



CIRCULATORY SYSTEM

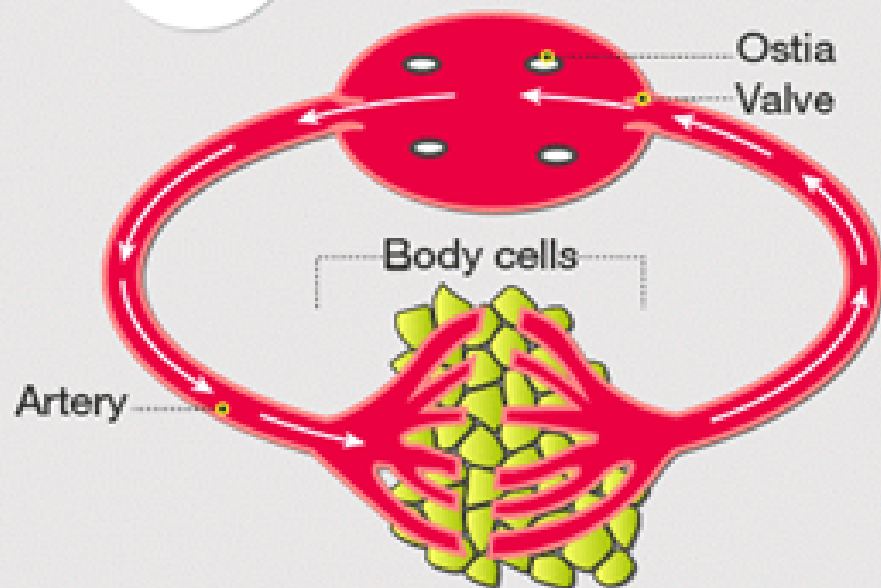
Evolution of heart and aortic arches

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COURSE : BSC. (P) LIFE SCIENCE 1st Year
TOPIC : Evolution of heart and aortic arches
Room No. : A-210, A-214, A-114

THE CIRCULATORY SYSTEM

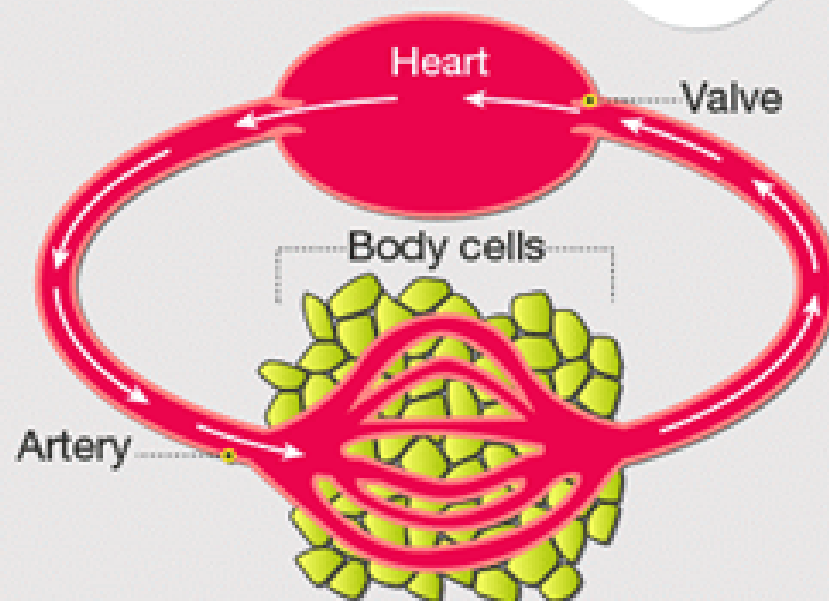


OPEN AND CLOSED CIRCULATORY SYSTEM



OPEN CIRCULATORY SYSTEM

THE OPEN CIRCULATORY SYSTEM IS COMMON TO MOLLUSCS AND ARTHROPODS. OPEN CIRCULATORY SYSTEMS PUMP BLOOD INTO A HEMOCOEL WITH THE BLOOD DIFFUSING BACK TO THE CIRCULATORY SYSTEM BETWEEN CELLS.



CLOSED CIRCULATORY SYSTEM

VERTEBRATES, AND A FEW INVERTEBRATES, HAVE A CLOSED CIRCULATORY SYSTEM. IN CLOSED CIRCULATORY SYSTEM BLOOD IS PUMPED BY A HEART THROUGH VESSELS, AND DOES NOT NORMALLY FILL BODY CAVITIES.

Parts of Circulatory System

Chordates have a completely closed circulatory system, further distinguished into two systems, blood vascular and lymphatic, having part as follows:

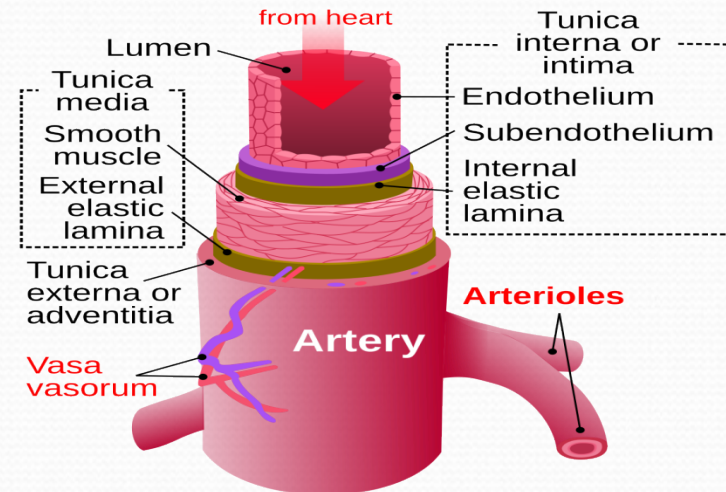
- 1. Blood vascular System-** It consist of heart, arteries, veins, capillaries and blood.
- 2. Lymphatic System-** It occurs exclusively in chordates, except cyclostomes and cartilaginous fishes and consists of lymph and lymph channels.

VERTEBRATE CARDIOVASCULAR SYSTEM

- transport gases, nutrients, waste products, hormones, heat and various other materials.
- Consist of heart, arteries, capillaries and veins.

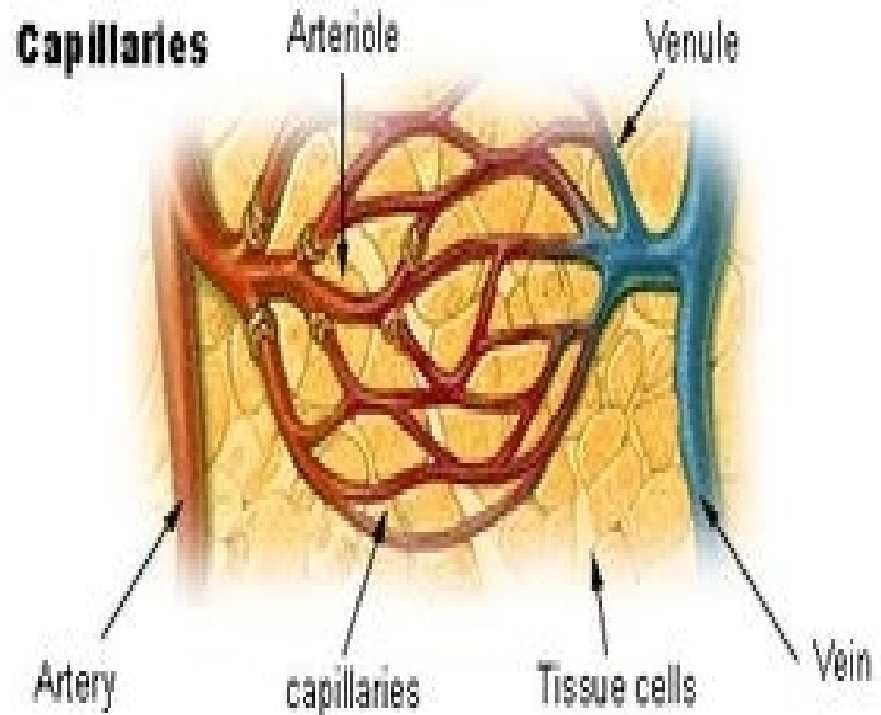
ARTERIES

- Carry blood away from the heart
- having muscular , elastic walls
- terminate in capillary beds



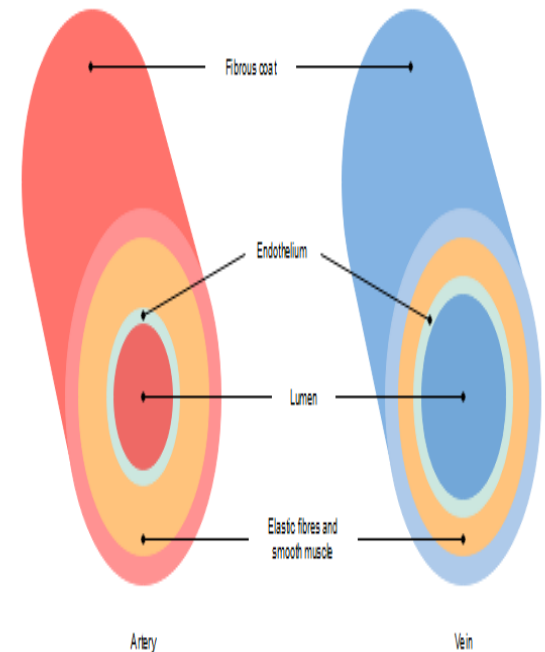
Capillaries

- Have very thin walls(endothelium only)
- Are the site of exchange between the blood and body cells



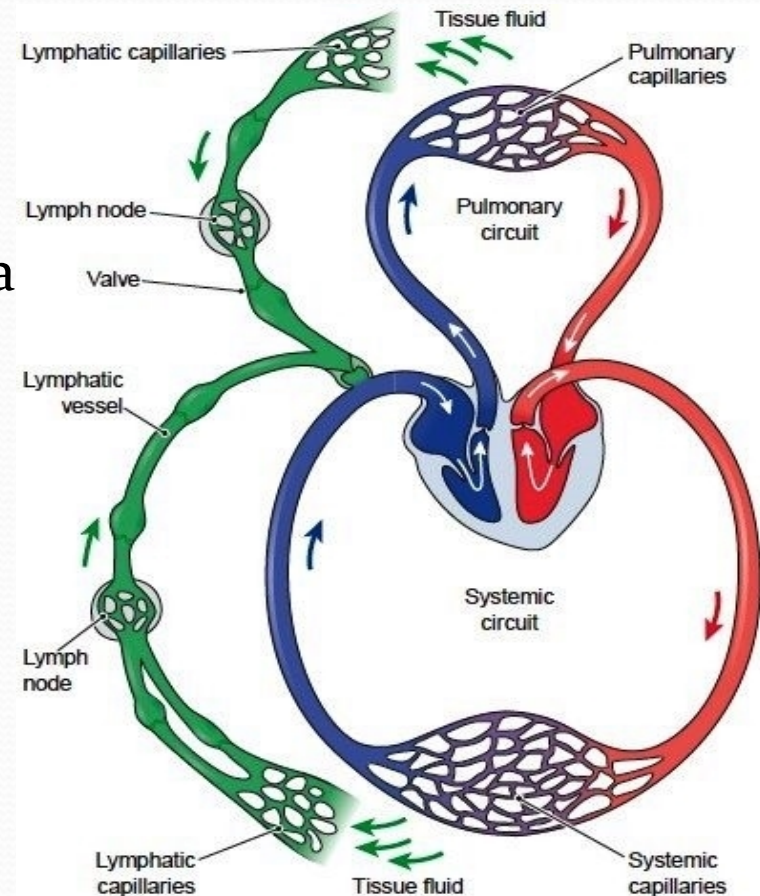
Veins

- Carry blood back to the heart
- Have less muscles in their walls rather than arteries but the walls are very elastic
- Begin at the end of capillary beds



Lymphatic System

- **Lymph** is the tissue fluid , lying between and bathing body cells.
- **Lymph capillaries** forming a network of minute, blind-ending channels, collect lymph.
- **Lymph vessels** formed by the union of lymph capillaries finally emptying into veins.
- **Lymph nodes** found only in mammals on lymph vessels, lymphocytes of blood.



Evolution of Heart in Vertebrates

In the embryo, two longitudinal endothelial tubes, formed by mesenchyme in ventral mesentry below archenteron, fused together to give rise to the heart.

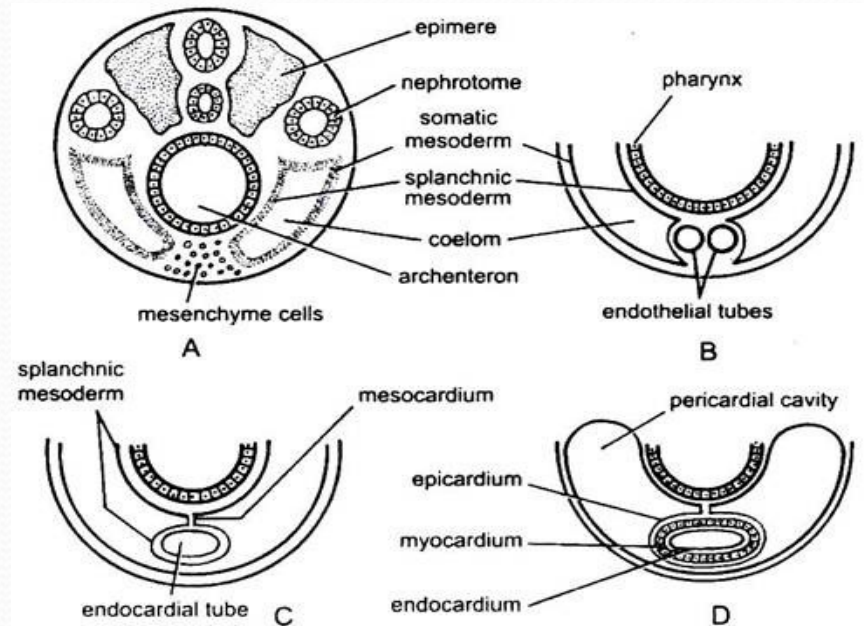
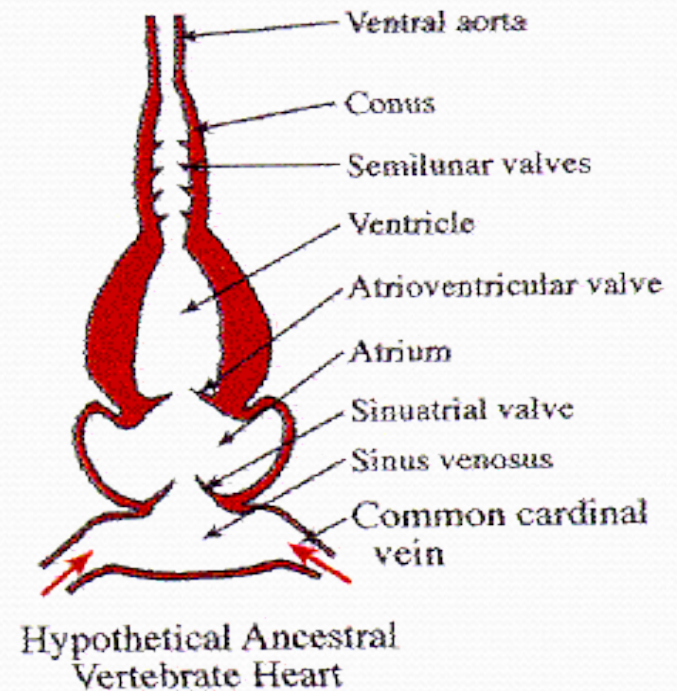


Fig. 45.2. T.S. of embryo showing stages in the development of heart.

1. Single-Chambered Heart: In *Amphioxus* (primitive chordate), a true heart is not found. A part of ventral aorta beneath the pharynx is muscular and contractile and acts as heart.

2. Two-Chambered Heart:

In cyclostomes, there are four chambers arranged in a linear order - a thin-walled sinus venosus, a slightly muscular atrium (auricle), a muscular ventricle and a muscular conus arteriosus or bulbus cordis. It lies in the body cavity in which other visceral organs are also present.



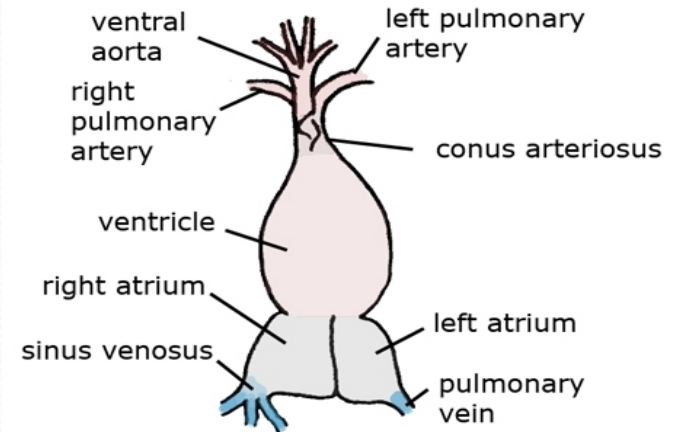
Elasmobranchs: Except Dipnoi, the circulatory system in fishes from cyclostomes to teleosts, only unoxygenated blood goes to the heart, from there it is pumped to the gills, aerated and then distributed to the body.

Teleosts: Heart is similar to that of cartilaginous fishes, except a bulbus arteriosus is present rather than a conus arteriosus which is probably why most of them are “cold-blooded”.

3. Three-Chambered Heart: In dipnoans a septum divides the atrium into a right and left chamber. This is correlated with the use of the swim-bladder as an organ of respiration and represents the first step toward the development of the double-type circulatory system whereby both oxygenated and unoxygenated blood enter the heart and are kept separate.

Amphibia: In amphibians, the dorsal atrium shifts anterior to ventricle. The atrium is completely divided into right and left chambers and has no foramen ovale in the inter-auricular septum, which remains open in dipnoans.

Diagrammatic view of frog heart

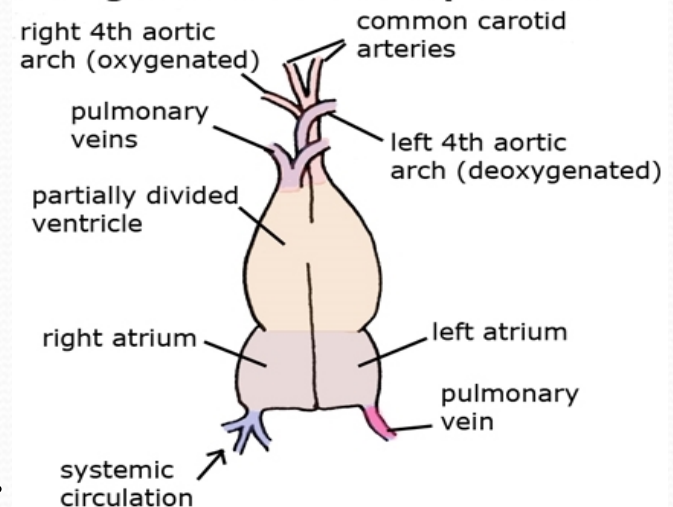


- **Reptilia:** In reptiles, the heart is further advanced.

The atrium is always completely separated into a right and left chamber, and in many forms the sinus venosus is incorporated into the wall of the right atrium.

The ventricle is also partly divided by a septum in most reptiles, and in the alligators and crocodiles is completely two-chambered.

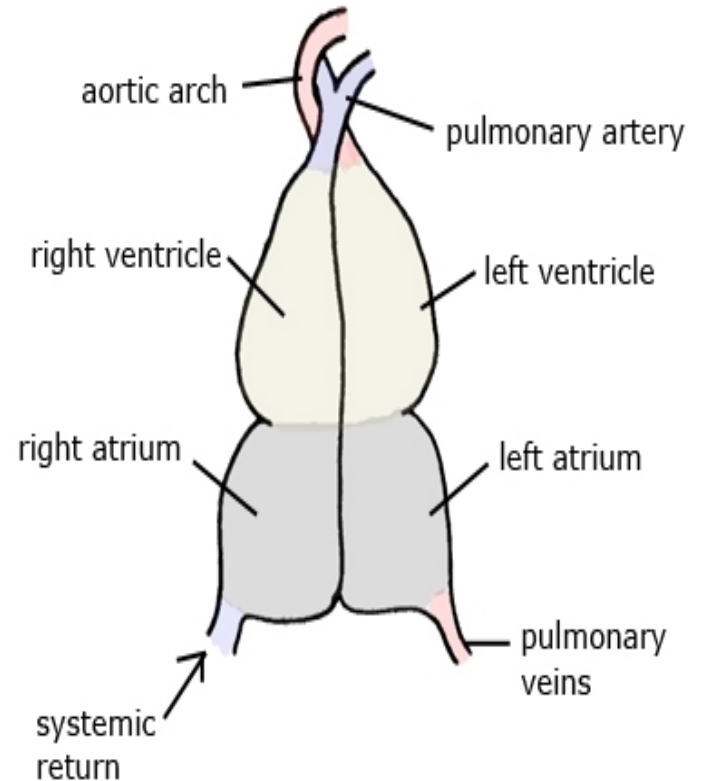
Diagrammatic view of reptile heart



4. Four-Chambered Heart:

Aves and Mammalia: In birds, the ventricle is completely divided into two, so that the heart is four chambered (2 auricles and 2 ventricles). There is complete separation of venous and arterial blood. Thus, there is double circulation in which there is no mixing of blood at any place.

Diagrammatic view of mammalian heart



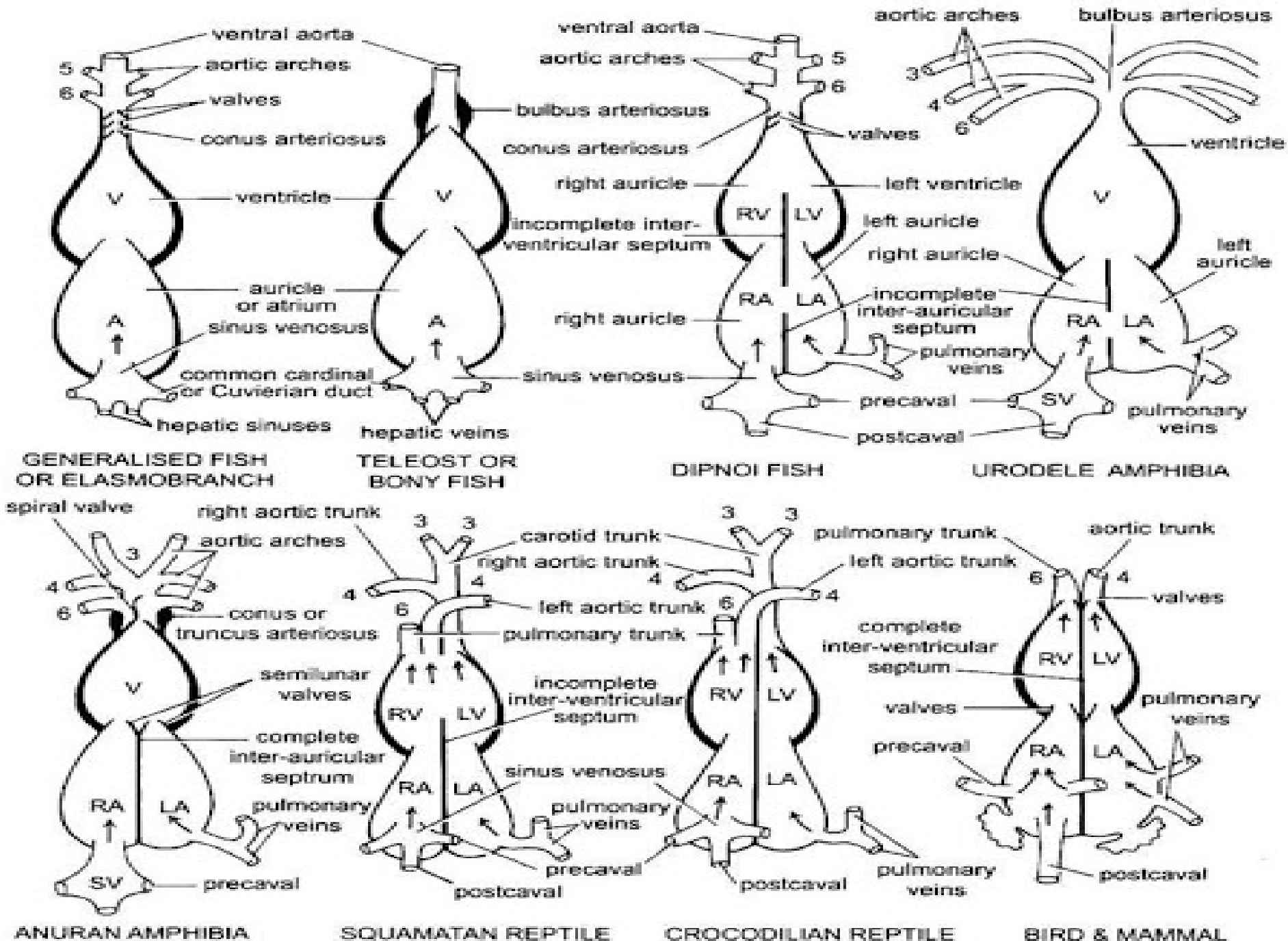


Fig. 45.4. Evolution of heart in different classes of vertebrates.

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