LANCELET , CHARACTERISTICS, IMPORTANCE IN EVOLUTION

MEDICAL ACADEMY NAMED BY SI GEORGIEVISKIY CFU NAMED BY V.I.VERANDSKIY

DEPARTMENT OF MEDICAL BIOLOGY

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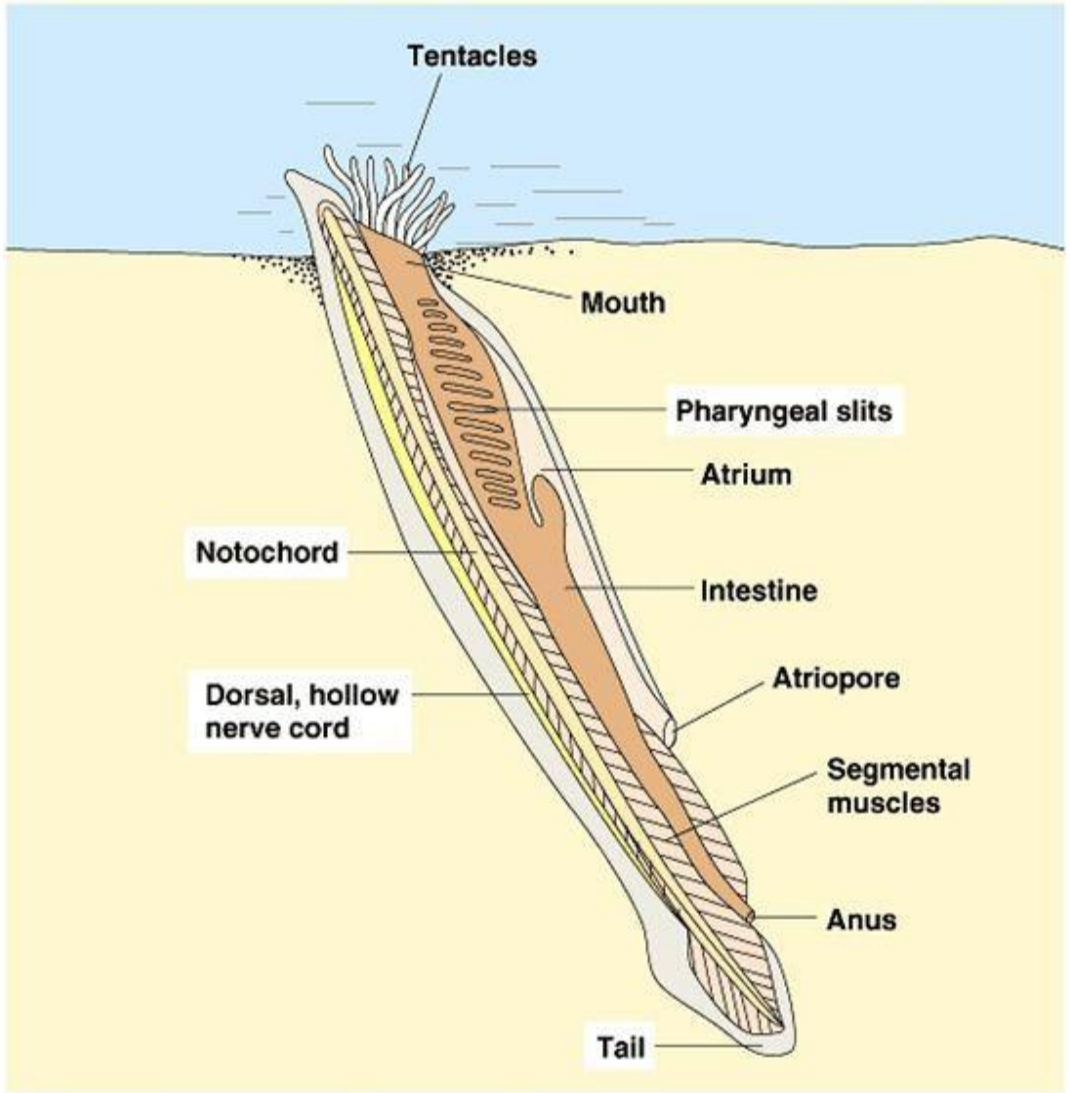
General introduction

The lancelets (/ˈlænslɪts/ or /ˈlɑːnslɪts/), also known as amphioxi (singular: amphioxus /æmfiˈɒksəs/), consist of some 30–35 species of "fish-like" benthic filter feeding chordates [2] in the order Amphioxiformes. They are the modern representatives of the subphylum Cephalochordata. Lancelets closely resemble, and are believed to be related to, 530-million-year-old Pikaia, fossils of which are known from the Burgess Shale. Zoologists are interested in them because they provide evolutionary insight into the origins of vertebrates. Lancelets contain many organs and organ systems that are closely related to those of modern fish, but in more primitive form. Therefore, they provide a number of examples of possible evolution exaptation.

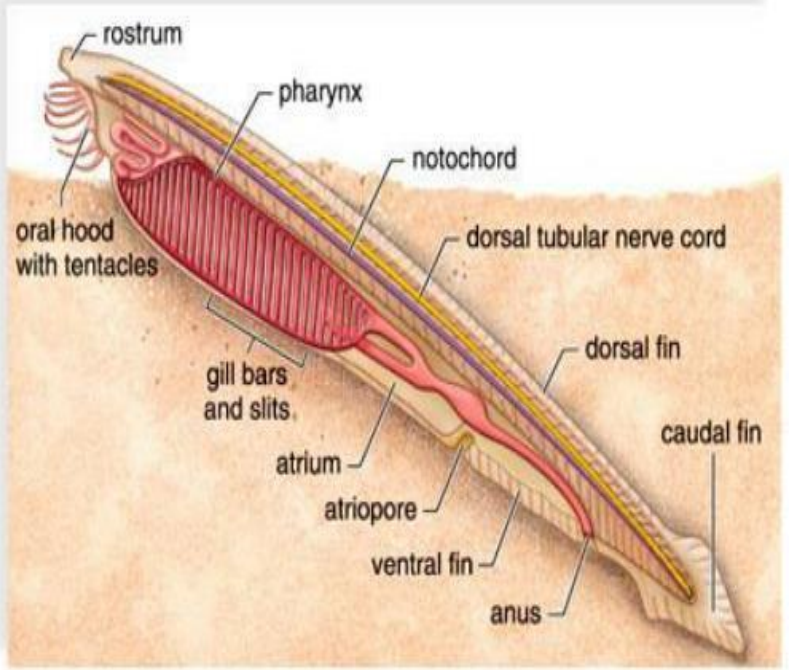
Features of lancelets

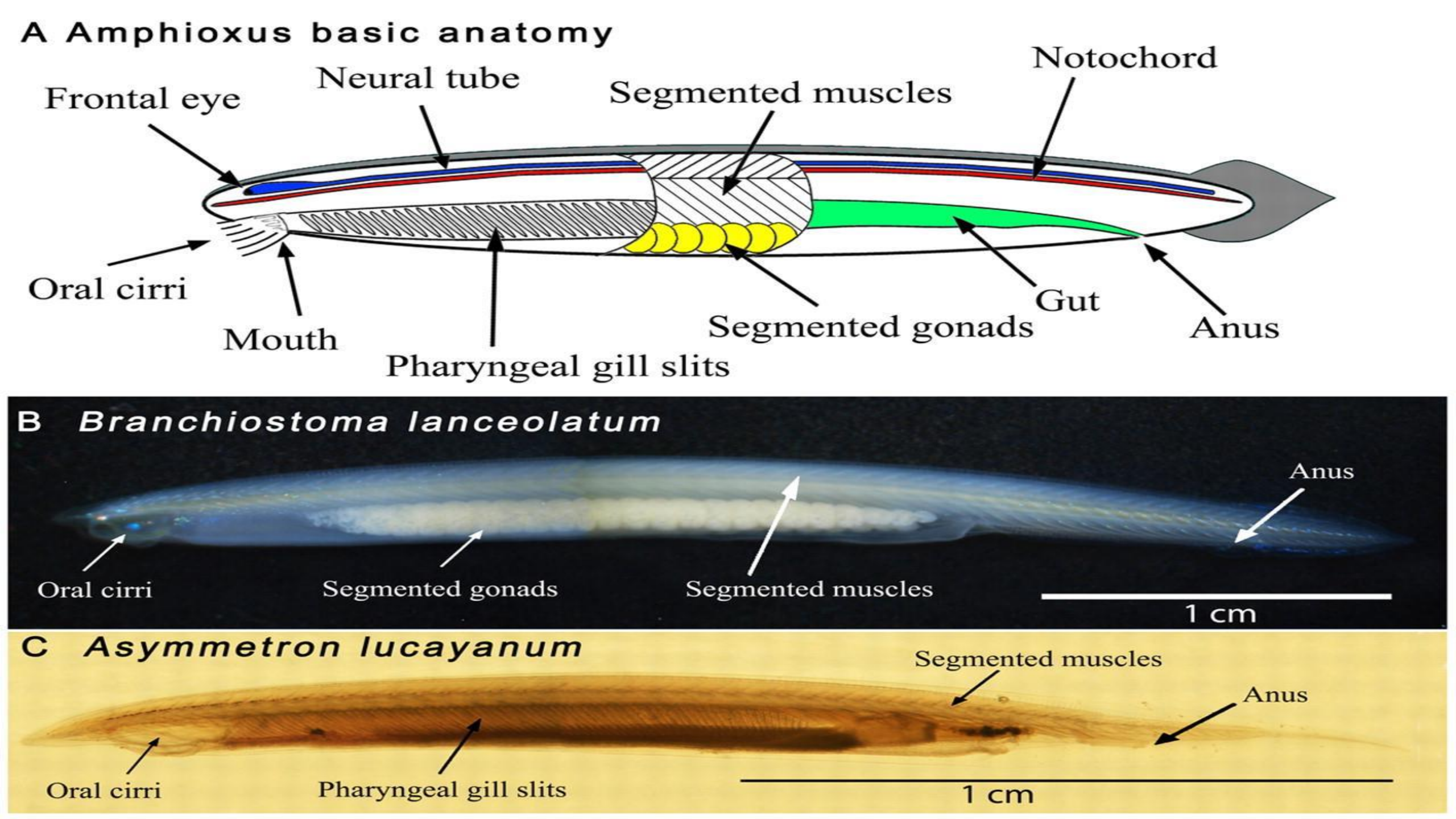
The dorsal hollow nerve cord is part of the chordate central nervous system.In vertebrate fishes, the pharyngeal slits become the gills.Humans are not chordates because humans do not have a tail.Vertebrates do not have a notochord at any point in their development; instead, they have a vertebral column.The endostyle secretes steroid hormones

Lancelets



- Fish-like shape
- Half (at least) of their body is buried in the sand
- Filter-feeders
- Have mouth and up to 100 pharyngeal slits along body



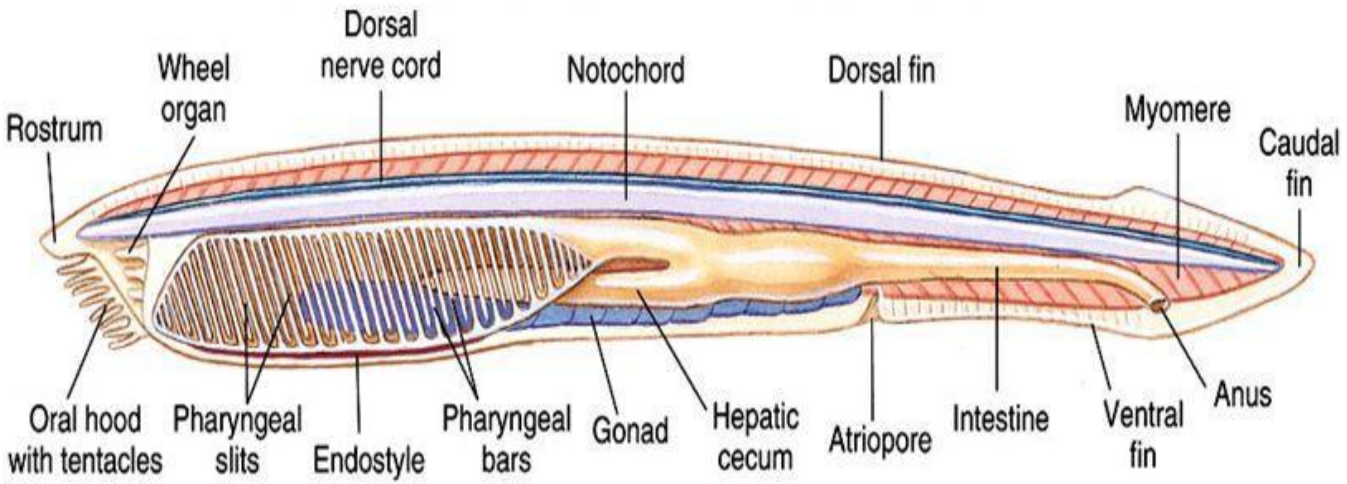

A Amphioxus basic anatomy
Frontal eye
Neural tube
Segmented muscles
Notochord
Oral cirri
Mouth
Pharyngeal gill slits
Segmented gonads
Gut
Anus
B Branchiostoma lanceolatum
Anus
Oral cirri
Segmented gonads
Segmented muscles
1 cm
C Asymmetron lucayanum
Segmented muscles
Anus
Oral cirri
Pharyngeal gill slits
1 cm

General characteristics and features of lancelets

The five characteristic features of chordates present during some time of their life cycles are a notochord, a dorsal hollow tubular nerve cord, pharyngeal slits, endostyle/thyroid gland, and a post-anal tail.

Digestive system

- The large mouth lies under the rostrum and opens into a spacious buccal cavity. The mouth is surrounded by a ring of tentacle-like buccal cirri (=oral cirri). These are involved in preliminary mechanical sorting of food particles and are probably chemoreceptive as well. The roof and walls of the buccal cavity form the oral hood. The trunk contains most of the gut, including the large conspicuous pharynx and the musculature.



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Circulatory system

- Lancelets have colorless blood which moves through a ventral vessel and back through a dorsal vessel

Lancelet (Branchiostoma Lanceolatum). Digital image. Web. 13 Mar. 2010. <http://www.daviddarling.info/images/lancelet.jpg>.

Nervous system

- Have a hollow, dorsal nerve (Urochordata on as larvae)
- Lancelets have a swollen tip of the dorsal nerve, which is not a true brain

Excretory system

- Lancelets pump water out through the atriopore, separately from waste
- Urochordata pump out water and waste with an excurrent siphon
  - Both have a separate mouth and anus

- Digestive System
  - Use pharyngeal slits lined with mucous to remove tiny food particles
- Excretory System
  - Composed of paired nephridia (a tubule open to the exterior; has ciliated or flagellated cells and absorptive walls)
- Locomotion/Musculature
  - Simple swimming mechanism
  - Coordinated contractions of muscles in chevrons (<<<) produce movement
  - Muscle segments called somites
- Skeletal Type
  - No solid skeleton, but has flexible notochord
  - Invertebrate

Gas exchange

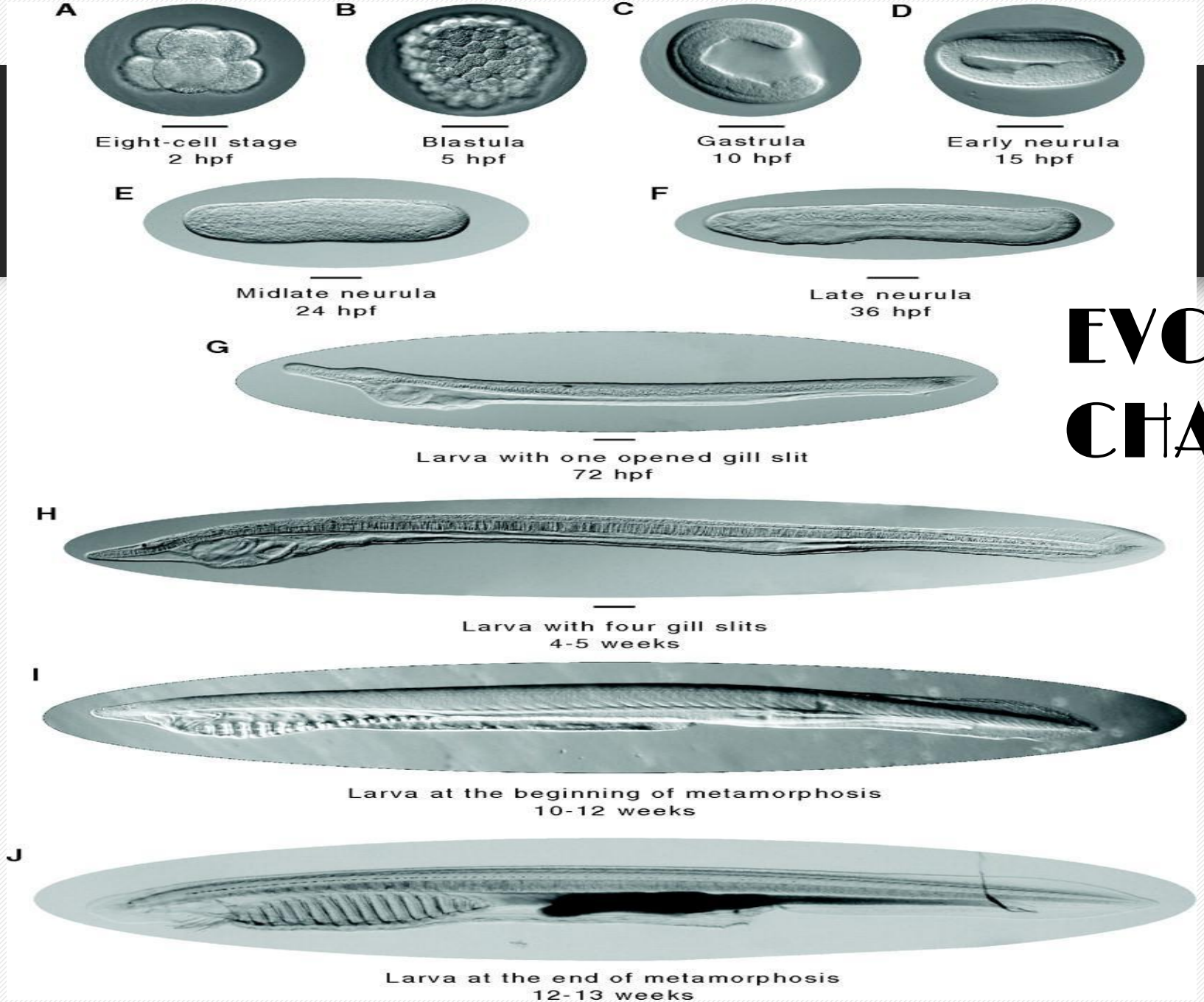
- In Lancelets and Tunicates, gas exchange takes place across the body surface, as well as through pharyngeal slits

Digital image. *Chemistry World Blog*. Web. 13 Mar. 2010. <http://prospect.rsc.org/blogs/cw/wp-content/uploads/2008/03/tunicate.jpg>.

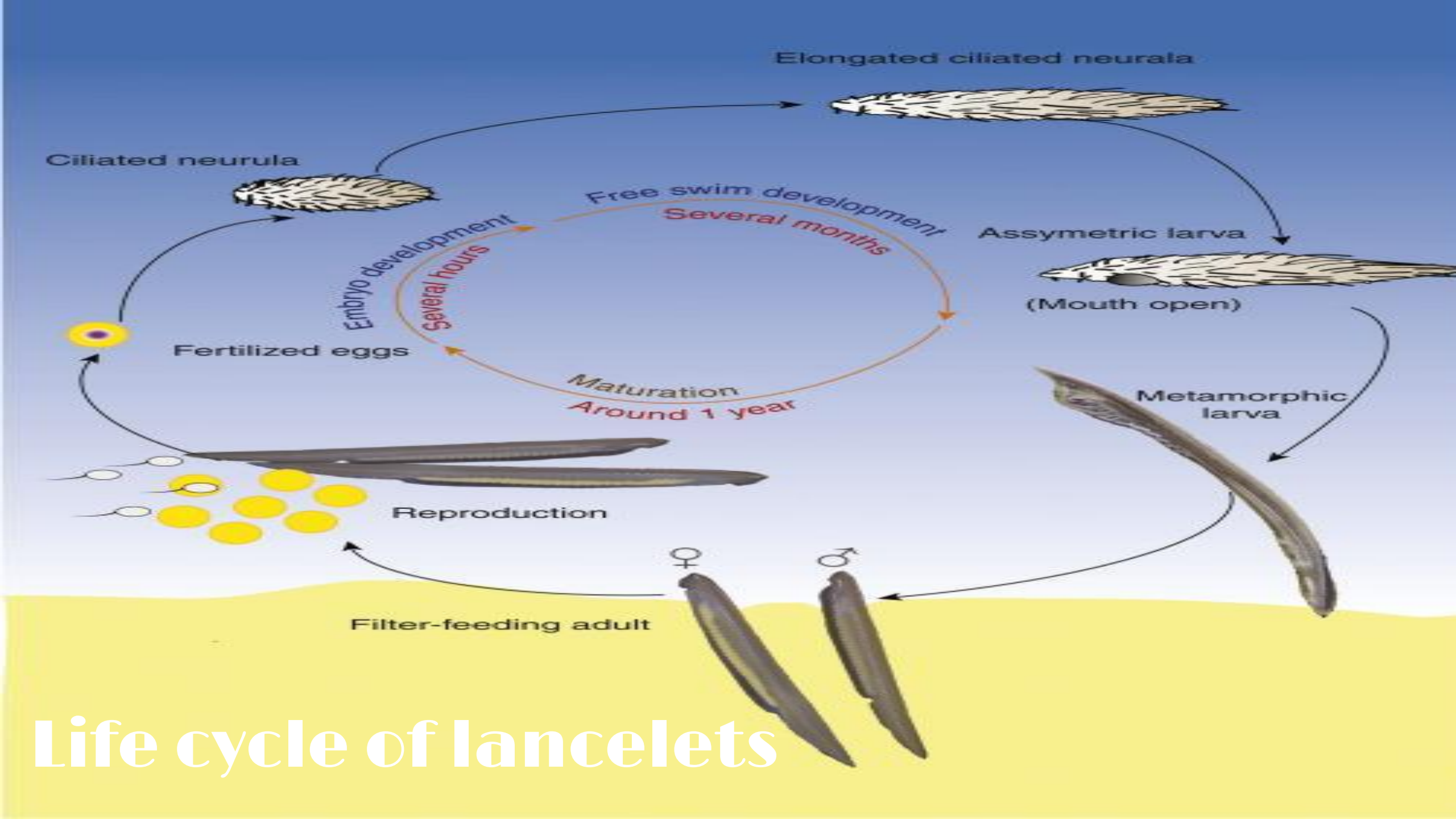
Paul Riviere

IMPORTANCE IN EVOLUTION

As the amphioxus lineage has likely been separated from other chordates for a very long time and displays a marked left-right asymmetry, its evolutionary history is potentially helpful in better understanding chordate and vertebrate origins. We studied the phylogenetic relationships within the extant amphioxus lineage based on mitochondrial genomes incorporating new Asymmetron and Epigonichthys populations, and based on previously reported nuclear transcriptomes. The resulting tree patterns are consistent, showing the Asymmetron clade diverging first, followed by the Epigonichthys and Branchiostoma clades splitting



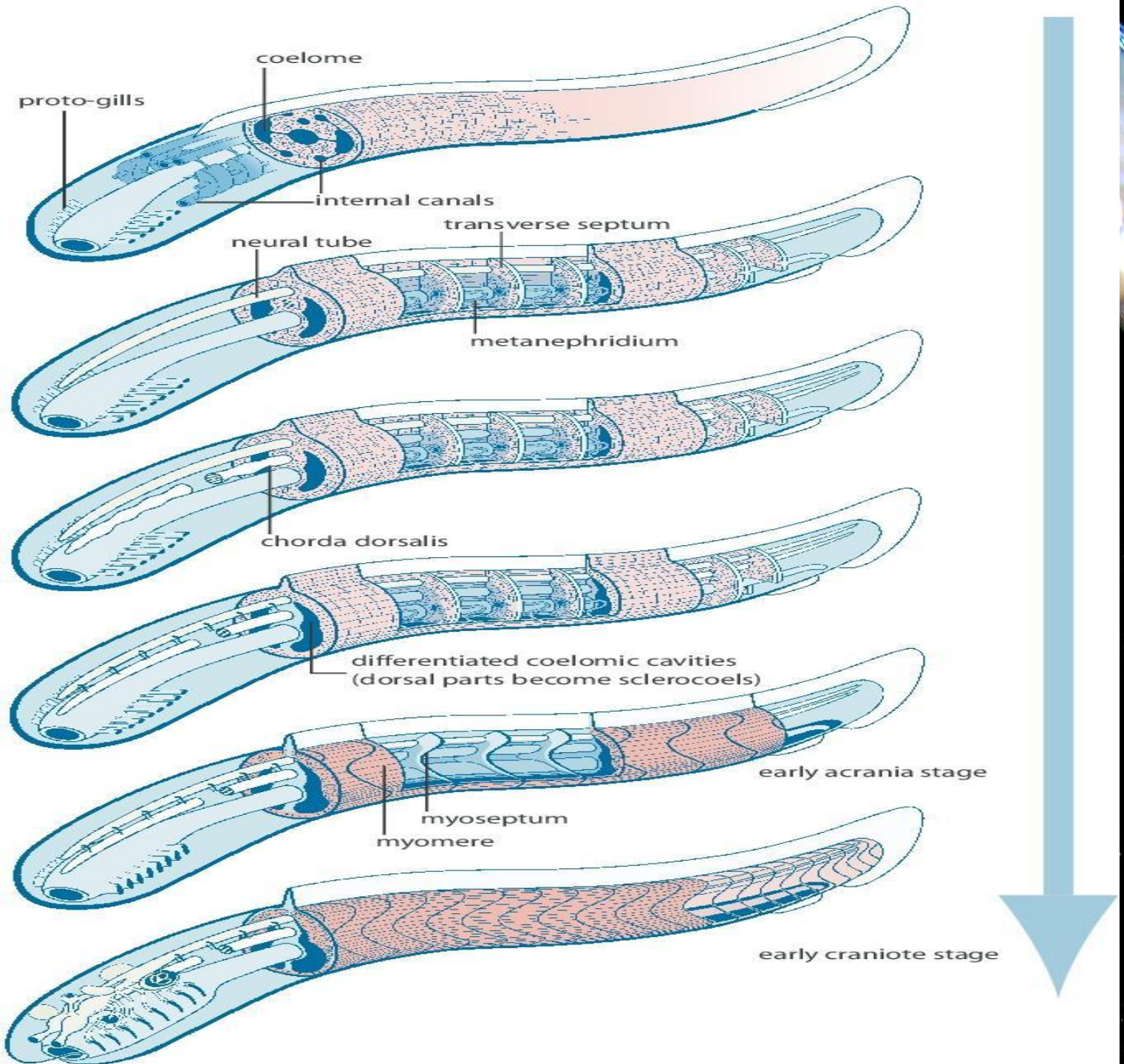
EVOLUTIONARY CHANGES

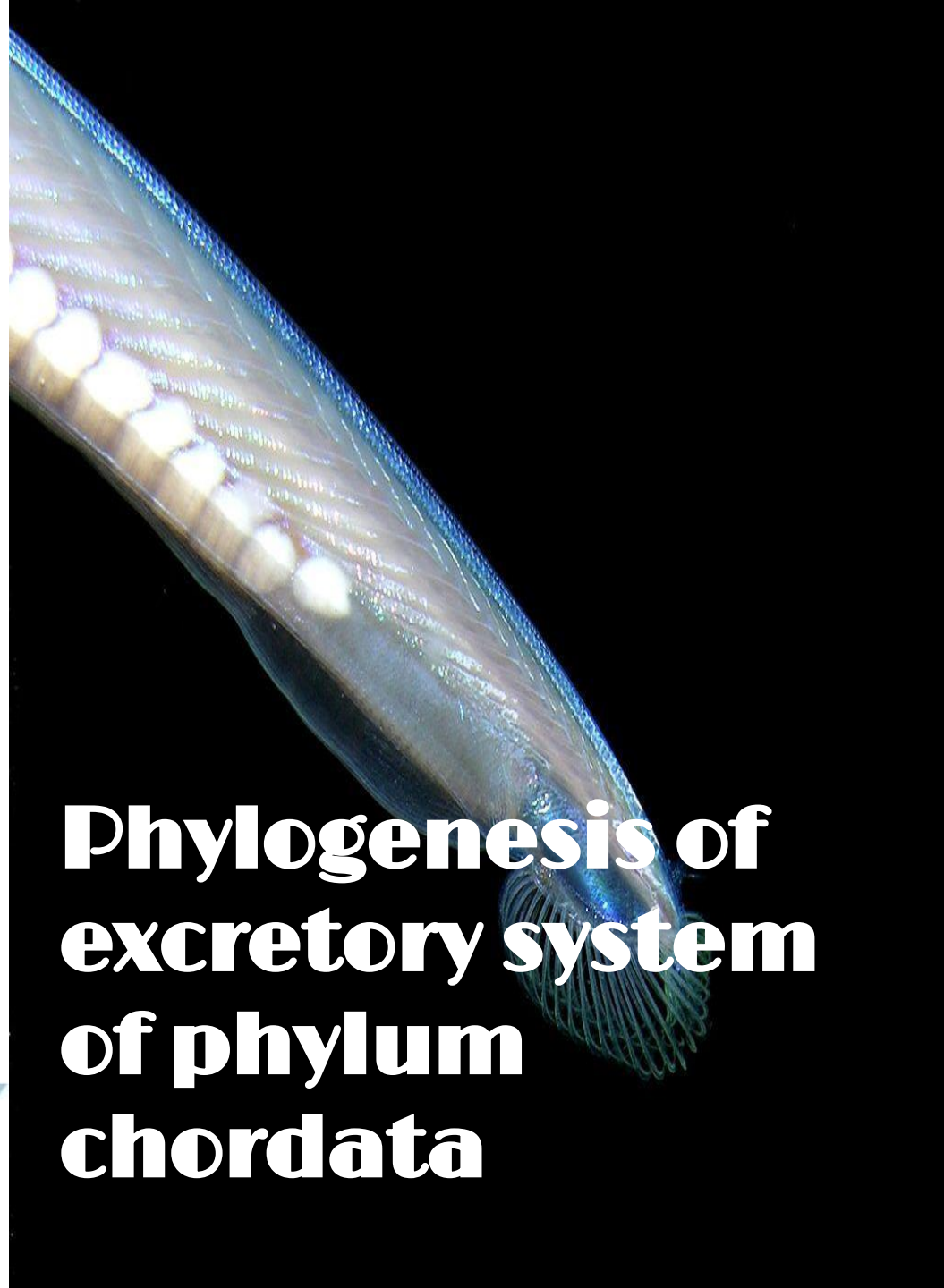


Life cycle of lancelets

Phylogenesis of excretory system of phylum chordata

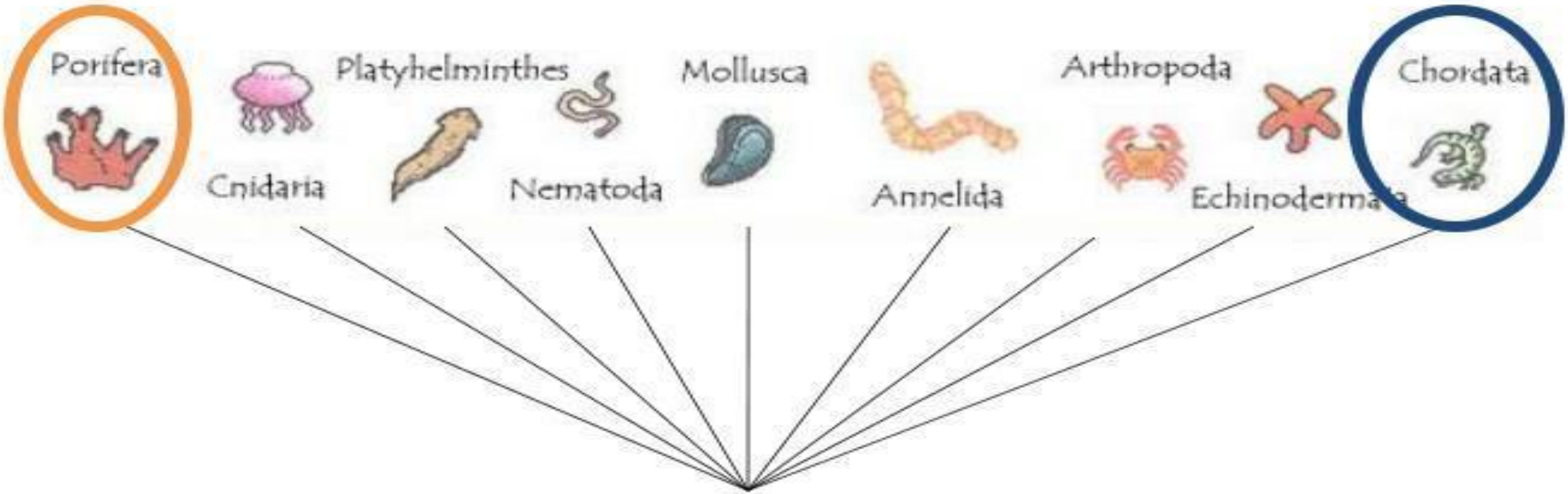
You have likely heard of the phylum Chordata because you yourself are part of this diverse group of animals. Ranging from the very small to the very large, from animals with shells to animals with fur, from those that fly to those that swim in the sea, Chordata incorporates a vast group of animals all over the planet.And while they may not all look the same, they are similar in that they produce wastes through metabolic processes and these wastes need to be removed from their bodies. This is accomplished in a number of different ways depending on the animal. These processes are performed by the excretory system, which quite literally serves to excrete wastes from the body.





Phylogenesis of excretory system of phylum chordata

Excretory System

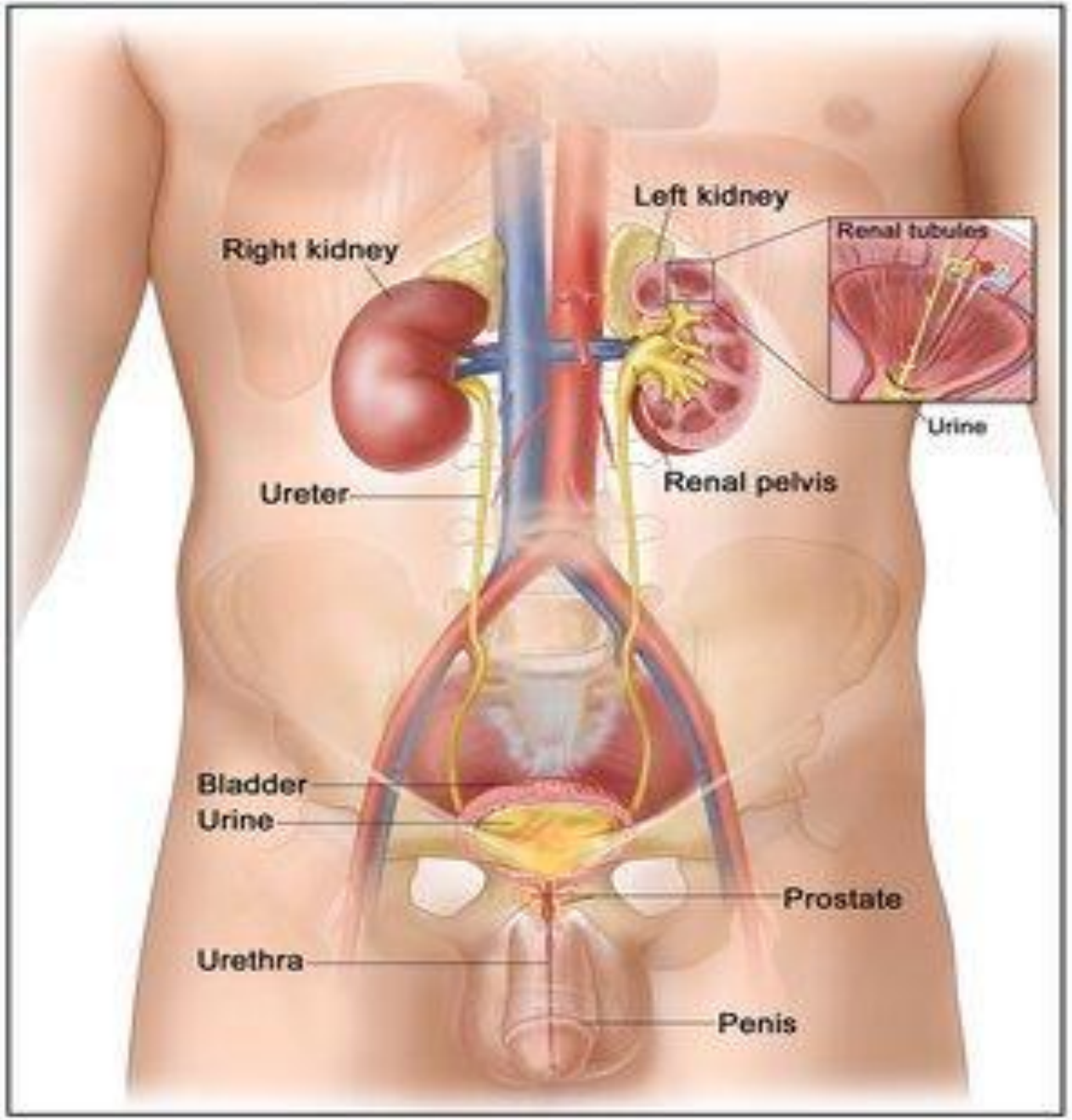


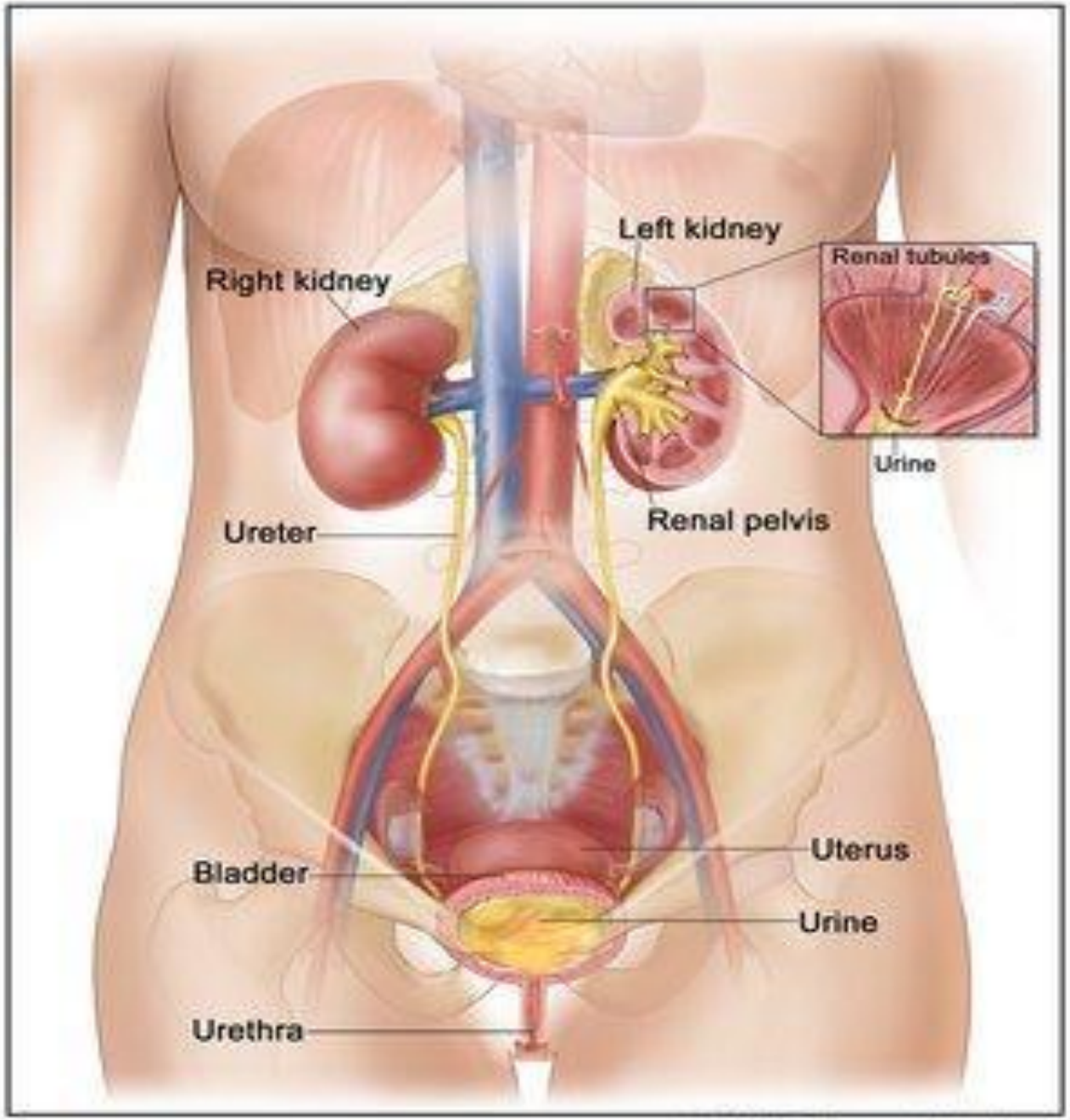
Developmental disorders

- Congenital anomalies of kidney and urinary tract (CAKUT) is a group of abnormalities affecting the kidneys or other structures of the urinary tract. The additional parts of the urinary tract that may be affected include the bladder, the tubes that carry urine from each kidney to the bladder (the ureters), and the tube that carries urine from the bladder out of the body (the urethra). CAKUT results from abnormal development of the urinary system and is present from birth (congenital), although the abnormality may not become apparent until later in life.

Classification of Development abnormalities

- Many different developmental abnormalities are classified as CAKUT, including underdevelopment or absence of a kidney (renal hypodysplasia or agenesis), a kidney formed of fluid-filled sacs called cysts (multicystic dysplastic kidney), buildup of urine in the kidneys (hydronephrosis), an extra ureter leading to the kidney (duplex kidney or duplicated collecting system), a blockage in a ureter where it joins the kidney (ureteropelvic junction obstruction), an abnormally wide ureter (megaureter), backflow of urine from the bladder into the ureter (vesicoureteral reflux), and an abnormal membrane in the urethra that blocks the flow of urine out of the bladder (posterior urethral valve).





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Thank you