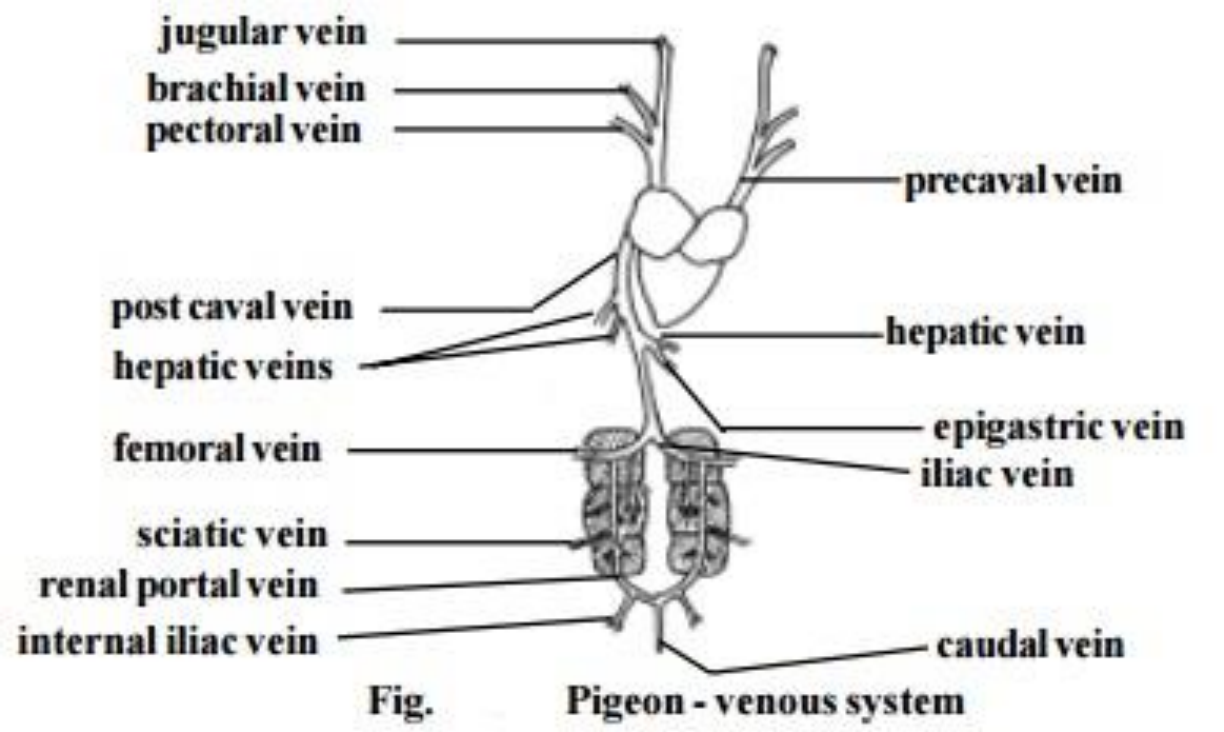

Fig. Pigeon - venous system

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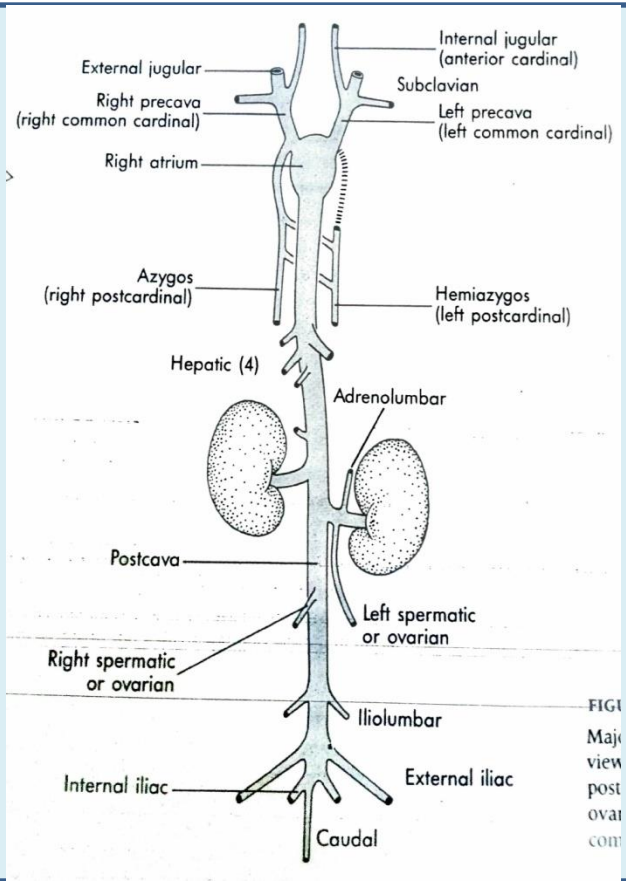

Venous system of Rabbit

- Heart--→ Venous heart, Branchial heart, Transitional heart, Pulmonary heart
- Double circulation, Single circulation
- Chambers: 2, 3, 4, 4
- Aortic Arches-→ 6,5,4,3
- Venous system--→ Basic plan of venous system, shark venous
- Lymphatic system---Lymph nodes, Lymph heart, definition lymph, Chyle-→ emulsified+ Lymph
- Internal jugular vein--→
- Cardinal veins-→