

LIFE SCIENCES 11

CHORDATES

Phylum	Chordata
Level of Organization	Organ
Digestive System	Tube
Symmetry	Bilateral
Coelom	Coelomate
Cavity Development	Deuterostome
Segmentation	Yes

Chordates

- most evolutionary advanced group
- 2 main categories – vertebrate and invertebrates
- share 4 common characteristics
 1. notochord
 - flexible, rod-like structure located just dorsal of the nerve cord
 - allows the organism to bend rather than shorten when muscles are contracted
 - vertebrates → the notochord is replaced by bone or cartilage to become the spine
 - invertebrates → notochord remains
 2. postanal tail
 - muscular tail located posterior to the anus
 - allows for more effective swimming
 3. dorsal tubular nerve cord
 - located dorsal to the digestive tract
 - anterior end become the brain
 - posterior end becomes the spinal cord
 4. pharyngeal pouches
 - invertebrates and aquatic vertebrates → first formed filter feeding structures, then later formed gills for gas exchange
 - terrestrial vertebrates → become auditory canal, tonsils, thymus and parathyroid

Invertebrate Chordates

1. Lancelets
 - small marine organism that are fish-like in appearance and bury themselves in sand or mud with only the mouth and gills exposed
 - filter feed by pulling water in through the mouth and over the pharyngeal gill slits
 - skin is only one cell layer thick – can watch internal structures work
 - muscles in segmented blocks – can swim with fish-like motions
 - no true head – only light receptors and sensory tentacles near the mouth
 - pumping blood vessels instead of a heart
 - separate sexes with external fertilization

2. Tunicates

- also called sea squirts
- thick outer protective covering called the tunic
- larval form has bilateral symmetry and exhibits all four chordate characteristics
- adult form is asymmetrical and sessile
- suck water in through an incurrent siphon, push it through gill slits in the pharynx, then squirt it out the excurrent siphon
- hermaphrodites with external fertilization

Vertebrate Chordates

- notochord is replaced by a vertebral or spinal column
 - allows for the formation of a skeleton of cartilage and/or bone to which muscles can attach
- formation of a neural crest
 - group of cells developed from the nerve cord
 - forms in the brain and skull, some sense organs, parts of the pharyngeal pouches, some nerve fibres, insulation for nerve fibres, and some glands

1. Fish

- two-chambered heart
 - 1 atrium and 1 ventricle
 - bulbous arteriosus regulates blood pressure to the gills
- kidneys for filtering out wastes
- A. Jawless Fish
 - lack scales on skin
 - eel-shaped
 - no jaw and no paired fins
 - retain a notochord as an adult, but have gills and all other vertebrate characteristics
 - hagfish and lampreys
- B. Cartilaginous Fish
 - endoskeleton made of cartilage
 - skin covered by tough placoid scales → give it a rough feel
 - have specialized senses for detecting prey (sharks and rays)
 - ability to sense electrical currents generated by muscle movements of other fish
 - lateral line system – able to sense pressure changes in the water caused by other fish swimming nearby
 - keen sense of smell – sharks can detect one drop of blood in 115 litres of water
 - sharks, skates and rays
- C. Bony Fish
 - endoskeleton made of bone
 - ray-finned fish
 - includes almost all bony fish

- fin membranes supported by spine-like rays
- body covered in scales
- exchange gases using gills
- adjust buoyancy using a swim bladder
- two chambered heart

D. lobe-finned fish

- only 8 living species
- fins composed of muscular lobes and joints similar to land vertebrates
- includes lungfish and coelacanths

2. Amphibians

- larvae may be limbless and use gills for gas exchange
- adults have four limbs and use both lungs and their moist skin for gas exchange
- have a full digestive system that ends in a cloaca → a chamber used to hold digestive wastes, urinary waste, and eggs/sperm
- 3 chambered heart – 2 atrium (upper chambers) and 1 ventricle (lower chamber)
 - double loop system – 1 loop carries blood to the lungs and 1 loop carries blood to the body
 - atria receive blood (right from body & left from lungs) and pump blood into the ventricle
 - blood becomes mixed in the ventricle
- nictitating membrane over the eye allows sight underwater
- have a tympanic membrane for hearing
- force air into the lungs by squeezing their throat
- most use external fertilization in water
- exotherms – cannot regulate body temperature internally
- frogs and toads, salamanders and newts, and caecilians (3900 species)

3. Reptiles

- evolution of an amniotic egg
 - embryo develops inside of a fluid-filled sac
 - gets nutrients from a yolk sac
 - wastes contained in a sac called the allantois
 - leathery shell allows for gas exchange, but keeps all of the fluids inside
- dry, scaly skin helps to keep fluids inside of the body, but must be shed for growth
- air is sucked into the lungs by expanding the upper part of the body cavity
- most have a three chambered heart
 - 2 atrium and one ventricle with an incomplete septum
 - crocodilians have a complete septum in the ventricle → 4 chambered heart
- exotherms
- lizards, snakes, turtles, tortoise, crocodiles, alligators (6000 species)

4. Birds

- body covered in feathers (except legs in most)
 - contour feathers – used for flight and protection from weather
 - down feathers – used for warmth
- light-weight bones reduce weight for flight
- large breast muscle – power for flight
- endotherms – ability to regulate internal body temperature
- one-way movement of air through the lungs
- 4 chambered heart
- muscular gizzard used to grind up food
- cloaca used for removing digestive wastes, metabolic wastes and for reproduction
- do not have a urinary bladder
- large cerebellum to coordinate flight movement and balance
- lay hard-shelled amniotic eggs
- about 8700 species

5. Mammals

- about 4500 species
- 2 common characteristics
 - hair – may be used for insulation, camouflage, sensory, waterproofing, signaling and defense
 - mammary glands – produce milk to feed young
- endotherms
- young born alive after internal fertilization
- 4 chambered heart
- have a diaphragm for moving air into the lungs
- highly developed cerebrum and cerebellum

A. Monotremes

- have a cloaca like birds
- lay hard-shelled eggs
- both males and females have modified sweat glands that leak milk
- example: duckbill platypus, spiny anteater

B. Marsupials

- born in an immature condition – crawl into pouch on mother and attach to a nipple for feeding where they finish developing
- example: opossum, kangaroo, koala bear

C. Placental Mammals

- internal development of young by attaching to the uterus and gaining nutrients through a placenta; waste materials also pass through placenta to mother
- young are dependent on adults for nutrition and learning how to survive after birth

