Invertebrates

- Animals without backbones
- Enormously successful both ecologically and evolutionarily
- 97% of the animal kingdom
Keep in mind...

- As we move through each Phyla, we move from simple to complex
  - Symmetry
  - Body cavities – absent & present
  - Asexual and sexual reproduction
  - Tissue layers
  - Immobile to mobile
  - Development of body systems
Phylum Porifera

- “Pore Bearing”
- Aquatic and Sessile
- Simplest and most primitive animal
- Has no organ systems
  - Cells arranged loosely in a gelatinous matrix
- Asymmetrical
- Acoelomates
- Asexual reproduction (Budding) and sexual reproduction (External fertilization and Hermaphrodites)

http://www.youtube.com/watch?v=RmPTM965-1c
Phylum Cnidaria

• Aquatic and radially symmetrical
• Sessile and motile
• Composed of two germ layers: ectoderm and endoderm
• Simple nervous system
  – Nerve Net – ring of nerve cells, synapses in both directions, no myelin sheath
• Specialized muscle and digestive systems
  – Incomplete digestion
Phylum Cnidaria

- Acoelomates
- Sexual and asexual reproduction
- Have two basic stages
  1. Medusa
  2. Polyp
- Examples – Hydra, Sea Anemones, Jellyfish

http://www.youtube.com/watch?v=RYVHK2vM1_Y
Phylum Platyhelminthes

- Flatworms
- Parasitic and nonparasitic
- Bilateral symmetry
- Simple nervous system – made of lateral nerve cords, area of cephalization, development of eye spots
- Simplest form of an excretory system
  - **Flame Cells** – excretory cell which opens, via ducts, to the outside of the body
Phylum Platyhelminthes

- Three germ layer – possess mesoderm
- Acoelomate
- Asexual reproduction (regeneration) and sexual reproduction (Hermaphroditic)
- Incomplete digestions
- Examples: Planaria and Tapeworms

http://www.youtube.com/watch?v=w0QzSYQGsnA - Planarian
http://www.youtube.com/watch?v=bb32g02IlS8 - Tapeworm
Phylum Nematoda

- Roundworms
- Bilateral Symmetry
- Three cell layers
- Pseudocoelomates
  - Possess a body cavity filled with fluid
- Digestive system is complete – has two openings – a tube within a tub
- Possess a distinct nervous system and excretory system
Phylum Nematoda

- Separate sexes, very few hermaphrodites
- Sexual reproduction
- Parasitic
  - Eggs hatch, juveniles released
  - Burrow through intestinal wall, into veins, lymph nodes, carried to heart and lungs
  - Pass through to trachea, swallowed, mature in stomach
- Examples: Pinworms and Hookworms

http://www.youtube.com/watch?v=dB0cL3PcYZI - Roundworm in Cat Intestine
http://www.youtube.com/watch?v=4p0kC1Q3iOE - Roundworms (Ascaris)
Phylum Annelida

- Segmented worms
- First phyla in which a true coelum is present - Eucoelomates
  - Tube within a tube
  - Lined with mesoderm
- Complete digestive system
- Closed circulatory system – presence of vessels
- Developed excretory systems – presence of nephridia - excretory tubules
Phylum Annelida

- Presence of sense organs and a primitive brain – including a nerve cord
- Sexual reproduction – hermaphrodites and separate sexes
- Bilateral symmetry

http://www.youtube.com/watch?v=9ZHTerOJYMA - Earthworms
http://www.youtube.com/watch?v=uO4Ikv-jLRs - Giant Earthworm
http://www.youtube.com/watch?v=cKUAroimQrk - Leeches
Phylum Mollusca

- Soft bodied
- Mostly marine
- Show incredible diversity – from clam to giant squid
- Bilateral symmetry
- 3 germ layers
- True coelom
- Many developed organ systems
  - Nervous system with sensory organs
  - Excretory system
  - Respiratory system
  - Circulatory systems (Open and closed)
Phylum Mollusca

- Sexual reproduction, some hermaphrodites
- Internal and external fertilization
- Complete digestion
- Examples: Clams, Oysters, Squid, Octopi

http://www.youtube.com/watch?v=IWAnliNc6wk - Vampire Squid
http://www.youtube.com/watch?v=qp2S5PXpH6s - Octopus
http://www.youtube.com/watch?v=IwAqhThd_EQ - Giant Octopi
Phylum Arthropoda

- Live in all environments
- Possess an endoskeleton made of chitin
- Most molt
- Possess jointed appendages, body segments fused
- Bilateral symmetry
- Developed nervous system, circulatory systems, digestive systems, musculature system
- True coelom
- Three cell layers
Phylum Arthropoda

- Possess highly sensitive sensory structures
  - Antennae
  - Hair
  - Eyes
- Sexual reproduction some hermaphrodites
- Many display metamorphosis
- Examples: Insects, Lobster, Crab

http://www.youtube.com/watch?v=-jNNvjJkLoc - Arthropods
Phylum Echinodermata

- Spiny-skinned
- Radial symmetry
- Coelom present
- Three cell layers
- Distinct organ systems
- Possess an endoskeleton
- Possess tube feet used for locomotion
  - Works similar to hydraulics
  - Water vascular system
Phylum Echinodermata

- Separate sexes, few hermaphrodites
- Asexual and sexual reproduction
- Complete digestive system
- Examples: Starfish, Sand dollar, sea urchins

http://www.youtube.com/watch?v=cec4YPXBnXk - Starfish
http://www.youtube.com/watch?v=D3W4OCnHyCs - Echinoderms
Arthropod Success

Why are they successful?
Arthropod Success

1. **Exoskeleton**
   - Made of chitin
   - Protection
   - Flexible and lightweight
   - Waterproof covering
   - Must shed to grow
   - Site for muscle attachment
2. **Segmentation and appendages**

   - Body divided into sections which are fused
   - Site for muscle attachment
   - Independent movement
   - Sensory attachment
   - Regions are:
     I. Head
     II. Thorax
     III. Abdomen
Arthropod Success

3. High developed sensory organs
   • Compound eyes and antennae
   • Ability to touch, smell, hear, maintain balance, and chemical reception
   • Keenly alert to their surrounding environment
4. **Behavior Patterns**

- Some display caste systems
  - Bees and ants
    - Workers – Infertile Females, only do work around the hive
    - Drones – fertile males
    - Queen – fertile male
- Some live in colonies
- Some use mimicry
5. **Methods for obtaining nourishment**
   - Many eat plants
   - Many eat other invertebrates
   - Some feed off blood of members of other kingdoms