Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (Second Year)

Subject: Zoology

Course Code: ZOC 103

Course Title: Anatomy of animal body systems

Unit: 04- Respiratory System

Module Name: Accessory respiratory organs

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Introduction:

In aquatic vertebrates, gills are the chief respiratory organs. The land vertebrates have the lungs for respiration. Additional structures other than gills and lungs which help in respiration are known as accessory respiratory organs.

Origin of accessory respiratory organs:

The development of accessory respiratory organs in fishes and some amphibians took place in order to cope with danger of drying streams, reduction of large reservoirs and consequent scarcity of oxygen in aquatic habitat.

List of accessory respiratory organs:

1) Skin
2) Labyrinthine organ
3) Epithelial lining
4) Cloacal bladders
5) Pharyngeal diverticula
6) Branchial diverticula
7) Swim or Air bladders

1) Skin:

Some fishes like common eel, *Anguilla* can travel by wriggling on damp grass though it has no special respiratory organs, but it has vascular areas in the skin by which it can breathe both in water and on land.

In amphibians, the moist skin is highly vascular. Lungless salamanders (Plethodonts) respire only through skin.

African male hairy frog, *Astylosternus* have vascular hairy cutaneous outgrowths which act as respiratory surface.

In the mud-skipper, *Periophthalmus* the caudal fin is highly vascular, the head and trunk of the fish project above water when it perches on a rock, only the caudal fin remains submerged and acts as a respiratory organ.

2) Labyrinthine organ:

i) The Indian climbing perch, *Anabas scandens* has special air chambers above the gills, where three concentrically folded bony laminae, called labyrinthiform organs are developed from the first epibranchial bone on each side.

ii) In Ophiocephalus, there is an accessory branchial cavity on each side above the gills.

3) Epithelial lining:

In some fishes and aquatic amphibians, the lining of cloaca, rectum, gut or bucco-pharyngeal epithelium is highly vascular and aids in respiration.

In *Calichthys*, rectal respiration takes place, the rectum is highly vascular into which water is alternately taken in and pumped out.

The loach, *Misgurnus* swallows air which passes through the intestine and is voided by the anus, the highly vascular mucous membrane absorbs oxygen from the air, carbondioxide is also passed through the anus.

4) Cloacal bladders:

In some aquatic turtles, a pair of thin-walled, lateral and greatly vascular cloacal bladders are continually being filled and emptied of water through vent and serve as important respiratory organ.

5) Pharyngeal diverticula:

The Indian 'Cuchia eel' *Amphipnous* has poorly developed gills, but on each side of the body there is a vascular sac as an outgrowth of the pharynx which opens anteriorly into the first gill-cleft. These sacs are respiratory.

6) Branchial diverticula:

In the Indian catfish, *Saccobranchus* there is a pair of large air sacs, each arising from the branchial chamber and extending laterally backwards into the trunk muscles. They can be filled with air for respiration.

The catfish, *Clarias* has a pair of supra-branchial organs, each lying on one side and divided into two parts, a highly branched arborescent organ formed from second and fourth branchial arches, and a vascular sac of the branchial chamber which encloses the arborescent organ.

7) Swim or Air bladders:

Swim or air-bladder arises as a diverticulum from the pharynx or oesophagus in bony fishes. It is originally lateral in position but becomes dorsal. It usually lies below or lateral to the vertebral column outside the coelom.

There are two types of swim bladders:

1) Physostomous swim bladder: it is directly connected to the gastro intestinal tract.

2) Physoclistous swim bladder: it is not connected to the digestive tract.

Functions of Accessory Respiratory Organs:

The fishes possessing accessory respiratory organs are capable of living in water where oxygen concentration is very low, since these organs contain a high percentage of oxygen. The acquisition of accessory respiratory organs in fishes is an adaptive feature.

Fishes come to the surface of water to gulp in air for transmission to the accessory respiratory organs. If these fishes are prevented from coming to the surface, they will die due to asphyxiation. The rate of absorption of oxygen in such organs is much higher than the rate of elimination of carbon-dioxide. Hence, it is natural that the gills excrete most of the carbon-dioxide.

Absorption of oxygen appears to be the primary function of the accessory respiratory organs.