

## AORTIC ARCHES

During the course of organic evolution the body become complex and required many system to facilitate different requirements of the body. One of the most important system is circulatory system comprising heart, blood vessels and blood for transportation of different material to the every cell of body.

Aortic arches are paired blood vessels connecting the ventral aorta with the dorsal aorta around the pharynx.

### BASIC STRUCTURE PLAN OF AORTIC ARCHES:

The embryo of all craniates consists of six pairs of aortic arches which ~~are~~<sup>arise</sup> from ventral aorta and runs both side laterally. The lateral aorta arise from ventral aorta and run upward around pharynx and they join together to form a dorsal lateral aorta or radices aorta. Behind the pharynx the two lateral dorsal aorta meet and fused together to form a median dorsal aorta. The anterior continuation of lateral dorsal aorta are called radices.

### Aortic Arches in different groups of vertebrates:

#### IN CYCLOSTOMES:

The cyclostomes have more than six pairs of aortic arches. In Lamprey there are eight pairs of aortic arches. The anterior <sup>most</sup> arches is the hyoid. The second is first branchial. Each aortic arch is divided into the afferent and efferent portion in the gill pouch.

#### IN FISHES:

In elasmobranchs there are five <sup>pairs of</sup> aortic arches. These are hyoid (2nd), third, fourth, fifth and sixth pairs. The first or mandibular aortic arches have disappeared.

In most bony fishes the hyoid (2nd) aortic arch also disappear because non-functional of 2nd gill slit. So only 4 aortic arches retained in adult. These are 3rd, 4th, 5th & 6th pairs.



However, in lung fishes a pair of pulmonary artery is given off from efferent portion of sixth pair aortic arches taking blood to the lung.

### IN TETRAPODS:

The pattern of development of aortic arches in tetrapods provide materials for studying the evolution of vertebrates.

In general, there is tendency of further reduction in the number of aortic arches in tetrapods. Since there is no internal gills, the aortic arches do not break up into afferent and efferent portion.

### IN AMPHIBIA

Due to introduction of lungs the aortic arches of amphibians undergo variously modified.

In Urodeles the 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> pairs of aortic arches persists although the 5<sup>th</sup> arch reduced. From 6<sup>th</sup> aortic arch arises the pulmonary artery which carry venous blood to lungs. The connection of 6<sup>th</sup> aortic arch with the dorsal aorta is retained as the ductus arteriosus or ductus Botalli.

In anurans the 5<sup>th</sup> aortic arch also disappear and hence only three pairs - 3<sup>rd</sup>, 4<sup>th</sup> and ~~5<sup>th</sup>~~ 6<sup>th</sup> pairs persists in adult. The third aortic arch along with a part of the ventral aorta becomes the carotid arch. The 4<sup>th</sup> aortic arch with its lateral dorsal aorta forms the systemic arch. A break in the continuity of the <sup>lateral</sup> dorsal aorta between 3<sup>rd</sup> & 4<sup>th</sup> aortic arches (Ductus caroticus) occurs by the disappearance of this part. Ducts of Botalli which connects the 6<sup>th</sup> arch with lateral dorsal aorta also disappear.

In Apoda the aortic arches undergo the same changes as Urodeles. Like Urodeles have also ducts of Botalli and ductus caroticus persists.



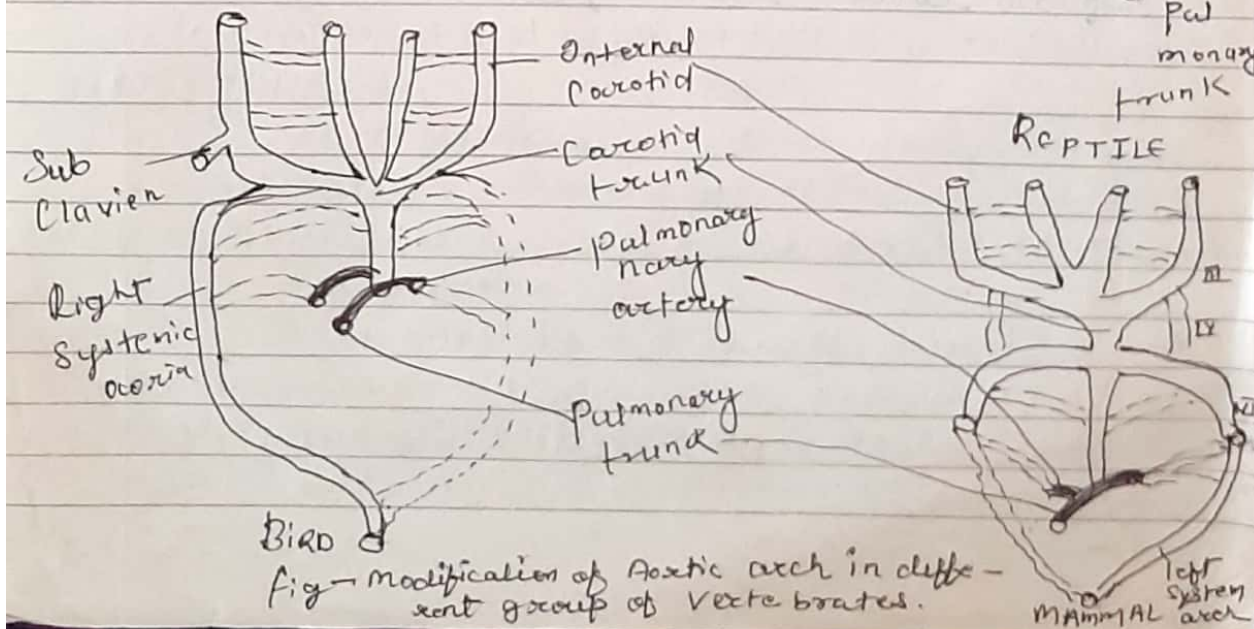
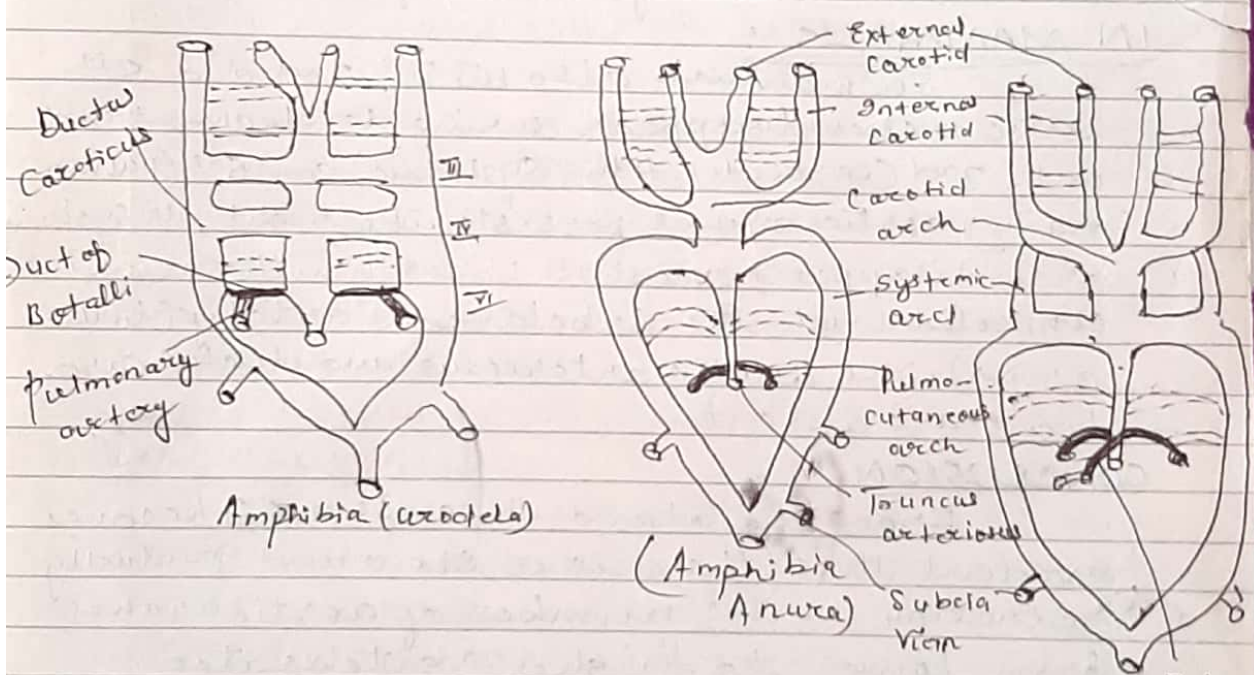
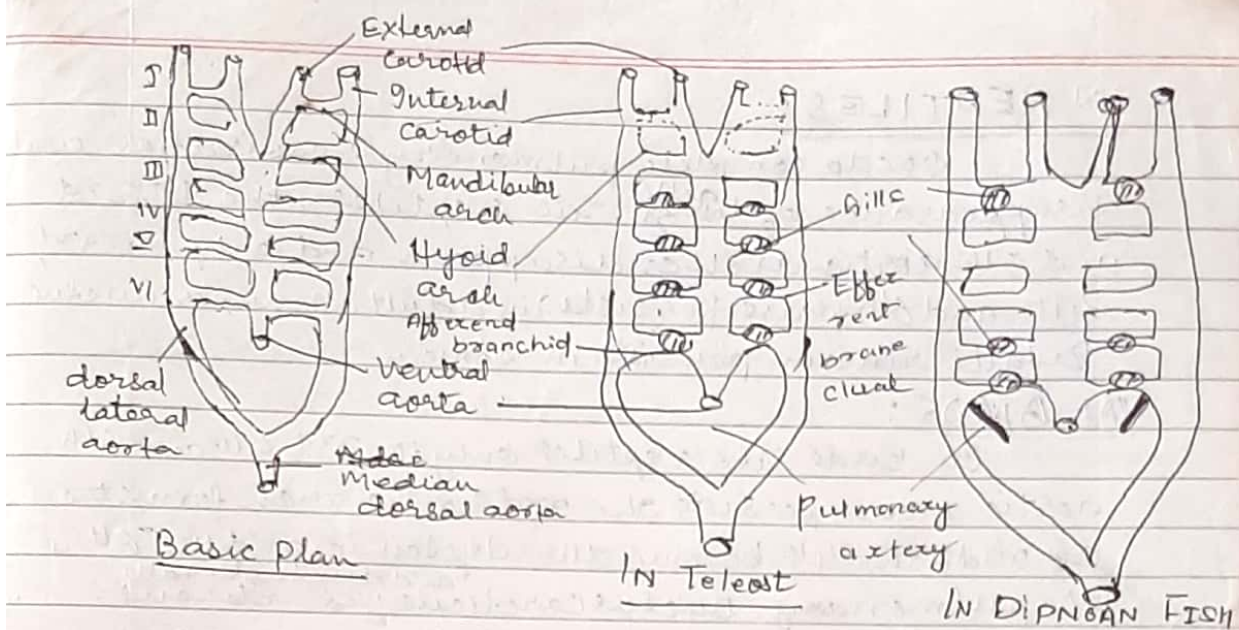


Fig - modification of Aortic arch in different group of Vertebrates.



## IN REPTILES:

Due to complete pulmonary respiration and disappearance of <sup>gills</sup> ~~lungs~~, in reptiles, the 1<sup>st</sup>, 2<sup>nd</sup> and 5<sup>th</sup> aortic arches disappear and only the 3<sup>rd</sup>, 4<sup>th</sup> and 6<sup>th</sup> pairs persist in adult. However, ductus Botalli remain persists in some.

## IN BIRDS:

In birds like reptiles only the 3<sup>rd</sup>, 4<sup>th</sup> and 6<sup>th</sup> aortic arches persists. The 3<sup>rd</sup> aortic arch forms the carotid, the 4<sup>th</sup> become the systemic and the 6<sup>th</sup> is the pulmonary. Ductus caroticus <sup>and ductus Botalli</sup> is absent. Birds retain only right systemic arch.

## IN MAMMALS:

In mammals also the 1<sup>st</sup>, 2<sup>nd</sup> and 5<sup>th</sup> aortic arches disappear during development and only 3<sup>rd</sup> (carotids), 4<sup>th</sup> (systemic) and 6<sup>th</sup> (pulmonary) aortic arches persists. The right 4<sup>th</sup> systemic arch disappears except its bases which remains connected with the subclavian artery (to the arms). The ductus arteriosus and ductus caroticus are absent.

## CONCLUSION:

From the above discussion, it becomes evident that there is a slow and gradually reduction in the number of aortic arches from lower to higher vertebrates.