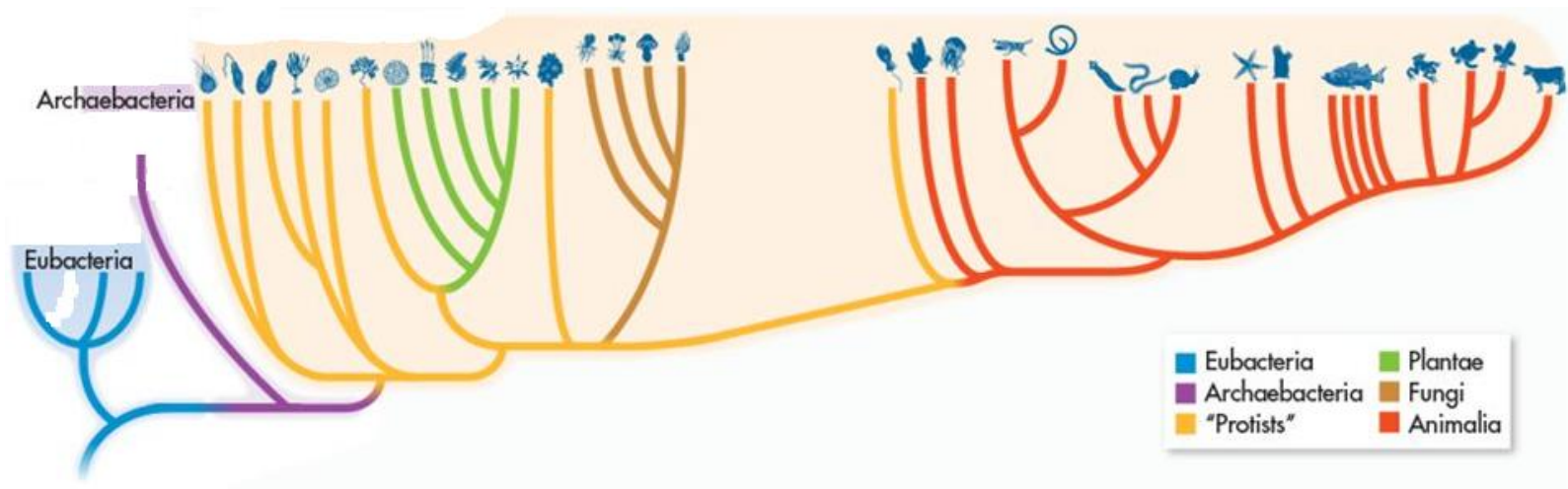


Class Notes

for

LIFE ON EARTH



Biology Semester B
Johnson
2018

I. Classification Systems

A. Used to organize and study the great diversity of living things on Earth

B. Methods of organization include:

1. Cladograms – branching diagram that shows evolutionary relationship between organisms.

Do Animacules assignment here (cladogram only)

2. Dichotomous Keys – chart used to identify things through a series of paired choices.

Shoe Cladogram *(6 or 7 shoes)*

Shoe Dichotomous Key

II. Taxonomy – the discipline of classifying and naming organisms.

A. Carolus Linnaeus (1707-1784) – invented the system still used today.

B. Seven levels of organization from **broadest to most specific**:

Kingdom –broadest level (six kingdoms of living things)

Phylum

Class

Order

Family

Genus

species

As an example of how this works, let's classify the **COYOTE**

Example: Coyote

Kingdom – animalia

Phylum – chordate

Class – mammalia

Order – carnivore

Family – canidae

Genus – Canis

species - latrans



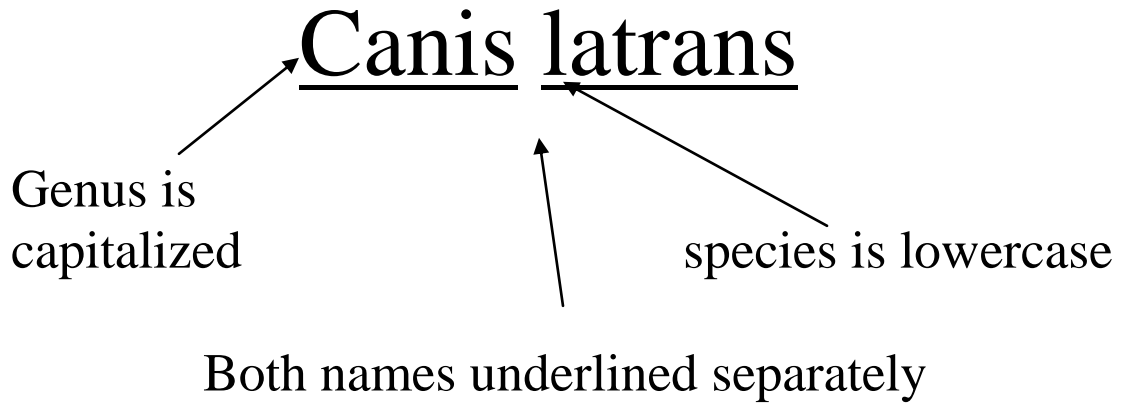
C. Binomial Nomenclature – giving an organism a scientific name based on its Genus and species names.

*Usually Latin or Greek

*Eliminates confusion of common names

Example: coyote

Canis latrans



The diagram illustrates the components of the binomial name Canis latrans. The word Canis is underlined and capitalized, with an arrow pointing to it from the text "Genus is capitalized". The word latrans is underlined and lowercase, with an arrow pointing to it from the text "species is lowercase". A third arrow points from the text "Both names underlined separately" to the underlines of both words.

Genus is capitalized

species is lowercase

Both names underlined separately

III. The Kingdoms

A. Linneaus made 2 kingdoms based on structural similarities.

B. Today we use six kingdoms based on structural, genetic, and evolutionary relationships:

1. Eubacteria
2. Archaeobacteria
3. Protista
4. Fungi
5. Plantae
6. Animalia

C. Overview of the six kingdoms

Kingdom	Eubacteria	Archaeobacteria	Protista	Fungi	Plantae	Animalia
Cell Type	Prokaryote	Prokaryote	Eukaryote	Eukaryote	Eukaryote	Eukaryote
Cell Structures	Complex cell walls	Simple cell walls	Some have cell walls; some have chloroplasts	Cell walls of chitin	Cell walls of cellulose; chloroplasts	No cell walls or chloroplasts
Number of Cells	Unicellular	Unicellular	Unicellular	Multicellular	Multicellular	Multicellular
Mode of Nutrition	Autotroph or Heterotroph	Autotroph or Heterotroph	Autotroph or Heterotroph	Heterotroph	Autotroph	Heterotroph

- I. Kingdom Archaeobacteria
- II. Kingdom Eubacteria
- III. Kingdom Protista
- IV. Kingdom Fungi
 - A. Phylum Zygomycota
 - B. Phylum Ascomycota
 - C. Phylum Basidiomycota
 - D. Phylum Deuteromycota
- V. Kingdom Plantae
 - A. Phylum Bryophyta
 - B. Phylum Tracheophyta
- VI. Kingdom Animalia
 - A. Phylum Porifera
 - B. Phylum Echinodermata
 - C. Phylum Cnidaria
 - D. Phylum Platyhelminthes
 - 1. Class Turbellaria
 - 2. Class Trematoda
 - 3. Class Cestoda
 - E. Phylum Nematoda
 - F. Phylum Annelidia
 - 1. Class Oligochaeta
 - 2. Class Hirudinea
 - G. Phylum Mollusca
 - 1. Class Bivalvia
 - 2. Class Gastropoda
 - 3. Class Cephalopoda
 - H. Phylum Arthropoda
 - 1. Subphylum Crustacea
 - 2. Subphylum Chelicerata
 - 3. Subphylum Uniramia
 - a. Class Chilopoda
 - b. Class Diplopoda
 - c. Class Insecta
 - I. Phylum Chordata
 - 1. Subphylum Vertebrata
 - a. Class Agnatha
 - b. Class Chondrichthyes
 - c. Class Osteichthyes
 - d. Class Amphibia
 - e. Class Reptilia
 - f. Class Aves
 - g. Class Mammalia (*lots of orders!*)

I. Kingdom Archaeobacteria (“old bacteria”)

A. unicellular prokaryotes

B. cell wall does not contain peptidoglycan

C. autotrophic and heterotrophic types

D. unaffected by antibiotics

E. first organisms on Earth

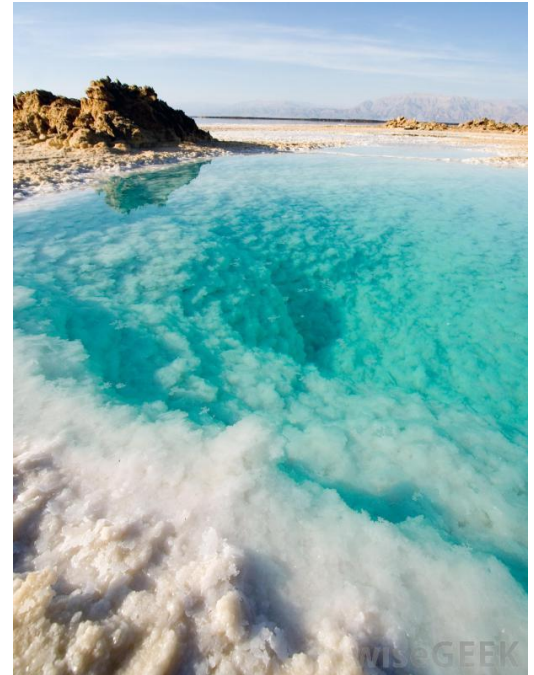
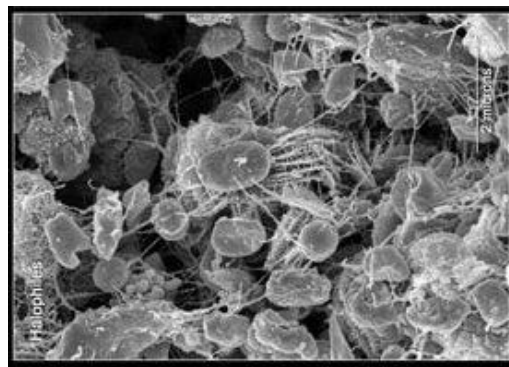
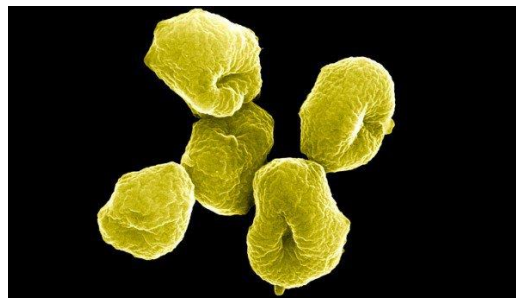
*converted poisonous atmosphere to oxygen

F. oxygen is toxic to them; live in extreme environments

*nearly boiling water of hot springs & ocean vents

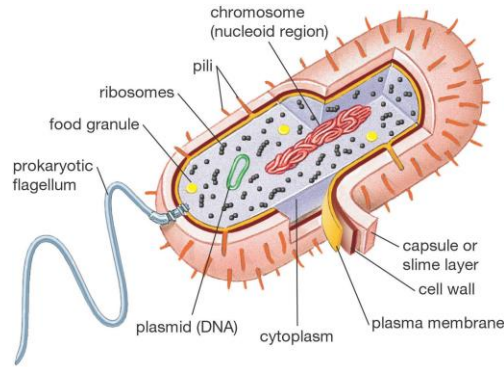
*crude oil

*extremely salty water

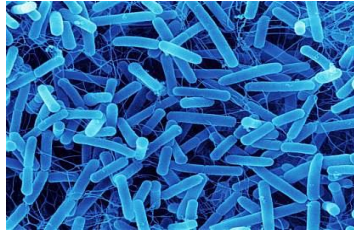
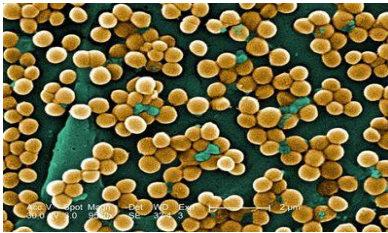


II. Kingdom Eubacteria (“true bacteria”)

- A. unicellular prokaryotes
- B. rigid cell walls made of protein “peptidoglycan”



- C. autotrophic and heterotrophic types
- D. classified by shape: rod, round, and spiral



- E. most bacteria are beneficial

Ex) *E. coli* in your intestines

“Probiotics” in foods

Lactobacillus in [yogurt](#) and cheese

Breaking down & recycling dead things in nature

- F. Some bacteria are harmful

Ex) *Salmonella* – eggs, chicken, reptiles

--“food poisoning”

Streptococcus – strep throat

Anthrax – eats body and releases toxins

--very deadly weapon used in WWII

Botulism – extremely deadly food poisoning

Tuberculosis – fatal, highly infectious, in lungs

Clostridium tetani – releases toxin that

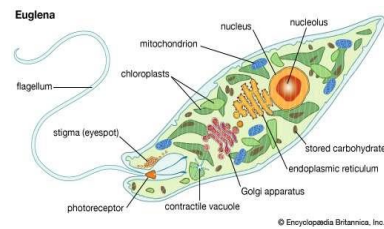
permanently flex muscles

III. Kingdom Protista

- A. unicellular eukaryotes
- B. rigid cell walls made of carbohydrate “cellulose”
- C. autotrophic and heterotrophic types
- D. very diverse, “catch-all” kingdom
- E. grouped by how they move;

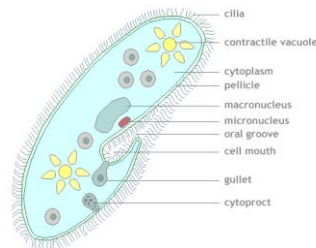
1. flagella – long whip-like tail

Ex: euglena



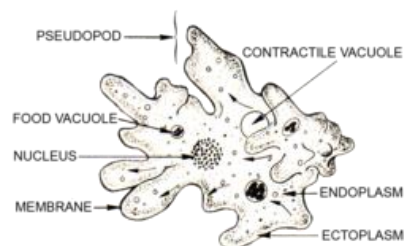
2. cilia – many short hairs

Ex: paramecium



3. pseudopods – cytoplasm extensions

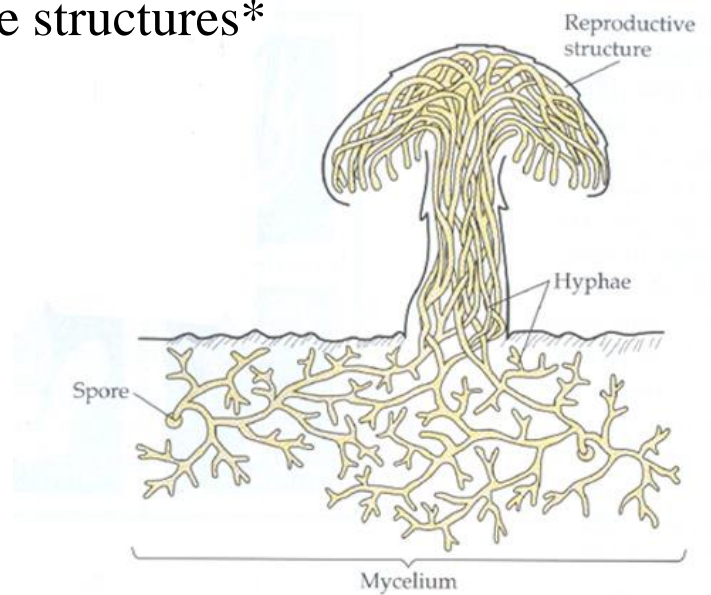
Ex: amoeba



IV. Kingdom Fungi

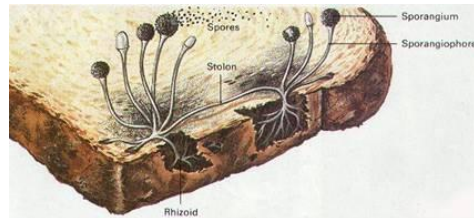
- A. multicellular heterotrophic eukaryotes
- B. feed as parasites or on decaying material
- C. cell walls made of chitin
- D. two basic parts of a fungus:
 - a. mycelium-like the roots (suck up nutrients)
 - b. fruiting body-like the stem (the part you can see)

reproductive structures



E. Four Phyla:

a. Phylum Zygomycota - bread molds



b. Phylum Ascomycota - mildew, yeast



c. Phylum Basidiomycota - mushrooms



- a. Shelf mushrooms - fruiting bodies up to 100 pounds!



- b. “Humongous Fungus” - largest organism on Earth



-2,385 acres

-35,000 tons

-estimated age: 8,650 years old

- d. Phylum Deuteromycota - athlete's foot, ringworm, penicillin



V. Kingdom Plantae

A. Multicellular autotrophic eukaryotes

B. Cell walls made of cellulose

C. Two main Phyla:

a. Phylum Bryophyta



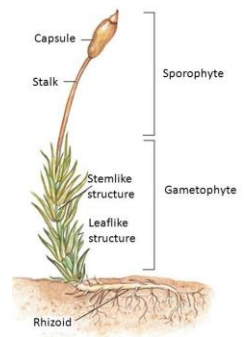
a. Moss-like plants

b. NO VASCULAR TISSUE

*internal tubes that carry
water and nutrients
throughout plant

c. only in constantly wet environments

d. small size



b. Phylum Tracheophyta

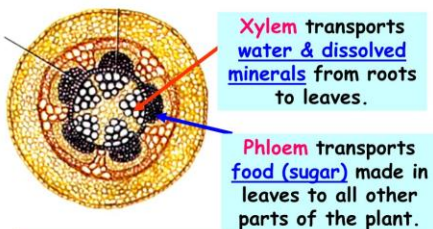
a. Ferns, trees, grasses, flowers, etc.

b. HAVE VASCULAR TISSUE

1. Xylem - tubes that carry water & nutrients
up from roots to leaves

2. Phloem - tubes that carry the products of
photosynthesis (sugars) from the
leaves throughout the plant

Vascular bundles: xylem & phloem



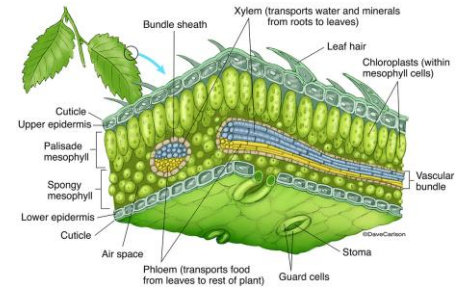
c. Vascular tissue allows them to grow tall

Ex) redwood tree=370 feet

D. Specialized plant structures

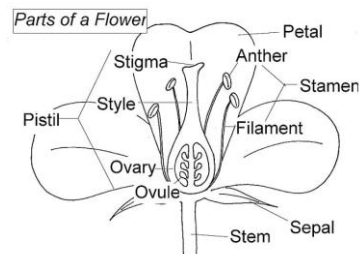
1. leaves

- a. chloroplasts convert sunlight into sugar
- b. thick, waxy outer layer called the cuticle prevents dehydration
- c. openings called stoma to let CO₂ in and O₂ out



2. flowers

- a. the reproductive organ of a plant
- b. highly modified leaves



E. Pollination & Seed Dispersal

1. Pollination = sexual fertilization

- a. pollen (plant sperm) + ovum (plant egg) = seed
- b. done by wind, bugs, birds, gravity, etc.

2. Seeds need to move away (disperse) from the parent plant so that they are not competing for resources

- a. wind - dandelions, maple “helicopters”



- b. animal feces - fruit is the lure, seeds pass through



- c. water - seeds can travel 100's of miles in the ocean

- d. animal fur - briars are seeds packages with “velcro” around them



VI. Kingdom Animalia

- multicellular heterotrophic eukaryotes

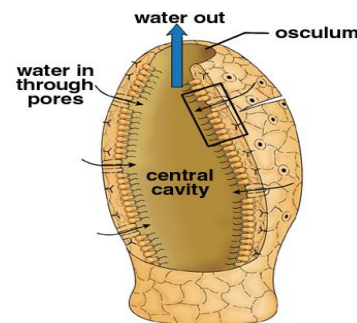
- 9 Phyla in this Kingdom:

(8 Invertebrate Phyla & 1 Vertebrate Phyla)

Invertebrate Animals – no backbone (8 Phyla)

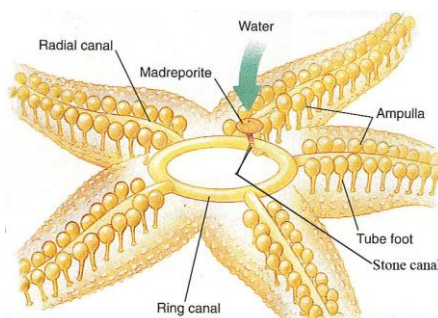
A. Phylum Porifera – Sponges

1. body plan is a sessile, asymmetrical tube
2. supported by spiny “skeleton” of spicules
3. flagella inside tube pump water through to filter food
4. provide habitat and hiding places for other organisms



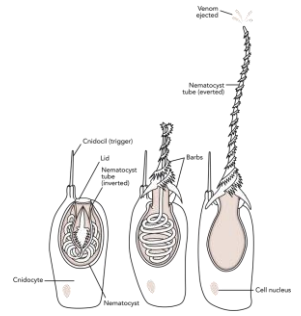
B. Phylum Echinodermata – starfish & urchins

1. skin over spiny endoskeleton plates
2. “water vascular system” for movement

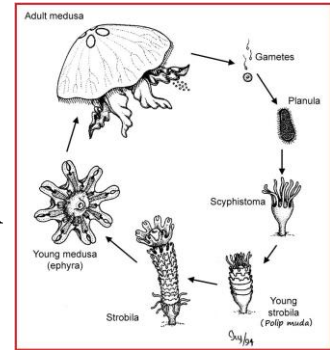


C. Phylum Cnidaria – jellyfish, anemones, corals

1. soft bodies with radial symmetry
2. tentacles with stinging cells called nematocysts



3. two life stages: polyp & medusa
 - a. polyp = sessile; tentacles point up
 - b. medusa = free-moving; tentacles point down



4. examples of cnidarians:

- a. box jellyfish (aka “sea wasp”)
 - Australia
 - very deadly toxin



- b. giant jellyfish (aka “Lions Mane jellyfish”)
 - Arctic waters
 - 4 meters wide X 30 meters long

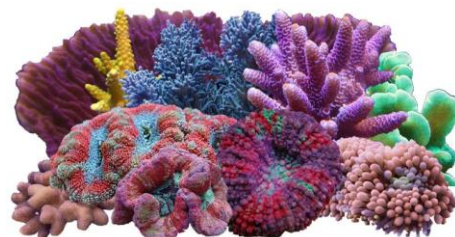


- c. Portugese man-of-war
 - actually a colony of several polyps
 - tentacles up to 40 feet long



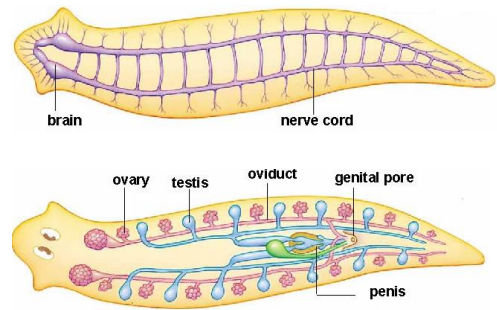
- d. Corals

- miniature polyps that make shells around bodies of calcium carbonate
- as corals die, shells remain and build up over thousands of years into coral reefs



D. Phylum Platyhelminthes - flatworms

1. simplest animals to have organ systems
2. cephalization-nerve bundle on one end defining a “head”
3. both sexes in same individual
4. parasitic & free-living forms
5. three classes:



a. Class Turbellaria - free living flatworms

- scavengers
- example: Planaria



b. Class Trematoda - flukes

- all are internal parasites
- 1/3 of world population infected
- Example: blood flukes - 2nd to malaria in parasitic-related deaths



c. Class Cestoda - tapeworms

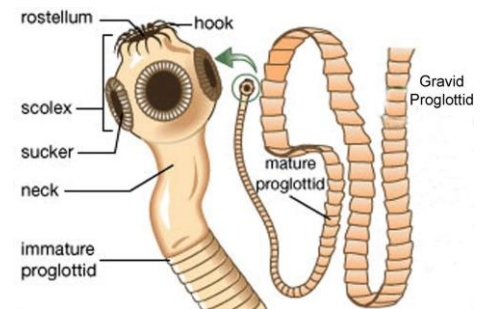
- all are intestinal parasites
- eat what you eat
- body plan:

- *scolex=head with hooks
- *proglottids=body segments

- break off and pass from body in feces
- 100,000-300,000 eggs per proglottid!

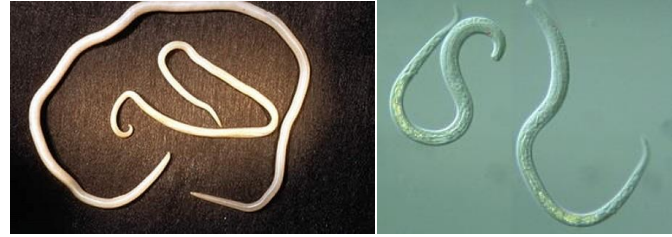
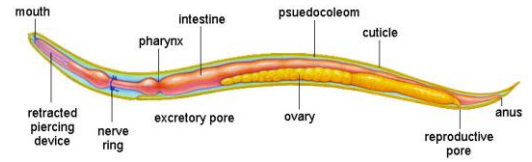
- Examples:

- *dog tapeworm = 1-2 feet long
- *beef tapeworm = 30 feet long



E. Phylum Nematoda - roundworms

1. unsegmented worms with tapered ends
2. parasitic & free-living forms
3. thousands per teaspoon of soil
4. separate sexes
5. Examples:



a. Intestinal roundworm

- most common parasite worldwide
- 6-20 inches long
- infected person can pass 200,000 eggs per day in their feces
- can burrow into any part of the body

b. Hookworm

- bore into skin through bare feet
- feed on blood

c. Pinworms

- live in intestines
- female sticks out of host's anus while sleeping and egg packets explode

d. Trichina worm

- lives in pig muscle (cook pork!)
- acute muscular pain

e. Dog heartworm

- fill dog's heart and block blood circulation

f. Guinea worm

- four-foot worm that lives under skin

g. Loa loa worm

- fill eyeball and cause "river blindness"

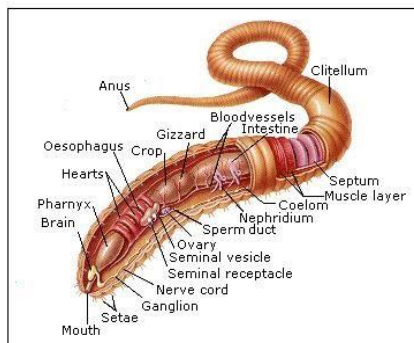
F. Phylum Annelidia - segmented worms

1. body divided into small segments
2. both male and female reproductive organs in single individual
3. two classes:

a. Class Oligochaeta - earthworms

-eat soil and digest organic materials

-tiny stiff “hairs” called setae help them grip the ground



b. Class Hirudinea - leeches

-most are external parasites that suck blood

-sometimes used medically to help blood flow after a surgery



G. Phylum Mollusca - clams, snails, slugs, octopi, squid

1. soft-bodied animals with internal or external shell
2. three classes of mollusks:

a. Class Bivalvia - clams, oysters, mussels

- 2 hinged shells
- shiny inside layer of shell called Mother-of-Pearl
- filter feeders



b. Class Gastropoda - snails & slugs

- single coiled shell or no shell
- herbivores
- rough tongue called a radula



c. Class Cephalopoda - octopi & squid

- foot divided into 8 or 10 tentacles
- carnivores with sharp beaks
- very intelligent
- ability to squirt ink
- cells called chromatophores for instant color-changing abilities
- Giant Pacific Octopus
 - *up to 150 pounds and 23 feet long
- Giant Squid
 - *up to 2 tons and 43 feet long



H. Phylum Arthropoda

1. Jointed appendages (legs, antennae, claws, etc.)
2. segmented body
3. exoskeleton made of chitin
 - *old exoskeleton is molted as arthropod grows
4. well-developed nervous system (and brain)
5. extremely successful group of animals!
6. Three subphyla:

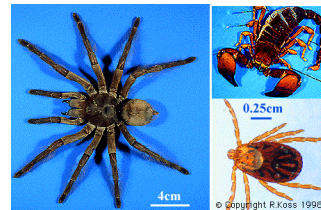
a. Subphylum Crustacea - crabs, shrimps, lobsters, pillbugs, crayfish

- 2 pairs of antennae
- 10 legs
- 2 or 3 body sections
- chewing mouthparts



b. Subphylum Chelicerata - spiders, ticks, scorpions

- 2 body segments
- 4 pairs of walking legs
- no antennae



-poisonous spiders in Michigan:

*Black Widow - shiny black with red hourglass shape under abdomen.

-Poison paralyzes nerves.

*Brown Recluse - hairy brown with violin shape on top of head.

-Poison dissolves tissues.



c. Subphylum Uniramia - centipedes, millipedes, insects

- one pair of antennae
- highly variable forms and lifestyles

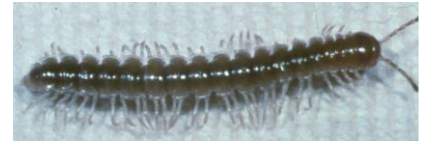
i. Class Chilopoda - centipedes

- *one pair legs per body segment
- *predators, strong venom



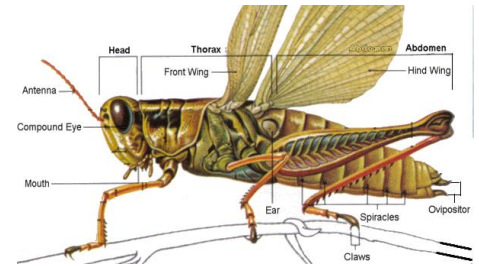
ii. Class Diplopoda - millipedes

- *two pair of legs per body segment
- *eat decaying plant material



iii. Class Insecta - insects

- *three body segments (head, thorax, abdomen)
- *three pairs of legs (on thorax)
- *usually have wings (on thorax)
- *reasons for their success:



- 1) small size
- 2) flight
- 3) high reproductive rates
- 4) mimicry
 - of surroundings (camouflage)
 - of other harmful insects
- 5) communication – sounds, chemicals, dancing
- 6) metamorphosis = changing forms between life stages prevents larvae and adults from competing for food, space etc.

I. Phylum Chordata – animals with “Nerve Cord”

- large nerve that runs down back
- brain on one end
- smaller nerve branch from it

A. Subphylum Vertebrata

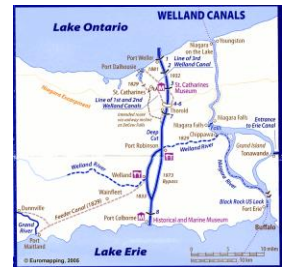
1. chordates that have a backbone (vertebral column) around their nerve cord (spinal cord).
2. there are 7 classes of vertebrates:

a. Class Agnatha - jawless fishes

- lampreys and hagfish
- no paired fins, scales, or jaws
- Sea Lamprey



- *parasite of fish in the Great Lakes
- *swam from Atlantic Ocean in 1829 when the Welland Canal was built around Niagara Falls.
- *almost destroyed large fish populations in Great Lakes by early 1960's
- *now controlled by chemically treating streams where they spawn



b. Class Chondrichthyes-cartilaginous fishes

- sharks, rays, skates
- skeleton made of cartilage (no bone in body)
- no swim bladder, but large oily liver (20% of their total body weight) keeps them afloat
- teeth stay sharp by falling out often and being replaced (every 7 days or so)
- pits on snout detect electrical currents



c. Class Osteichthyes - bony fishes

- skeleton made of bone
- slimy mucous covering to protect against bacteria, fungus, parasites
- extremely diverse species



d. Class Amphibia – frogs, toads, salamanders

- moist skin with mucous glands
- no scales or claws
- aquatic larval stage (tadpole):
 - *gills
 - *2-chambered heart
 - *herbivorous
- terrestrial adult stage:
 - *lungs
 - *3-chambered heart
 - *carnivorous
- nictitating membrane = clear 3rd eyelid
- very sensitive to pollution so they make excellent bioindicators

e. Class Reptilia – snakes, lizards, crocodiles, turtles

- dry, scaly skin
- claws (if they have feet!)
- terrestrial eggs with leathery shells
 - *first group not tied to water

f. Class Aves - birds

- feathers & modified front limbs
- legs covered with scales
 - *descendents from reptiles (remember Archaeopteryx?)
- adaptations for flight:
 - *feathers
 - *aerodynamic body shape
 - *very efficient respiratory system
 - *4 chambered heart
 - *hollow bones
- hard-shelled eggs resist drying out

g. Class Mammalia

- mammary glands which make milk
- hair
- 4 chambered heart
- three main groups of mammals:
 - 1) Monotremes - lay eggs
 - platypus & echidna
 - 2) Marsupials - embryos grow in a pouch
 - kangaroos, opossums
 - 3) Placentals - embryos grow in placenta
 - 12 orders in this class
 - mice, cats, whales, and us!

Mammal Orders ~ *up to 26, here's a few.....*

- **Order Momotremata** – egg-laying mammals
 - Examples:
- **Order Marsupalia** – pouched animals
 - Examples:
- **Order Artiodactyla** - even-toed hoofed animals
 - Examples:
- **Order Perissodactyla** - odd-toed hoofed animals
 - Examples:
- **Order Carnivora** - meat-eaters
 - Examples:
- **Order Cetacea** -whales and porpoises
 - Examples:
- **Order Proboscidea** – elephants
 - Examples:
- **Order Sirenia** - dugongs and manatees
 - Examples:
- **Order Rodentia** - gnawing mammals
 - Examples:
- **Order Chiroptera** – bats
 - Examples:
- **Order Insectivora** - insect-eaters
 - Examples:
- **Order Lagomorpha** - pikas, hares, and rabbits
 - Examples:
- **Order Pinnipedia** - seals and walruses
 - Examples:
- **Order Primates** – primates
 - Examples:

