SWIM BLADDER IN FISH

SEM-III ,Paper:CC5T

Dr.Ranajit Kr. Khalua
Assistant Professor
Dept. Zoology

Narajole Raj College
Paschim Medinipur

Air bladder or Swim Bladder

A characteristic organ of bony fishes is a gas-filled neumatic sac, called *air bladder or swim bladder*, ring dorsal to the digestive tract, directly beneath the vertebral column and mesonephric kidneys but outside coelom. Swim bladder does not occur in elasmobranchs. However, it is found in all bony fishes except a few bottom dwellers (*Lophius*, *Pleuronectes*, etc.). It is vestigial in *Latimeria*, the only living crossopteygian.

Generally speaking, the air bladder arises as an outgrowth from the oesophageal region of the alimentary canal. It shows a great diversity in mode of development, structure and function in different fishes. It lies ventral to alimentary canal in *Polypterus*, laterally in Dipnoi, and dorsally or dorso-ventrally in teleosts.

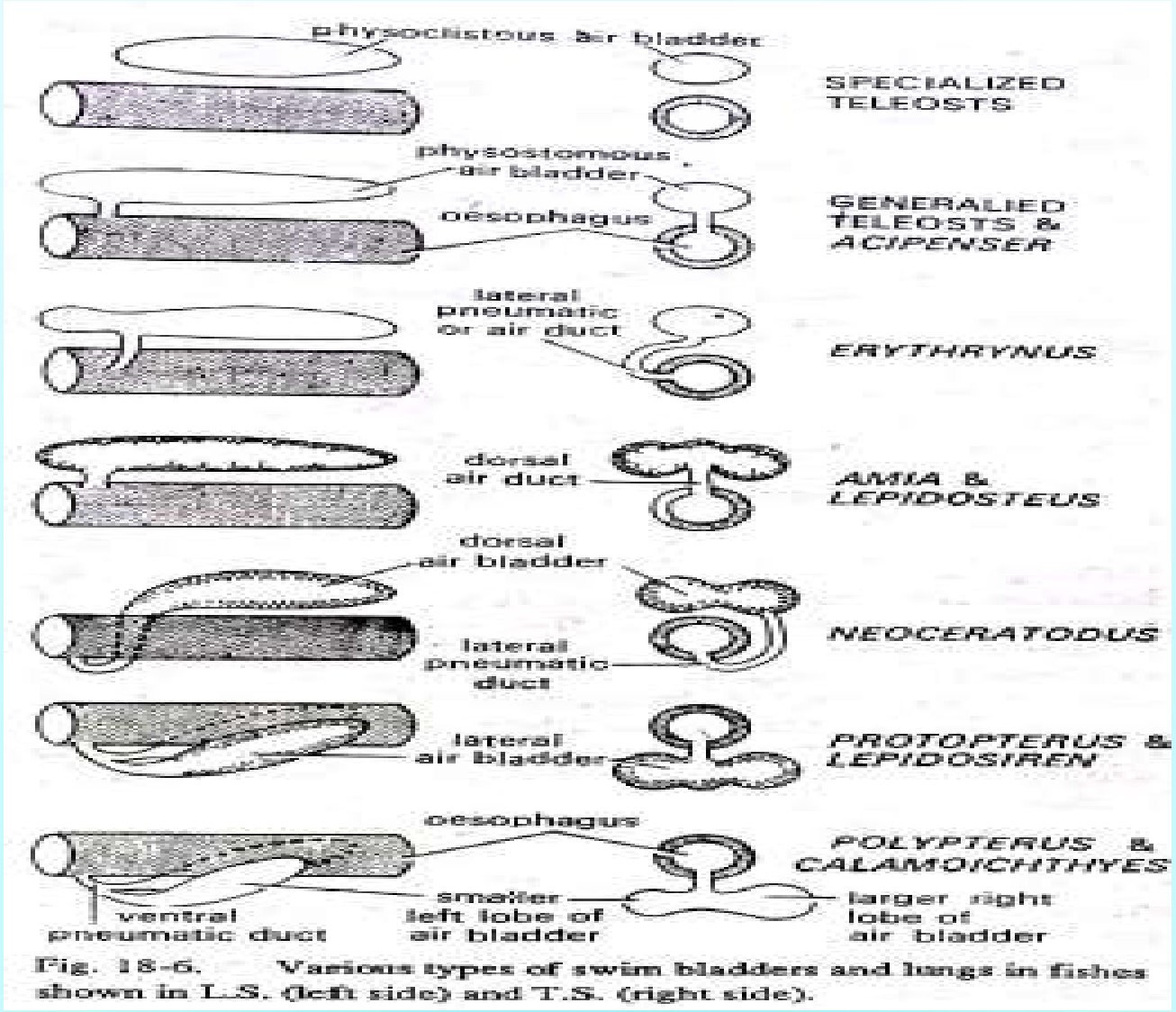

Fig. 18-6. Various types of swim bladders and lungs in fishes shown in L.S. (left side) and T.S. (right side).

1. Development of swim-bladder. Opinions differ as regards the development of swim-bladder in fishes. In teleosts, it originates as an unpaired dorsal or dorso-lateral diverticulum of the oesophagus. It starts as a small pouch budded off from the oesophagus. The diverticulum with an opening in the oesophagus becomes subsequently divided into two halves. Of these two, the left one often atrophies except in a few primitive forms. The right half becomes well-developed and take a median position. In dipnoans and Polypteridae, the swim-bladder is modified into the 'lungs' and originates as the down-growths from the floor of the pharynx. These out-growths have been rotated around the right side of the alimentary canal to occupy the dorsal position. As a consequence of shifting of the position, the original right 'lung' becomes the left one. **Spengel** advocates the view that the swim-bladder in fishes originates from the posterior pair of the gill-pouches, but definite embryological evidence in support of this idea is lacking.

2. **Basic structure of swim-bladder.** The swim-bladder in fishes varies greatly in structure, size and shape. 1. It is essentially a tough sac-like structure with an overlying capillary network. 2. Beneath the capillary system there is a connective tissue layer called **tunica externa.** 3. Below this layer lies the **tunica interna** consisting primarily of smooth muscle fibres and epithelial gas-gland. 4. The swim-bladder lies below the kidneys, between the gonads and above the gut. 5. The connection with the oesophagus may be retained throughout life or may be lost in the adult.

Gas composition

Biot (1807) and Morean (1876) have shown that the gas secreted by the swim-bladder is mostly oxygen. Nitrogen, and little quantity of carbon-dioxide are also present. Generally the gas composition varies in different species. In salmonids, the maximum amount of gas in the swim-bladder is Nitrogen. Again in many species the composition includes mostly a mixture of oxygen and carbondioxide.

3. **Types of swim-bladder.** Depending on the presence of the duct (*ductus pneumaticus*) between the swim-bladder and the oesophagus, the swim-bladder in fishes can be divided into two broad categories : **Physostomous** [Gk. physi = a bladder; stomata, mouth] and **Physoclistous** types [Gk. clistic = enclosed..

A. **Physostomous condition.** As stated earlier he swim-bladder develops from the oesopha-gus. When the **ductus pneumaticus is present between the swim-bladder and the oesopha-gus**, the swim-bladder is called **physostomous** ype (Fig. 6.85A).

This condition is observed in bony ganoid fishes, the dipnoans and soft-rayed teleosts.

B. **Physoclistous condition.** In this condition the ductus pneumaticus is either closed or atrophied (Fig. 6.85B). This type of swim-bladder is observed in spiny-rayed fishes. In this type of swim-bladder, there lies an anteroventral secretory **gas gland** (containing retia mirabilia) and a posterodorsal gas absorbing region called the **oval**.

C. **Transitional condition.** In Eel (*Anguilla*), a transitional condition between the physosto-mous and physoclistous type is present.

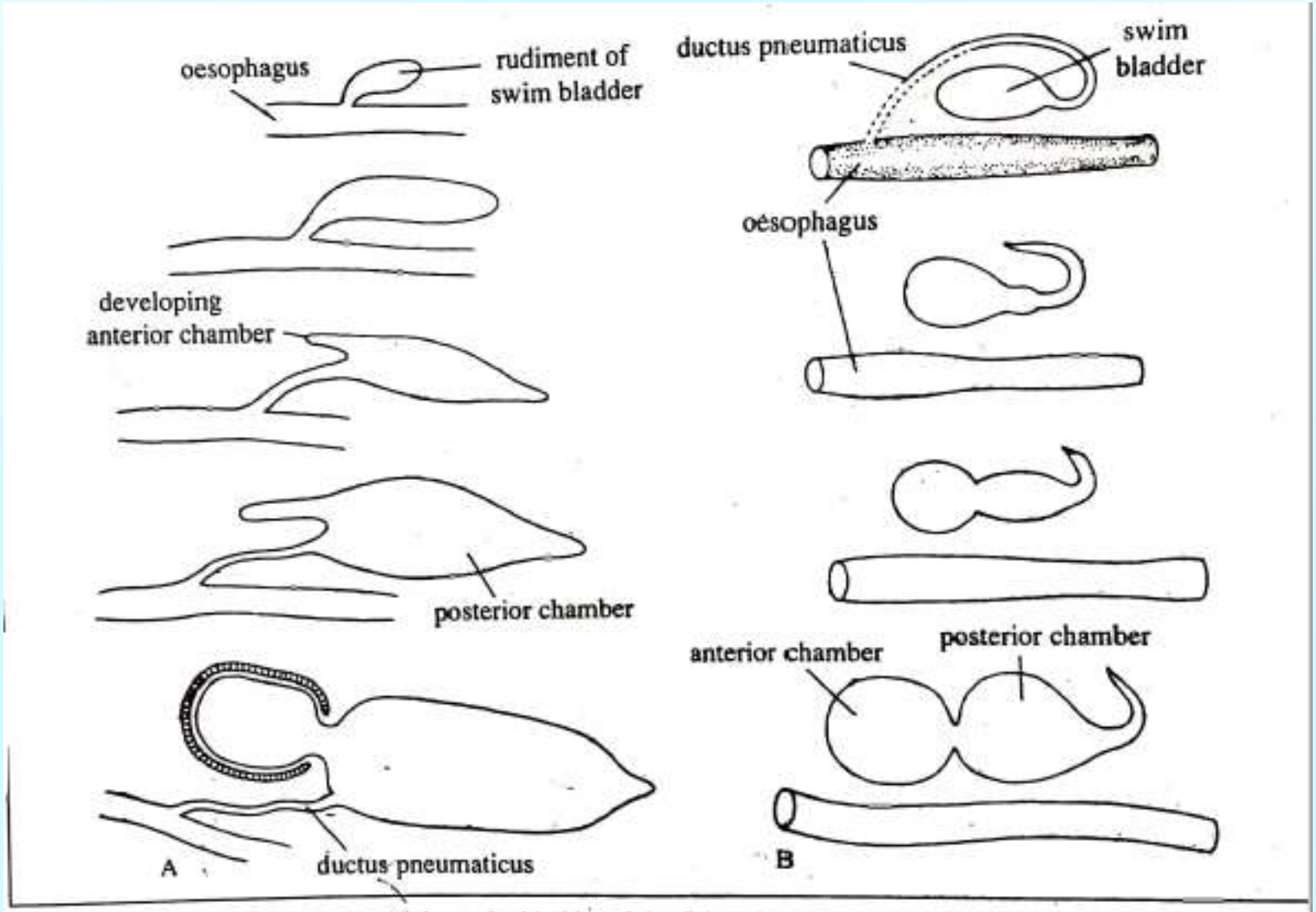

Fig. 6.85 : Showing the derivation of the swim-bladder of the fishes from the gut. A. Stages of formation of physostomous type of swim-bladder in *Catostomus*. B. Stages of formation of the physoclistous type of swim-bladder

4. Functions of air bladder. Air bladders or swim bladders in fishes are associated with several functions.

(a) Respiration. In lower or intermediate fishes, such as ganoids and lung fishes, the air bladder serves as a lung. These fishes come to water surface regularly to gulp air. In physostomous (with duct) teleosts, which also gulp air, the bladder serves as an accessory respiratory organ. Even in physoclistous (ductless) teleosts, the bladder is said to store oxygen to be utilized during deficiency.

(b) Hydrostasis. Air bladder in teleosts functions chiefly as a hydrostatic organ. Secretion of more gases means lower specific gravity so that fish rises in water. Resorption of gases means increased specific gravity and the fish sinks. Thus, the fish is able to rise or sink and maintain its equilibrium or position in water without any muscular effort.

(c) Sound production. Some fishes are able to produce sounds with the gases inside air bladder by the use of special muscles attached to the air bladder.