Kingdom Animalia

Animals are multicellular heterotrophs, and usually mobile
Food is usually ingested and digested in an internal cavity

Diversity in form
Most are invertebrates - Only 1% of all species are vertebrates
37 animal phyla (10 to be covered in these lectures)
Size ranges from microscopic forms to enormous whales
Most are marine, some are freshwater, few are terrestrial
   Three phyla dominate the land: arthropods, mollusks, chordates

Animal cells lack cell walls - their cells are relatively flexible
Cells are well organized into tissues, except for sponges
   Tissue: made of cells specialized to perform specific function

Active movement - made possible by muscles - flexible contractile cells combined with rigid resistant structures - a hard skeleton or incompressible water-filled spaces

Sexual reproduction
   All animals have gametic meiosis - a diploid organism produces haploid gametes by meiosis in specialized tissues

Embryonic development
   Zygote becomes an adult through process of embryonic development - organization and differentiation of tissue layers
   Pattern of development important in determining evolutionary relationships
Classification of Animals

Subkingdom Parazoa - the Sponges

Subkingdom Eumetazoa - all animal phyla with true multicellularity - well developed tissues

Radiata - phyla with radial symmetry, two tissue layers
(Phylum Cnidaria and Phylum Ctenophora)

Bilateria - all remaining animal phyla have bilateral symmetry and three tissue layers: ectoderm, mesoderm, and endoderm
Within the Bilateria there are types of tissue organization:

Coelom: a body cavity lined completely with mesoderm.

Acoelomates have no body cavity - flatworms.

Pseudocoelomates have a body cavity (pseudocoel) with mesoderm to the outside only - roundworms and rotifers.

Coelomates have a coelom - all remaining animal phyla.

Within the coelomates there are two ways that embryonic development occurs:

Protostomes have spiral cleavage, the blastopore becomes the mouth, mosaic development - molluscs, annelids, arthropods.

Deuterostomes have radial cleavage, the blastopore becomes the anus, regulative development - echinoderms, chordates.
Significance of characteristics

Bilateral symmetry allows for greater specialization of body regions
- a head, midbody, and tail - have different functions
  more efficient locomotion
- a head with sensory structures and coordination of the nervous
  system - cephalization

A coelom can be used for storage of energy rich compounds (fat)
- reproductive products – eggs, sperm, embryos
Organs can develop with separation from other tissues
- Allows for specialization of regions of the digestive system
Water filled space that can be used to move body parts
- Allows for circulation of fluids around organs

Phylum Porifera - Sponges
Mostly marine, few freshwater species,
- most lack any symmetry
Three basic shapes - ascon, sycon, leucon
- Many are colonial, all are sessile as adults
Little coordination among cells
- Simple mass of cells in a gelatinous matrix
Cells are specialized
- Choanocytes - collar cells - for feeding
  Epithelial layer of flattened cells,
  frequently contractile in nature
- Amoebocytes - found in Mesohyl -
  intermediate gelatinous layer
May possess minute, needles called spicules made of silica or calcium
May possess fibrous protein “spongin”
Filter feeders
Water flows through system of pores and canals
In through pores (ostia), out through osculum, passageways lined
with choanocytes capture food and pass it through to other cells in
the sponge body

Reproduction
can fragment and reorganize for asexual reproduction
Sexual reproduction via production of egg and sperm
   Sperm differentiate from choanocytes and leave sponge
   eggs differentiate from amoebocytes in mesohyl
Sperm are captured by choanocytes and taken into mesohyl
Larval sponges undergo development within adults
Have external choanocytes when released
Exist as free-swimming planktonic form for a short time
Settle on a suitable substrate to begin transformation to sessile
adult life
**Phylum Cnidaria** – jellyfish, hydres, anemones, corals

nearly all are marine

radial symmetry

have endoderm and ectoderm but no mesoderm or well developed organs

Carnivores, capture food with tentacles that surround mouth using specialized stinging cells - “cnidocytes”

No blood vessels, No respiratory system, No specialized body cavity, Nerve cells organized into nets to coordinate muscle contraction

Have two body forms - polyp and medusa

**Polyp**: cylindrical, tentacles surround mouth generally attached to substrate solitary or colonial may form hard internal or external skeleton

**Medusa**: bell-shaped, tentacles at edges of “bell” free-floating, mouth faces down

Some groups have only polyps or only medusae
Some groups alternate between the two body forms Sometimes called “alternation of generations”
An internal digestive cavity enables cnidarians to consume large food items. Enzymes secreted into a primitive gut begin digestion. Particles digested further by cells of gastrodermis. Undigested food particles expelled from gut through mouth.

Cnidocytes are cells specialized for food capture and defense. Located on tentacles and body. Each cnidocyte contains a harpoon-like nematocyst that discharges when touched.

Reproduction
Polyps reproduce asexually by budding, form polyps or medusae. Sexual reproduction produces fertilized eggs. Develops into a free swimming, ciliated planula larva.
Classes of Cnidarians

Class Hydrozoa - Hydroids
- Mostly marine
- Often have both polyp and medusa forms in life cycle
- Some colonial forms like Obelia
- Others include Portuguese man-of-war and freshwater Hydra

Class Scyphozoa - Jellyfish

Class Anthozoa - Corals and Anemones

Class Cubozoa - Box Jellyfish
Class Scyphozoa - Jellyfish
Conspicuous medusae alternate with inconspicuous polyp forms
Medusa is bell-shaped, tentacles hang around margins
Outer epithelial layer contains contractile cells
Sex produces planula larvae
Polyps can reproduce asexually

Class Cubozoa - Box Jellyfish
Once included within Class Scyphozoa
Medusa is box-shaped, polyps are inconspicuous or unknown
Tentacle found at each corner of box
Strong swimmers, voracious predators
Many have powerful stings - some can be fatal to humans
**Class Anthozoa:** Sea Anemones and Corals
Solitary and colonial marine organisms
polyp body form only
Corals secrete hard calcium carbonate
skeletons and form coral reefs
Live primarily in shallow warm waters,
harbor symbiotic algae - “zooxanthellae”
Waters that support corals are nutrient
poor - corals do well because of algae

**Phylum Ctenophora - Comb Jellies**
Similar in biology to Cnidarians,
more complex body, no stinging cells
Abundant in the open ocean
Have two long retractable tentacles
Possess eight comb-like plates of fused
cilia for locomotion
Many are luminescent