Animal Kingdom
We are going to study the following animal phyla:

A) Porifera- sponges
B) Coelenterata (Cnidaria) - jelly fish
C) Platyhelminthes- flat worms
D) Aschelminthes (Nematoda) - round worms
E) Annelida- segmented worms
F) Mollusca- soft bodied (octopus)
G) Arthropoda- joined legged with exoskeleton
H) Echinodermata- spiny skinned (star fish)
I) Chordata- back bone
Symmetry

Four Types of Symmetry

- SPHERICAL
- RADIAL
- BILATERAL
- ASYMMETRIC
Spherical - Body plan is a sphere.
Radial- Body radiates out from one point and is on only one plane.
Bilateral - Body is made in two identical mirror images.
Asymmetric - No definite body plan. The body shows random growth.
Body Plan Terminology

- anterior
- dorsal
- ventral
- posterior
Phylum: Porifera

- asymmetrical
- egg turns to **free swimming larva** that attaches to rock and undergoes metamorphosis into adult
- the **body wall consists of two cell layers**
- the pores of the body wall are connected to an internal canal system
- **collar cells** - have flagellum that create (1 way) current to draw water and food in to gut
- no tissues, organs, nervous system, or brain
- no circulatory system (no heart, blood or veins)
- no muscle (**sessile** - do not move)
- internal skeleton (**endoskeleton**) of spicules
- example sponges
Sponge
Body
Plan

Water exits through osculum.

Water and food enter through pores.

Central cavity

Collar cells
Scuba Sponge
Tube Sponges
Phylum Coelenterata (Cnidaria)

- radially symmetrical
- have true tissue (nerve, muscle, digestive)
- have nerve net but no brain
- nematocysts - sac containing coiled threadlike tubes that shoot out and inject toxin (1 tentacle can have over 1000)
- 2 body forms
  1) free swimming medusa (jelly fish)
  2) polyp - sessile (doesn't move around) tube like body with mouth surrounded by tentacles
- saclike cavity for digestion with single opening
- examples: jellyfish, coral, hydra, sea anemone
Jellyfish
Sun Coral
Hydra
Sea anemones
Phylum Platyhelminthes
(Flat Worms)

• free living and parasitic forms

• bilateral symmetry

• first life form to have mesoderm (3rd cell layer)

• true organs – digestive system but with only one opening

• first life form to show cephalization (concentration of nerve tissue in head resembling brain)

• 2 ventral nerve cords

• no circulatory system

• examples: tapeworms, planaria, liver flukes
Human tapeworms have lost most sensory receptors and their digestive tract but have a highly evolved reproductive system. Modified epidermis “tegumant” protects against digestive enzymes and the immune system.
Head (scolex) of Tapeworm
Tapeworm (Taenia)

Small mammals eat eggs on grass.

Proglottids shed in feces; lay eggs on the ground.

Dogs & Cats eat mammals and become infected.

Scolex or head attaches.

Adult tapeworm attaches to small intestine wall.

Segments called proglottids.
Planaria
Flukes
Sheep Liver Flukes
Phylum Aschelminthes (Nematoda) - round worms

- are parasitic or free-living
- are bilaterally symmetrical
- have no circulatory or respiratory system
- have a digestive tube with mouth and anus
- lateral ventral nerves running along body
- examples: ascaris, hookworm, trichinella, filaria
**Ascaris (Intestinal Roundworm)**—These nematodes are found in humans (and pigs) and are present mostly in unsanitary areas without modern plumbing. Around one in six people worldwide are infected by Ascaris. A study conducted in Cameroon focused on school children and found that 65.5% were infected with Ascaris parasitic roundworms. Ascaris eggs are spread through feces, and, when ingested, hatch and bore through the intestinal wall. They move to the heart, the lungs, and finally out the breathing passages where they are swallowed, thus perpetuating the cycle. Females lay hundreds of thousands of eggs each day and can reach nearly 30 centimeters in length. The life cycle of the disease was finally discovered in Japan in 1922 when Shimesu Koino, a researcher, infected both a volunteer and himself, and then traced the progress of the disease.
Mouth of Hookworm
Hookworm Life Cycle

Teeth Attach to Small Intestine Wall

Larva may be ingested or penetrate intact skin.

Dam may pass larva to nursing pups or via the placental blood supply.

Eggs are passed in feces & hatch on ground in 16-20 hours

Tough Mouth Capsule Won't Collapse When Sucking Blood

Infected larva may live in moist soil or on plant vegetation.
Trichinella—This nematode is responsible for the most serious roundworm-caused disease, which is known as trichinosis. They live in pigs’ intestines and produce young that make their way to muscle tissue and form tough cysts. When uncooked pork is ingested by humans, the roundworms cause trichinosis, which can sometimes be fatal. This parasite is also found in bears. In the United States it is suspected that almost two and a half percent of the population are infected with trichinosis.
Phylum Annelida
(Segmented Worms)

• marine, freshwater, or terrestrial
• bilaterally symmetrical
• the body is internally and externally segmented
• appendages are non-jointed or lacking
• the nerve cord is in a ventral position, solid and often paired
• setae – four pairs of bristles on each segment for movement
Phylum Annelida
(Segmented Worms)

- first group to have closed circulatory system (blood flows in closed vessels)
- digestive system includes: mouth, muscular pharynx, esophagus, intestine, anus
- examples: earthworm, leeches, polychaetes
INTERNAL ANATOMY OF AN EARTHWORM (lateral section)

- brain
- mouth cavity
- pharynx
- ventral nerve cord
- seminal receptacle
- ventral blood vessel
- nephridium
- esophagus
- lateral heart
- seminal vesicles
- crop
- dorsal blood vessel
- gizzard
Leech
Marine Polychaete
Phylum Mollusca (soft body)

- marine, freshwater, or terrestrial
- bilaterally symmetrical or asymmetrical
- no segmentation
- have well-developed digestive and circulatory systems
- highly developed nervous system with large brain with many ganglion (some have image forming eyes)
- extensively folded gills with "gill heart" (pumps blood back to "systemic heart")
Phylum Mollusca (soft body)

• has an organ called a mantle (fold of tissue over the body) which secretes a hard shell
• muscular mantle for water flow & jet power for fast swimming
• examples: octopus, squid, cuttle fish, clams, oysters, mussels, scallops, tooth shells, snails, slugs
Octopus
Squid
Cuttle fish
Clams

- Posterior Adductor Muscle
- Hinge
- Excurrent Siphon
- Mantle
- Incurrent Siphon
- Foot
- Palp
Oyster
Mussels
Scallops
Land Snails
Aquatic Snail
Blue Ocean Slug (*Glaucus atlanticus*)
Phylum Arthropoda

- marine, freshwater, or terrestrial
- there are over 1 million types of arthropods (more than any other animal phylum!)
- bilaterally symmetrical
- has a ventral, main nerve cord and dorsal blood vessel
- nerve cord is solid
- muscles are inside the skeleton, it has an exoskeleton
- the body is segmented, but the segments are often fused
- has jointed appendages
Phylum Arthropoda
Class Insecta

• there are more different species of insects than all other animals combined
• there are approximately 1,800,000,000,000,000,000,000 insects living on the planet
• has one pair of antennae
• the body is divided into 3 parts - head, thorax, and abdomen
• has three pairs of legs on thorax
• examples: butterfly, bee, grasshopper
A grasshopper’s two large eyes are compound eyes. They are made up of many separate lenses. The lenses work together to form a complete picture. A grasshopper uses its compound eyes to see. Scientists aren’t sure how a grasshopper uses its smaller eyes.
Grasshopper - External Features (Female and Male)

- fore wing
- gena
- frons
- clypeus
- labrum
- palp
- prothorax
- compound eye
- antenna
- claw
- trochanter
- tarsus
- femur
- tibia
- ovipositor

- head
- thorax
- abdomen
Leaf Mimic Insect
Praying Mantis
Walking Stick
Wasp
Honey Bee
Phylum Arthropoda
Class Arachnida

- two body parts (cephalothorax and abdomen)
- has four pairs of legs
- no antennae
- has no jaws - the feeding appendages may resemble claw-bearing legs
- all spiders have poisonous glands and fangs, but only a few are harmful to humans
- some (orb weavers) spin silk webs
- examples: spider, scorpion, ticks, mites
Orb Weavers - spin webs to catch their next meal!
Jumping Spider - internal hydraulic system (blood) extends their limbs by altering the pressure of within them. This enables the spiders to jump up to 80 times the length of its body without having muscular legs.
Tarantula
Black Widow

Adult female black widow spiders are gloss black with an hourglass shaped marking on the underside of its abdomen.
Deer Tick
Dog Tick
Wood Tick
Common household dust mites live in the fine layer of minute dust particles that continually settles on household items. They are associated with allergies.
Dust mites favor homes with high humidity levels and constant warm temperatures.
Rear end of tiny mites feeding on the dead skin cells of an eyelash hair follicle.
Rust mite – live on white pine needles
Flat mite – common in and on various citrus fruits
Phylum Arthropoda
Class Crustacea

• mainly marine
• has 2 pairs of antennae
• 3 body parts with first two often fused (cephalothorax)
• has respiration by gills
• examples: crab, lobster, crayfish, shrimp, barnacles
Fiddler Crab
Lobster
Crayfish
MORPHOLOGY OF A CRAYFISH

- antenna
- cheliped
- antennule
- compound eye (stalked eye)
- walking leg
- segment
- telson
- claw
- rostrum
- head
- thorax
- abdomen
- exopodite
- endopodite
- uropod
Phylum Arthropoda
Class Chilopoda

- carnivorous
- has one pair of long antennae
- the entire body is segmented, but flat
- there is one pair of legs on each segment
- has a pair of poison glands behind head
- example: centipede
House Centipede
Soil Centipede
Giant Centipede with its young!!!
Chinese Redhead Centipede
Phylum Arthropoda
Class Diplopoda

- feed on plants - **herbivorous**
- has **one pair of long antennae**
- there are **two pairs of legs on each segment**
- has **no poison glands**
- it curls into a ring when disturbed
- example: millipede
Common Millipede
Phylum Echinodermata

• all are marine
• adults are radially symmetrical
• larvae are bilaterally symmetrical
• oral and radial nerve cord
• has an internal limy skeleton, usually with many projecting spines
• a system of water-filled tubes, acting on the suction principle, catches food and assists in locomotion
• examples: starfish, brittle stars, sea urchin, sea cucumber, and sand dollar
Starfish
Sea star
Brittle Star
Sea urchin
Sea Cucumber
Sand Dollar
Phylum Chordata

• marine, freshwater, or terrestrial
• bilaterally symmetrical
• spinal cord: hollow dorsal nerve tube
• notochord: is a flexible rod beneath spinal cord (which may be lost or replaced during development)
• muscles cover skeleton (endoskeleton)
• several pairs of pharyngeal slits (through which water is taken in and passed out) in the throat region (these may be changed or lost during development)
• some segmentation, especially in muscles and nerves
There are three classes of fish that are separated based on two characteristics:

1) What type of jaws they have
   a) sucker (no jaw)
   b) jaw

2) What their skeleton is made of
   a) cartilage
   b) bone
Phylum Chordata
Class Agnatha

- has no jaws
- has no paired fins
- has a skeleton of cartilage
- has a two-chambered heart
- examples: hagfish, lamprey
Hagfish
Brook Lamprey
Phylum Chordata
Class Chondrichthyes
(Cartilaginous Fish)

- has a jaw and skeleton of cartilage
- has five or more pharyngeal slits externally visible
- has a ventral mouth and nostrils
- has a two chambered heart
- no swim bladder
- lateral line (predatory adaptation for detecting vibrations)
- examples: sharks, skates, rays
MORPHOLOGY OF A SHARK

- head
- first dorsal fin
- second dorsal fin
- caudal fin
- eye
- mouth
- external gill opening
- pectoral fin
- belly
- pelvic fin
Reef Shark
Leopard Shark
Great White Shark
Skates
Manta Ray
Spotted Stingray
Fresh Water Stingray
Phylum Chordata
Class Osteichthyes (Bony Fish)

- has a jaw and a skeleton of bone
- the pharyngeal slits are covered and are not externally visible
- has a two-chambered heart
- have a swim bladder
- lateral line (predatory adaptation for detecting vibrations)
- examples: salmon, trout, cod, perch
INTERNAL ANATOMY OF A BONY FISH

- brain
- esophagus
- aorta
- stomach
- bladder
- spinal cord
- kidney
- olfactory bulb
- eye
- tooth
- gills
- heart
- liver
- gall bladder
- pyloric cacum
- intestine
- gonad
- anus
- genital orifice
- urinary orifice
Sockeye Salmon
Coho Salmon
Ling Cod
Yellow Perch
Northern Pike
Phylum Chordata
Class Amphibia

• have a three-chambered heart
• lack claws on their toes
• seldom have scales
• the eggs have no shells and must be laid in water
• most have lungs (adult) – may also breathe through moist skin
• are cold-blooded
• examples: frog, toad, salamander
Digestive Systems Compared

Frog
- heart
- eye
- brain
- mouth
- pharynx
- ear
- esophagus
- gall bladder
- lung
- liver
- small intestine
- large intestine
- spleen
- anus
- cloaca
- urinary bladder
- pancreas
- stomach
Poison Dart Frog
Baw Baw Frog
Tomato Frog
Toad
American Toad
Spotted Salamander
Grotto Salamander
Phylum Chordata
Class Reptilia

- have scales on skin
- breathe by lungs
- are cold blooded
- have three-chambered heart (except crocs have 4)
- have two pairs of appendages with claws (small and lacking in some)
- egg - leathery shell
- examples: snake, lizard, turtle
Diamondback Rattlesnake
MORPHOLOGY OF A VENOMOUS SNAKE

- nostril
- venom canal
- fang
- tooth
- glottis
- forked tongue
- eye
- head
- poison gland
- neck
- scale
Spitting Cobra

**Spitting cobra** spit venom from their mouth when defending themselves against predators which can cause permanent blindness if introduced to the eye. Some species can "spit" their venom a distance as great as two meters. While spitting is typically their primary form of defense, all spitting cobras are capable of delivering venom through a bite as well.
Bull Snake
Red-tailed Boa (our snake)
Python
Earless Lizard
Spiny Lizard
Chuckwalla
Box Turtle
Snapping Turtle
Giant Tortoise

They can weigh as much as 300 kg (660 lbs) and can grow to be 1.3 m (4 ft) long. They are one of the world's longest-living animals, with an average lifespan of 100 years or more.
Galapagos Sea Turtle
Green Sea Turtle
Komodo Dragon
Crocodile
Can reach 70 years, 15 feet, 2000 lbs
Phylum Chordata
Class Aves

• have **feathers**
• they **lay eggs with a hard calcareous shell**
• they have **wings**
• have a **four-chambered heart**
• are **warm-blooded**
• examples: sparrow, chicken, ostrich
Peregrine Falcon

Fastest animal on the planet in its hunting dive, the stoop, which involves soaring to a great height and then diving steeply at speeds of over 322 km/h (200 mph) hitting one wing of its prey, so as not to harm itself on impact. Has body length of 34–50 cm (13–20 in) and a wingspan of around 80–120 cm (31–47 in)
Bald Eagle
Ostrich

Can run at speeds of about 65 km/h (40 mph). Male ostriches weight up to 155 kg (340 lb). Male ostriches can be 2.7 m (9 ft) in height. At one year of age, ostriches weigh around 45 kg (100 lb). An Ostrich can live up to 75 years.
Mallard Duck
Canadian Goose
Emperor Penguin
Adults average about 1.1 m (3 ft 7 in) tall and weigh 35 kg (75 lb). Diving penguins reach velocities of 27 km/h (17 mph), reach a depth of 565 m (1,870 ft) and stay submerged for up to 22 minutes.
Phylum Chordata
Class Mammalia

- they **have hair**
- the **mammary glands** (modified sweat glands) of female secrete milk
- **give birth to live young**
- are **warm-blooded**
- have a **four chambered heart**
- the teeth are usually of four well-defined types: **incisors, canines, premolars & molars**
- examples: primates, cats, bats, whales, etc.
Male Lion - Can exceed 250 kg (550 lb) in weight.
Lionesses hunt in groups and stalk their chosen prey. They can reach speeds of 59 km/h (40 mph) for short bursts and must sneak up to the victim until they reach a distance of approximately 30 m (98 ft).
Brown Bat
Humpback Whale

Adults range in length from 12–16 metres (40–50 ft) and weigh approximately 36,000 kilograms (79,000 lbs)
Killer Whale
Blue Whale - up to 33 metres (110 ft) in length and 181 metric tonnes, it is believed to be the largest animal ever to have existed.
Star-Nosed Mole

The mole's most distinctive feature is a circle of 22 mobile, pink, fleshy tentacles at the end of the snout. These are used to identify food by touch, such as worms, insects and crustaceans.
Duck Billed Platypus

They are the only mammals that lay eggs rather than giving birth to live young. The male Platypus has a spur on the hind foot that delivers a venom capable of causing severe pain to humans.
Female kangaroo and her joey are from the marsupial family.
New born joey sucking on teat of mother in pouch.
Large males can be 2 metres (6 ft 7 in) tall, weigh 90 kg (200 lb) and reach speeds of up to 70 km/h.