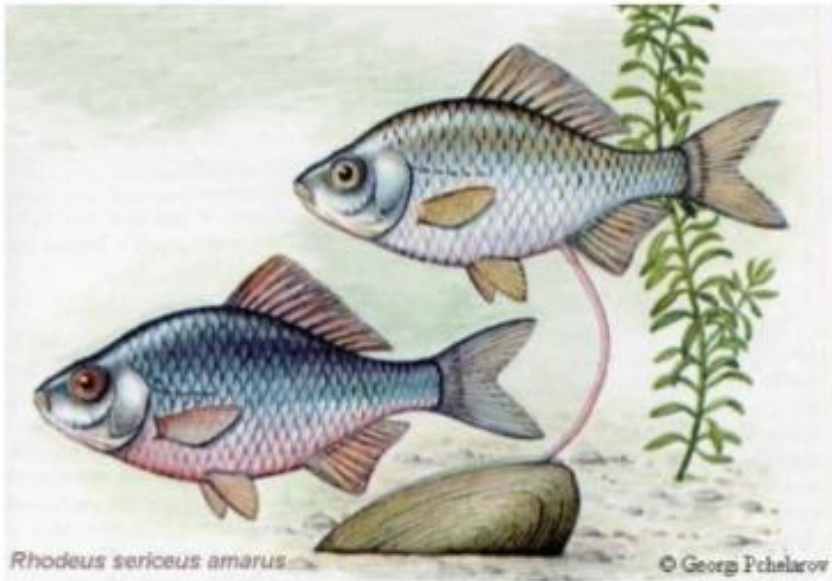




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Reproduction

Fish Reproduction



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Overview and function of the reproductive system

The overall purpose of the reproductive system is

to produce sex cells,

bring egg and sperm

cells together,

provide for nourishment of the embryo or fetus until hatching or birth,

and to release young from the maternal body

Introduction

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The fish, like most animals, begins life as an egg and as in other invertebrates, the single cell egg can not develop unless it is fertilized by a sperm produced by a male.

Fish sperm is most commonly referred to as **milt**.

Eggs may be fertilized either **externally or internally**.

External fertilization takes place when the egg is penetrated by the sperm after the egg leaves the female's body.

Most fish are reproduced by this system.

Internal fertilization occurs when the male introduces the sperm into the female's body, where it makes contact with and fertilizes the egg.



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Some sharks are **ovoviviparous**;

that is, the egg is fertilized internally and held within the female without attachment to her until it is ready to be extruded alive.

In other species, such as some of the sharks and the sculpin, and the skate, the egg is penetrated by the sperm inside the female's body, but it does not hatch until some time after being released from the female.

Reproduction and associated activities in fish are generally referred to as **spawning**.

The **spawning season**, or breeding period, is that time when the eggs of the female and the milt, or sperm, of the male are ripe.

This period may last only a few days or it may extend into weeks and even months.

Fish that live in tropical waters of fairly constant temperature may spawn year round.



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Reproduction

The reproduction in fishes is

bisexual,
hermaphrodite or
parthenogenic

the most predominate process is **bisexual reproduction**. In such fishes the sexes are separate. Eg :- The individuals are **dioecious**.

Hermaphrodite -in few fishes both sexes are present in same individuals. Eg. Perca, Stizortadian, Micropterus.

In *Poecillia formosa* parthenogenesis occurs, actually the correct process is gynogenesis

i.e., the development of young without fertilization.



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Members belonging to class Pisces show a variety of sexuality from

1. **synchronous hermaphroditism**,
protogynous hermaphroditism and
protandrous hermaphroditism
(consecutive hermaphroditism) to
2. **gonochorism (Dioecious).**



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Types of Reproduction:

Synchronous hermaphroditism :

In synchronous hermaphroditism, both testis and ovary mature at the same time with a possibility of self fertilization.

Eg. *Serranus subligirus*

Family – Serranidae, Cyprinodontidae,
Maenidae, Labridae, Poopidae etc.



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Consecutive hermaphroditism:

In Consecutive hermaphroditism the fish may be first a female with **functional ovaries** and consequently a functional male, such hermaphroditism is called “**Protogynous hermaphroditism**” and

when the fish first a **functional male** and then a functional female such hermaphroditism is term “**Protandrous hermaphroditism**”.

Protandrous - Gonostamatidae, Sparidae, Labridae.

Protogynous – Synbranchidae, Serranidae, Maenidae.



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Gonochorism (Dioecious):

Gonochorism means when both the sexes, male and female are two separate functional individuals

(unisexual the male and female reproductive organs born on different individuals).



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Sexual differences

The characteristics of sexual differences or sexual dimorphism that unable identification of the sexes is classified as primary and secondary.

Primary sexual characters are those that are concerned actually with the reproductive processes.

Testis and their ducts in the male and ovaries and their duct in the female constitute **primary sexual characters**.

The secondary sexual characters themselves are really of two kinds those which have no primary relationship with the reproductive act at all, and those which are definitely accessory to reproduction.

A genital papilla is present in the male fishes of lampreys (Petromyzonidae) darters (*Etheostoma nigrum*) white bass (*Morone chrysops*).



“**Tubercles**” appear on various areas of the body surface in many males during sexual maturity.

For example, smelts (*Ormerus*), some minnows (*Cyprinidae*).

The **fins often** provide characteristic distinctive of males: on an average they are larger than in female.

In some fishes, the “**caudal fin**” may show sexual dimorphism,

for example the lower lobe as greatly extended in the males of the sword tail (*Xiphophorus helleri*) and

somewhat enlarged in white sucker (*Catostomus commersoni*).

Obviously “**colouration**” in fishes often serves as a mark of sexual distinction and recognition; it is termed **sexual dichromatism**.



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In general, the males are **brighter or more intense in colour** than the females.

For example, in orange spotted sunfish (*Lepomis humilis*) Bowfin (*Amia calva*), the male has a darker eye spot on the tail region.

Other example are Wrasses (Labridae) and parrot fishes (Scaridae).

- Size of the fish -

Some species of fishes exhibit size difference between sexes . For example, in Tilapia; males grow faster than female , but in major carps the females grow faster than male.





• Colouration –

some species of fishes exhibit sexual dichromatism i.e. different color patterns in different sexes. During breeding season male develops bright coloration in fishes such as salmonids .





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Several different head characteristics also serve to distinguish the sexes among fishes for example, In Salmon and Trouts (Salmonidae) the breeding males typically develop a knobby

• Shape of head –

A few species exhibit sexual differences in the shape of head . In male salmon , the snout develops like a hook whereas in females the same are not noticed.





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A few accessory reproductive structures among females serve as sexual characteristics.

An outstanding example is the egg laying tube or ovipositor in the female of the European

• Ovipositor –

In a few fishes like bitterlings the ready to spawn females develop long, pink tubes from genital aperture region which is used for laying eggs into the mantle cavity through the inhalent siphon of freshwater mussel.





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• Genital papilla –

In few fishes like Clarias , Heteropneustes etc . Male have prominent genital papilla, particularly during breeding season which are elongated and cylindrical in male but small, button shape in females.

Visual Selection of the Genital Papilla



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SEXUAL DIMORPHISM

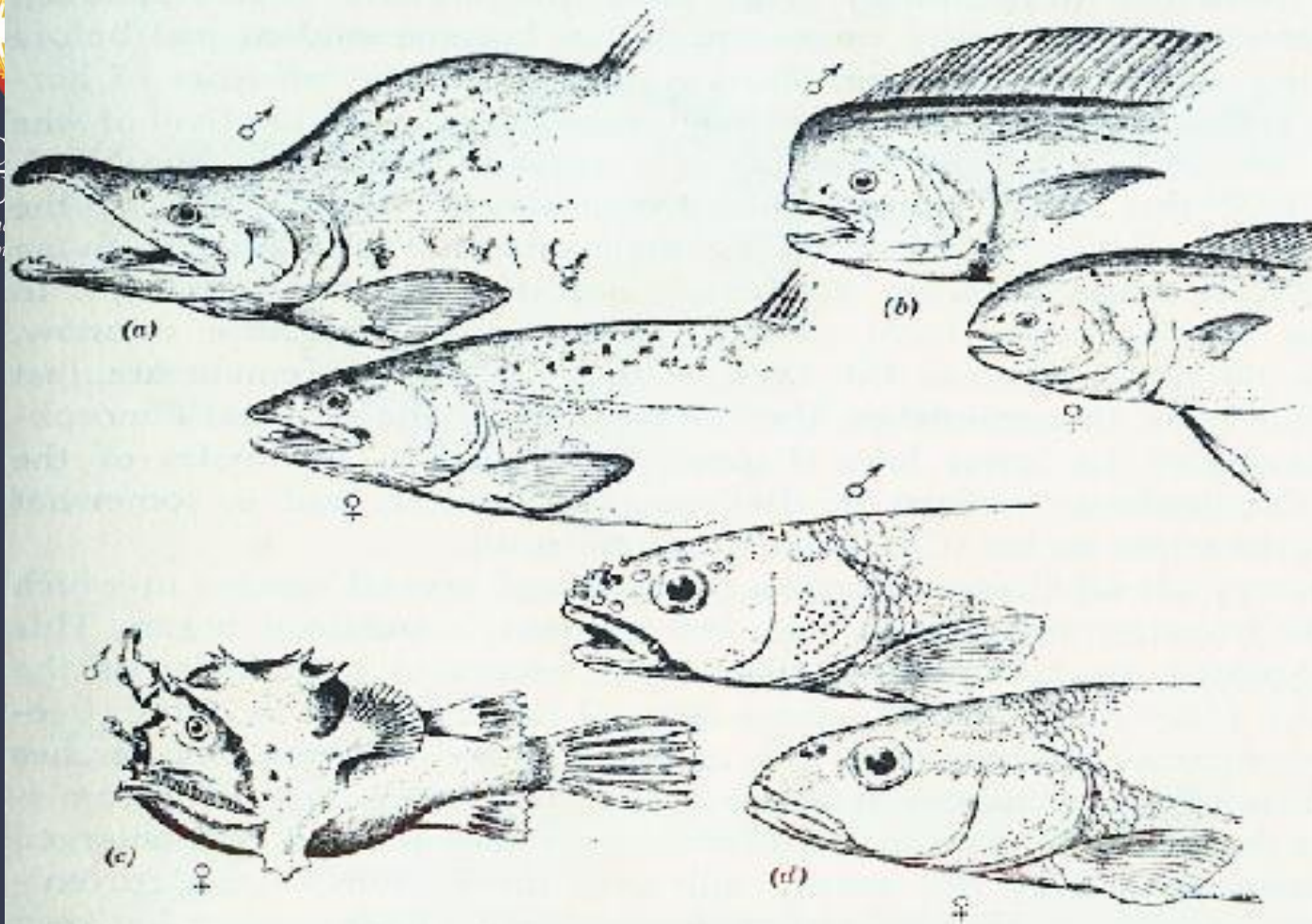


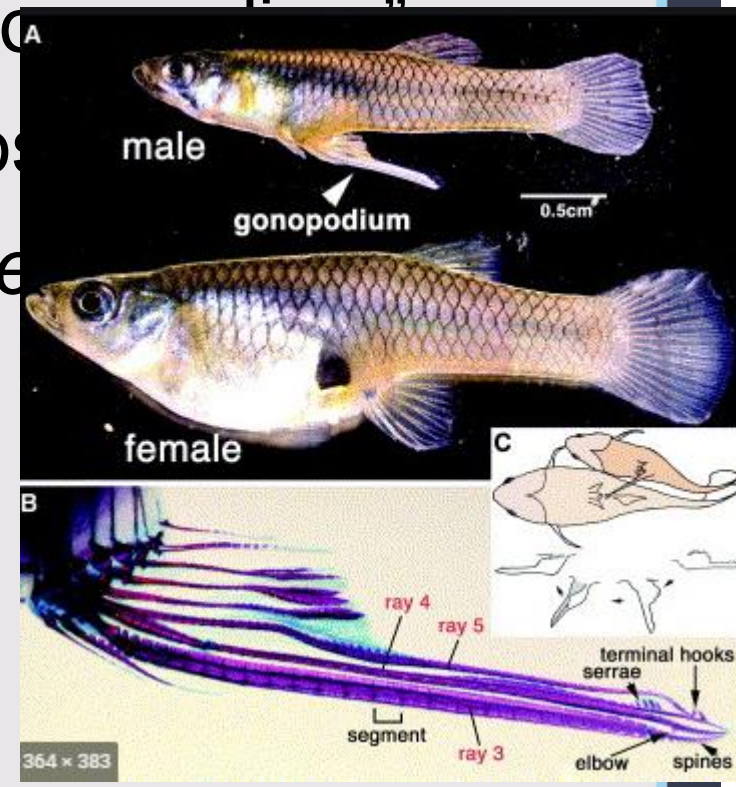
Fig. 10.4 Sexual dimorphism among fishes as shown by: (a) humped back and hooked jaws of the male in the pink salmon (*Oncorhynchus gorbushu*); (b) domed forehead and anterior position of the dorsal fin in the dolphin (*Coryphaena hippurus*); (c) parasitic male of the deepsea anglerfish (*Photocorynus spiniceps*); (d) nuptial tubercles on the snout and forehead of the creek chub (*Semotilus atromaculatus*).



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An accessory sexual characters marks the males of several species in which the anal fin becomes enlarged into an “intermittent copulatory organ”. This organ designated as the “gonopodium” occurs in such fishes as the mosquitofish (*Gambusia affinis*) the guppy (*Lebistes reticulatus*) and other males of live bearing top minnows (Poeciliidae).



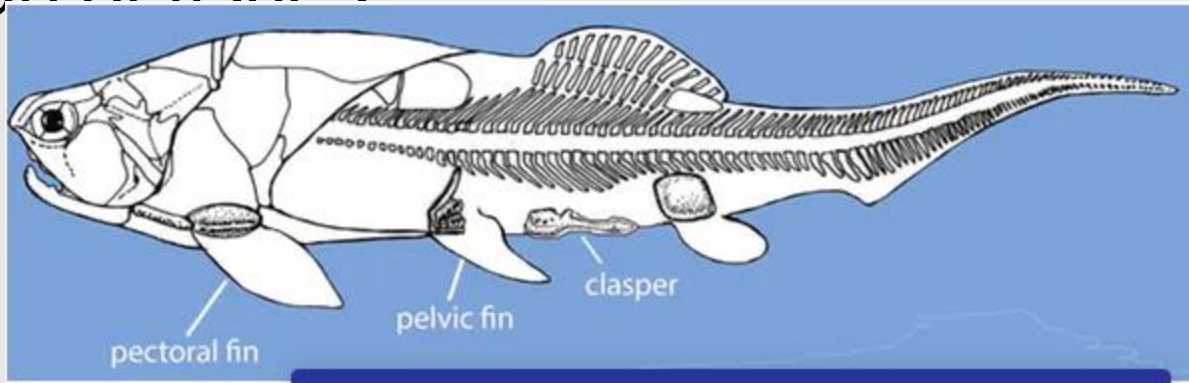


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Pelvic fins are variously modified in the sharks and their relatives (Elasmobranchi) as intermittent structures,

The “myxopterygia” (Claspers) that help to ensure internal fertilization, which is widespread in this group of fishes





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Reproductive system Gonads

The gonads of fishes are usually elongated structures suspended by mesenteries from the dorsal aspect of the abdominal cavity.

Their relationship to the kidney and their ducts differs widely among groups.



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Lampreys

The gonads are single, suspended from the midline and reach most of the length of the body cavity.

Though no sperm ducts or oviducts are present at spawning but both the eggs and sperm are shed into the body cavity from which they exit through paired abdominal pores to the urogenital sinus.

A prominent urogenital papilla is developed in mature specimen.



Sharks

The testes are paired and usually placed anteriorly in the body cavity suspended dorsally by means of a “mesorchium”.

Often right testis is larger than the left, sperm discharges into a central canal network that communicates with the anterior part of the kidney through efferent ducts tranversing the mesorchium.

Ovaries are paired, but the left one may be greatly reduced in size in some species.

Like the testes, they are placed well anteriorly in the body cavity; each is suspended by a mesovarium.



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The oviducts open anteriorly to the ovaries and usually have a common mouth or funnel.

Eggs are released into the coelom, proceed into this funnel and then traveled down the oviduct to the region of the shellgland (Nidamental gland) where fertilization occurs and a horney shell or membrane as secreted.

In oviparous species, the shell is **tough** and protects the developing embryo.

In viviparous species, the shell is slight or vestigial and the young develop in the posterior, uterine portion of the oviducts.



Bony Fishes

In most of the bony fishes testis are whitish, lobulate organs, lying along the gas bladder, although in some groups such as Salmonids, the organs are smooth and entire without lobules.

In most of the forms, there is no connection at all between the reproductive openings to the exterior for the two systems with the urinary pore posterior to the genital pore.

In some the sperm ducts connects with the urinary system in a urogenital sinus located at the posterior end of the body cavity.



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Ovaries of bony fishes are typically saccular and continue with the oviduct.

The ovaries of fishes are usually well separated, but fusion of the right and left organs can be seen in some Perciformes.

Ovaries of the yellow perch, are so completely fused so as to give the appearance of a single organ.

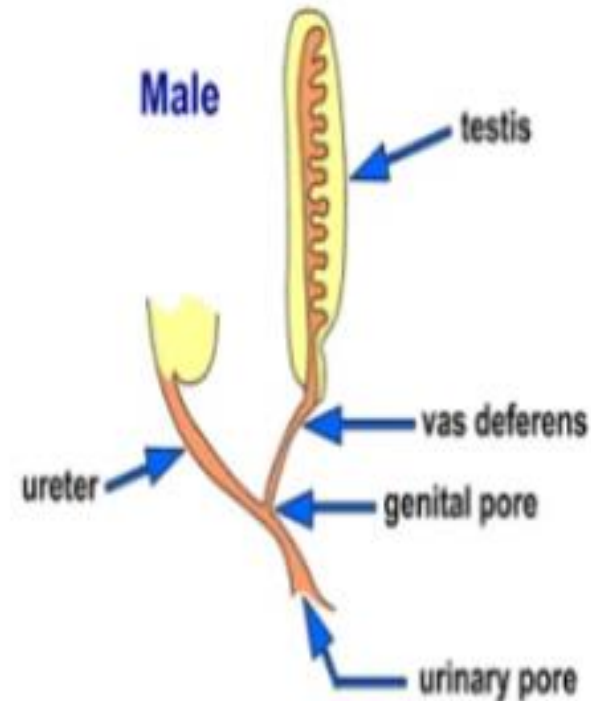
This ovary is fused to the body wall just posterior to the anus and eggs are extruded when this area ruptures,

so those oviducts are not functional.

The rupture of the body wall heals soon after oviposition.

MALE REPRODUCTIVE ORGAN

Reproductive organs of the male fish consist of testes which are elongated paired structures attached to the dorsal body wall. From the posterior mesodermal surface of each testis, the main sperm duct (vas deferens) arises and lead to the urinogenital papilla situated between the rectum and urinary bladder.



FEMALE REPRODUCTIVE ORGAN

Unlike mammals, the female reproductive system of teleosts is highly variable with a wide range of reproductive patterns including viviparity. The teleostean ovary in general is a hollow paired organ. There may be hundreds or even millions of fertile eggs present in the ovary of a fish at any given time.

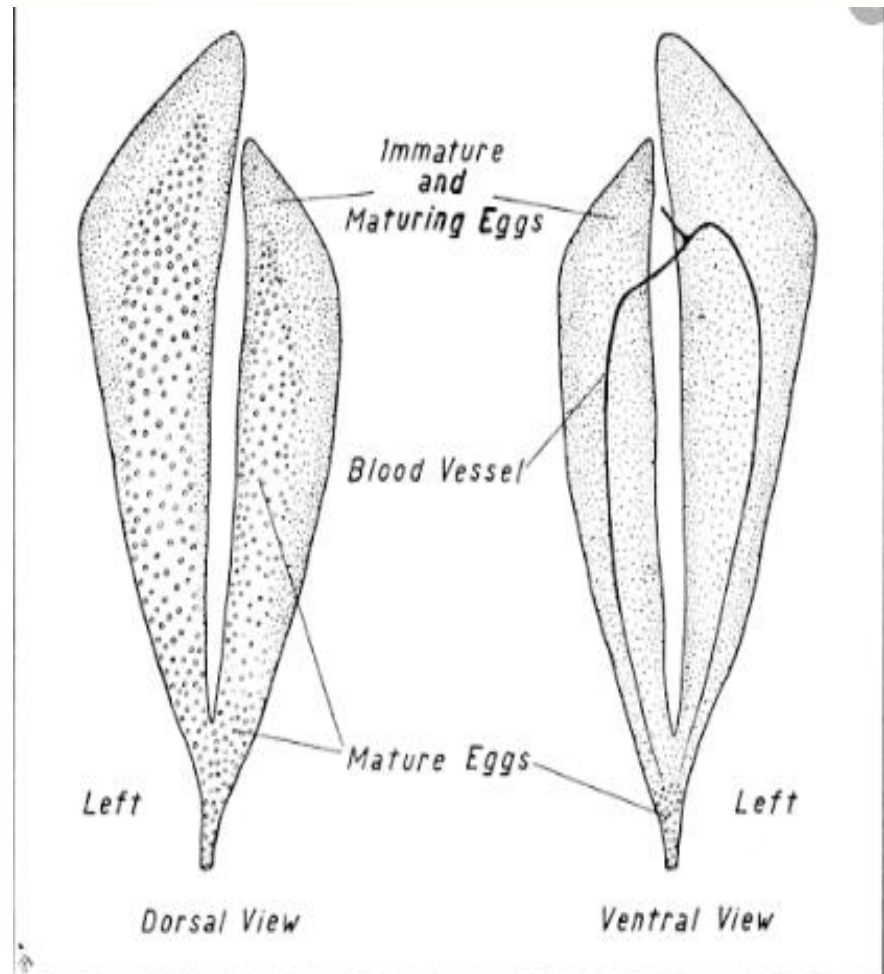


FIG. 1. Diagrammatic drawing of a mature sardine ovary showing the location of different groups of eggs.

Reproductive Systems

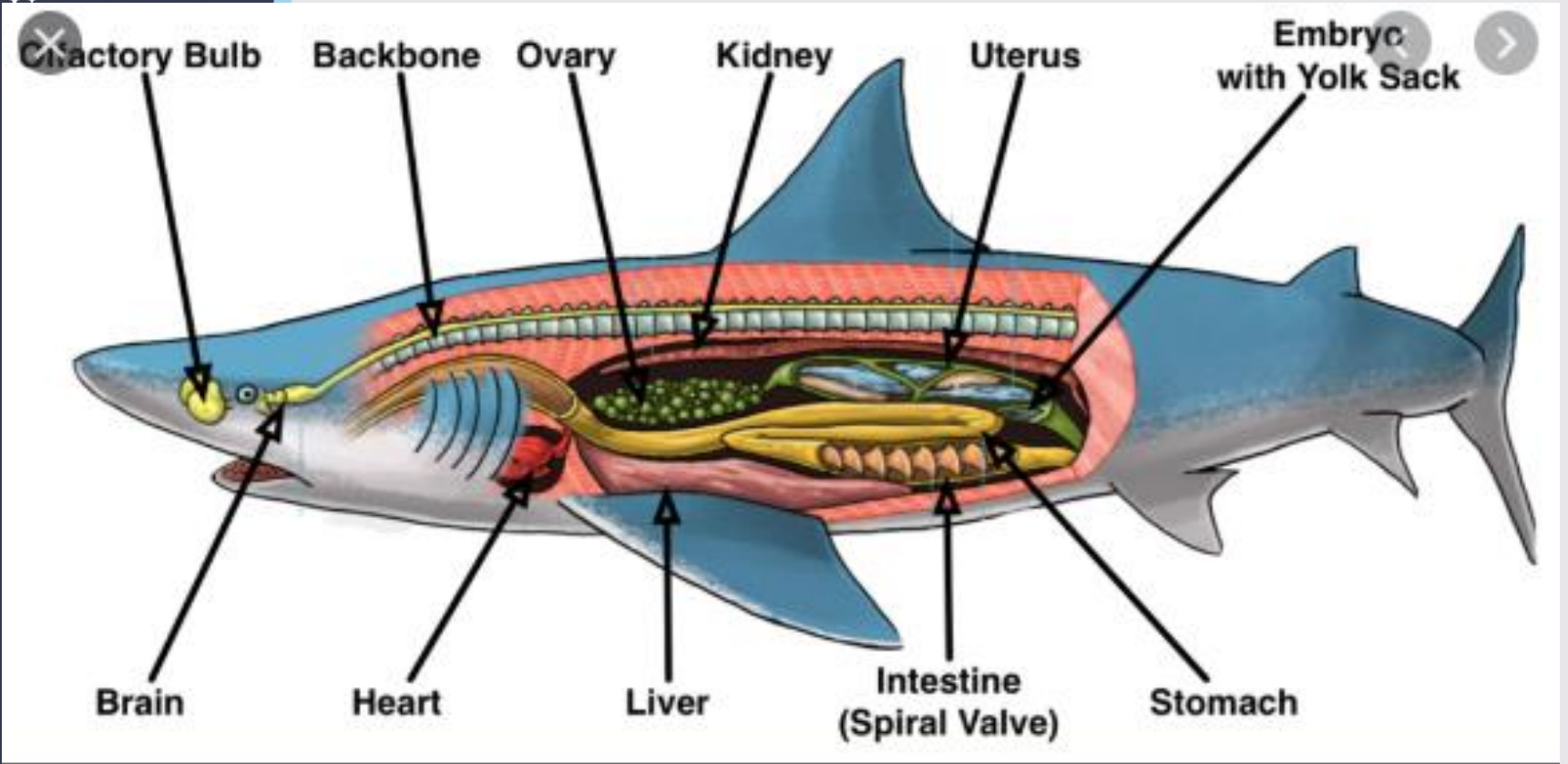
- **Cartilaginous Fishes**
 - Ducts lead from testes and ovaries to **cloaca** (common passage for digestive, excretory and reproductive systems)
 - Cloaca leads to the anus
- **Bony & Jawless Fishes**
 - Have a **urogenital opening** (separate opening behind the anus for urine and gametes)



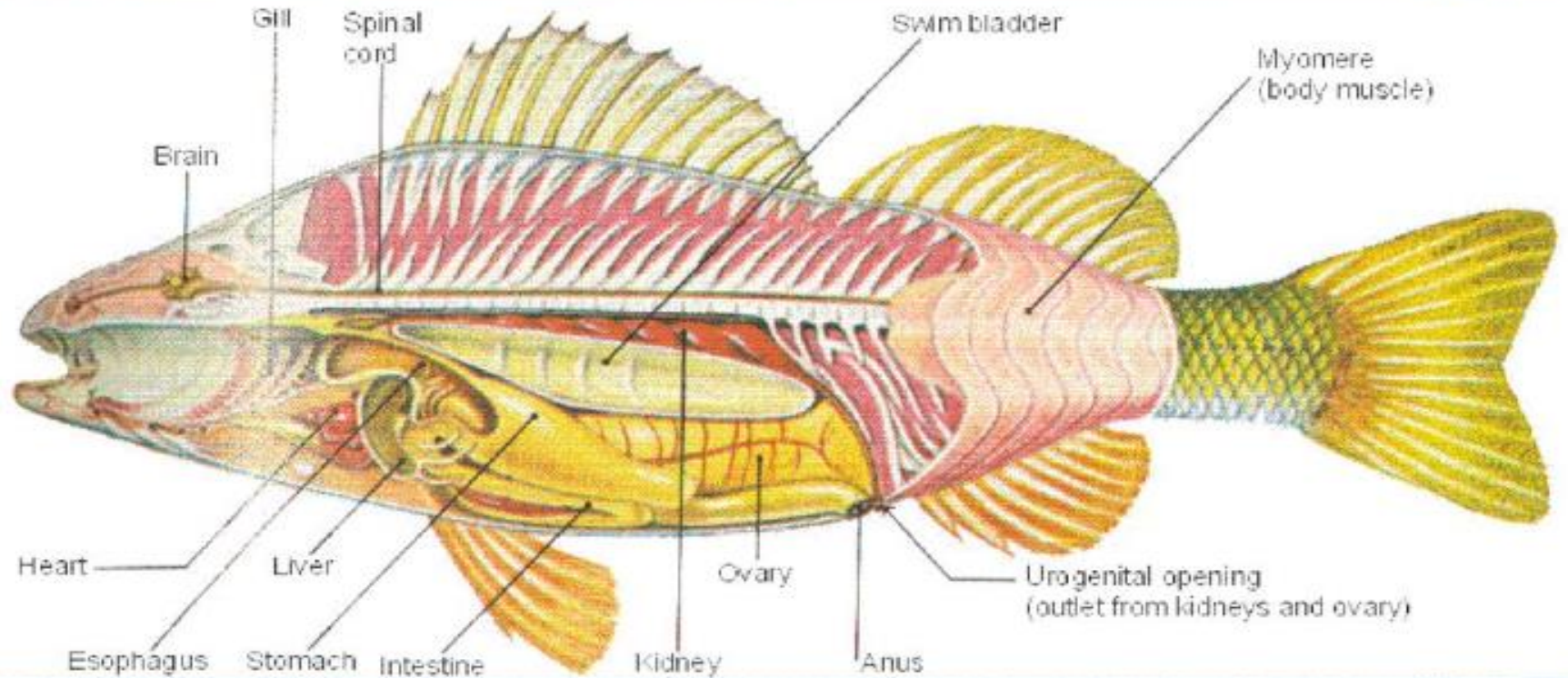


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Internal anatomy of a shark



Reproductive System – Bony Fish





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The fishes have one pair of bilateral gonad. They are generally symmetrical. They are suspended from the dorsal portion of the body cavity by mesenteries across the roof of the body cavity in close association with kidneys. The mesentery in female is called mesovarium. They are also present in *Neoceratodus* (Fig. 20.1a, b, c). While in male it is known as mesorchium. It is richly supported with blood vessels and nerve fibres.



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Thank you