Kingdom Animalia

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

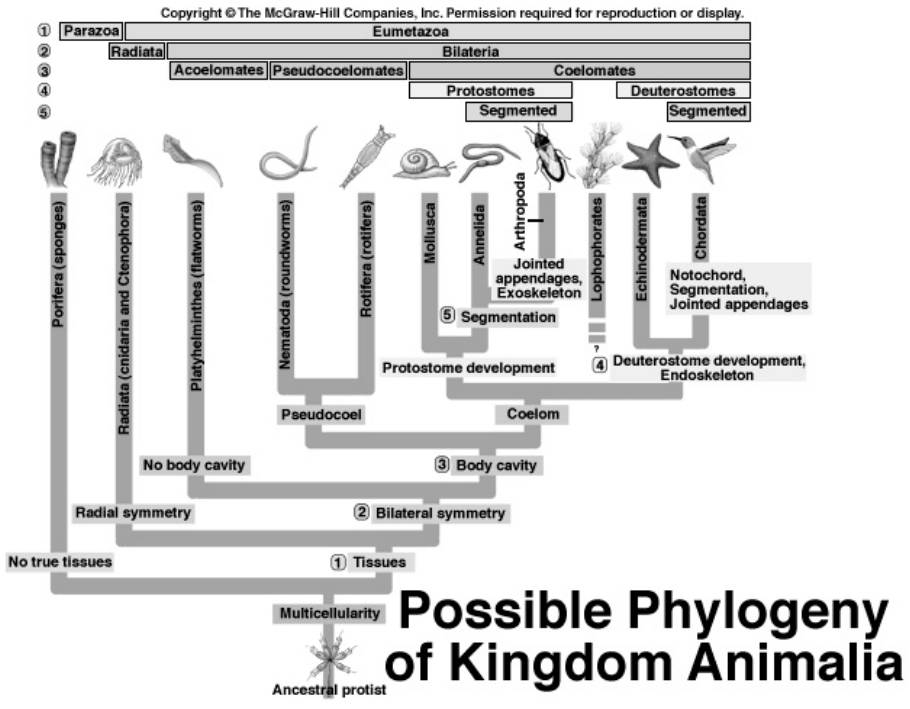
Diversity in form
Most are invertebrates - Only 1% of all species are vertebrates
37 animal phyla (10 to be covered in these lectures)
Size ranges from microscopic forms to enormous whales
Most are marine, some are freshwater, few are terrestrial
    Three phyla dominate the land: arthropods, mollusks,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



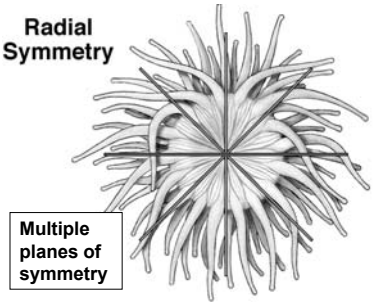
Classification of Animals

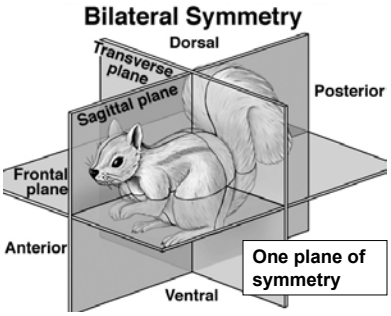
Subkingdom Parazoa - the Sponges

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



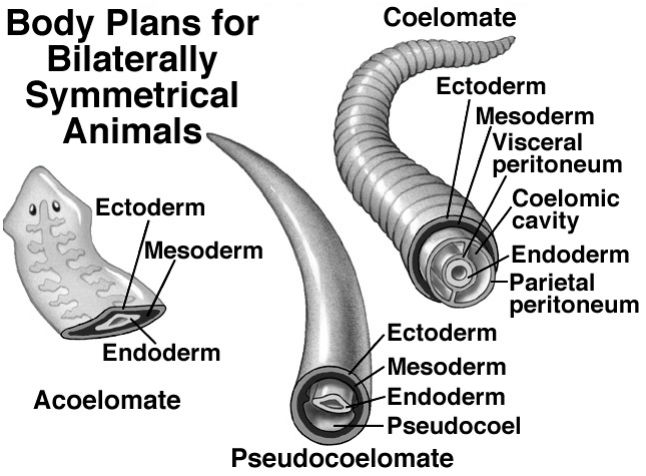


Within the Bilateria there are types of tissue organization

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

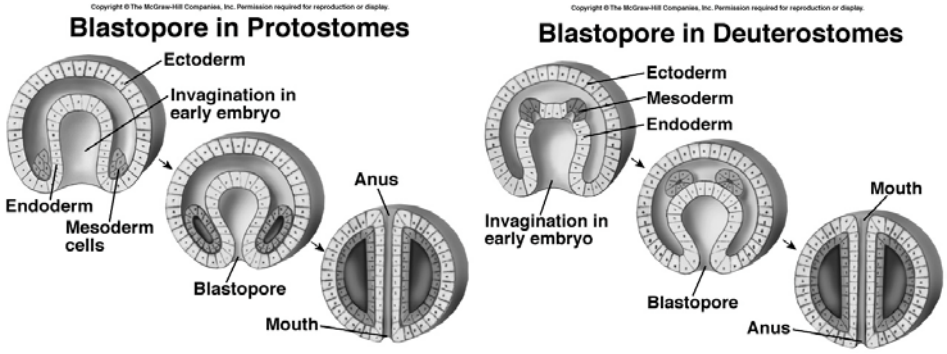


Coelomates have a coelom - all remaining animal phyla

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

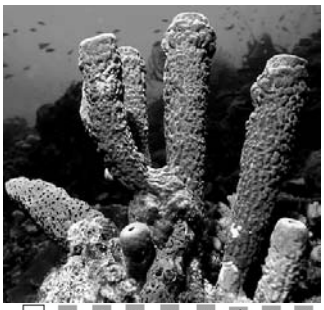
Bilateral symmetry allows for greater specialization of body regions
- a head, midbody, and tail - have different functions
more efficient locomotion
a head with sensory structures and coordination of the nervous system - cephalization

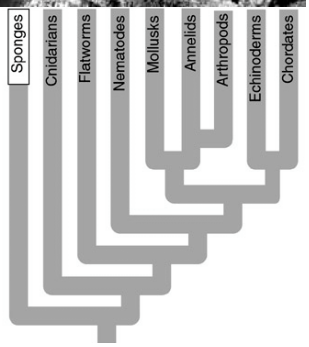
A coelom can be used for storage of energy rich compounds (fat)
reproductive products – eggs, sperm, embryos
Organs can develop with separation from other tissues
Allows for specialization of regions of the digestive system
Water filled space that can be used to move body parts
Allows for circulation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

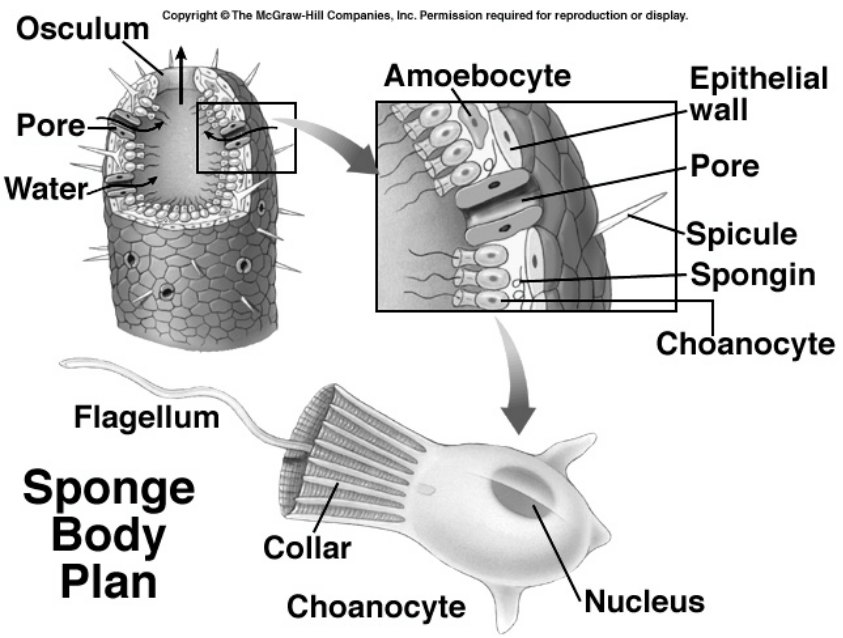
Phylum Porifera - Sponges

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"







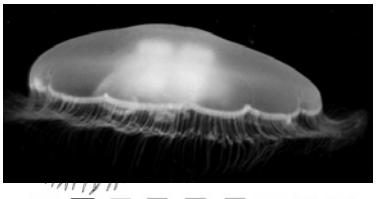
Filter feeders
Water flows through system of pores and canals
In through pores (ostia), out through osculum, passageways lined with choanocytes capture food and pass it through to other cells in the sponge body

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, hydras, anemonaes, corals

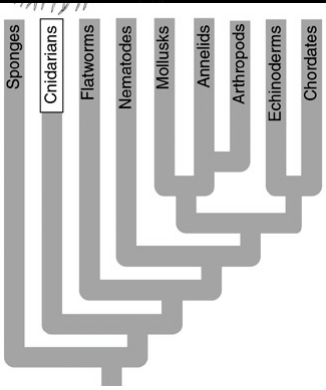
nearly all are marine



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

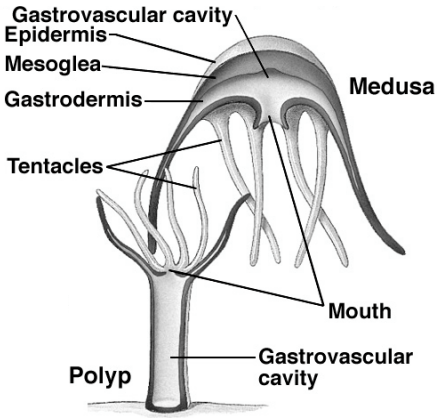
Have two body forms - polyp and medusa



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"



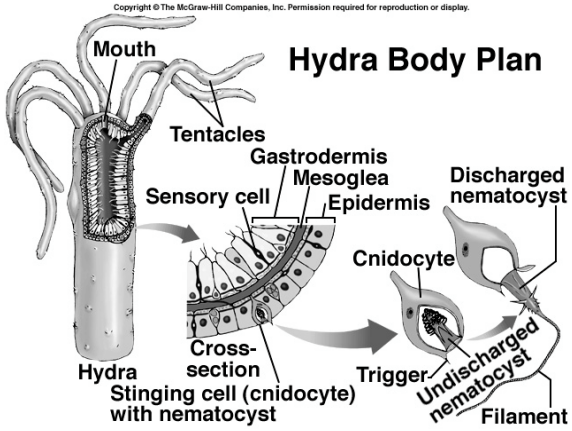
An internal digestive cavity enables cnidarians to consume large food items

- 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

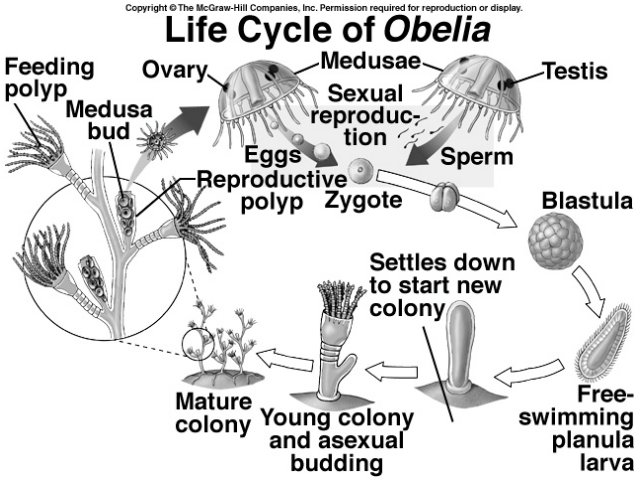


Reproduction

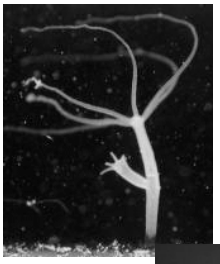
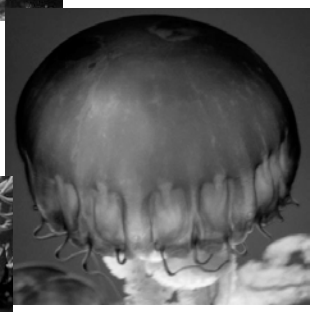
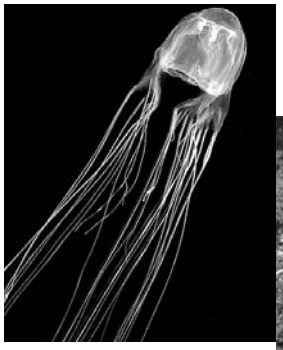
Polyps reproduce asexually by budding, form polyps or medusae

Sexual reproduction produces fertilized eggs

Develops into a free swimming, ciliated planula larva

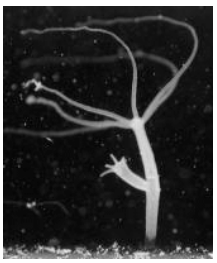


Classes of Cnidarians
Class Hydrozoa - Hydroids
Class Scyphozoa - Jellyfish
Class Anthozoa - Corals and Anemones
Class Cubozoa - Box Jellyfish


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

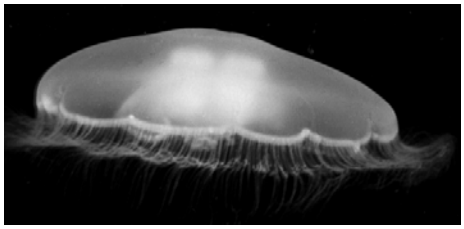
Conspicuous medusae alternate with inconspicuous polyp forms

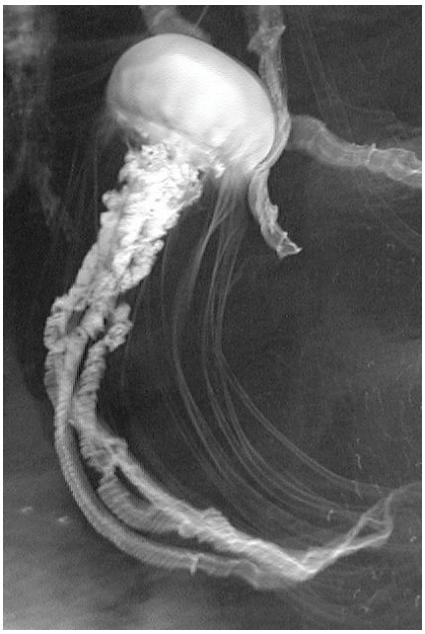
Medusa is bell-shaped, tentacles hang around margins

Outer epithelial layer contains contractile cells

Sex produces planula larvae

Polyps can reproduce asexually





Class Cubozoa - Box Jellyfish

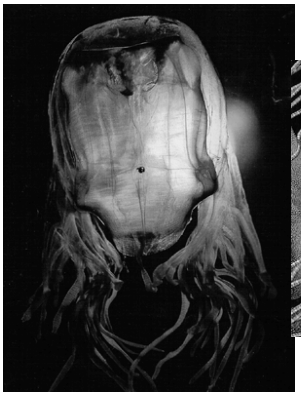
Once included within Class Scyphozoa

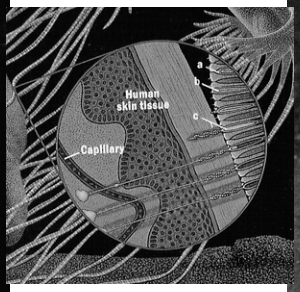
Medusa is box-shaped, polyps are inconspicuous or unknown

Tentacle found at each corner of box

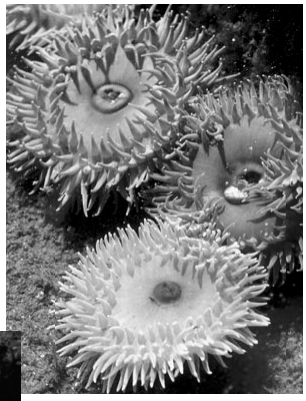
Strong swimmers, voracious predators

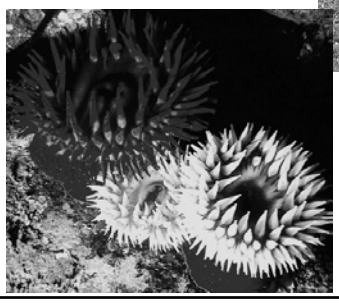
Many have powerful stings - some can be fatal to humans





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