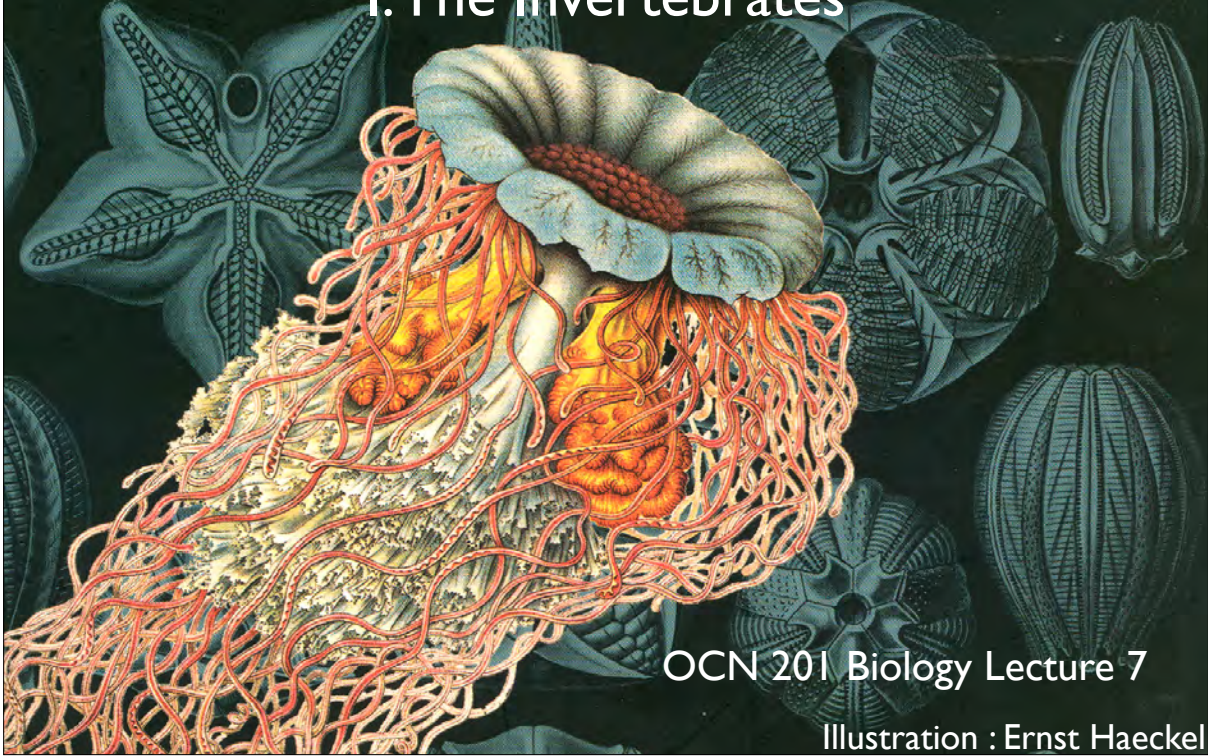


Marine Animals

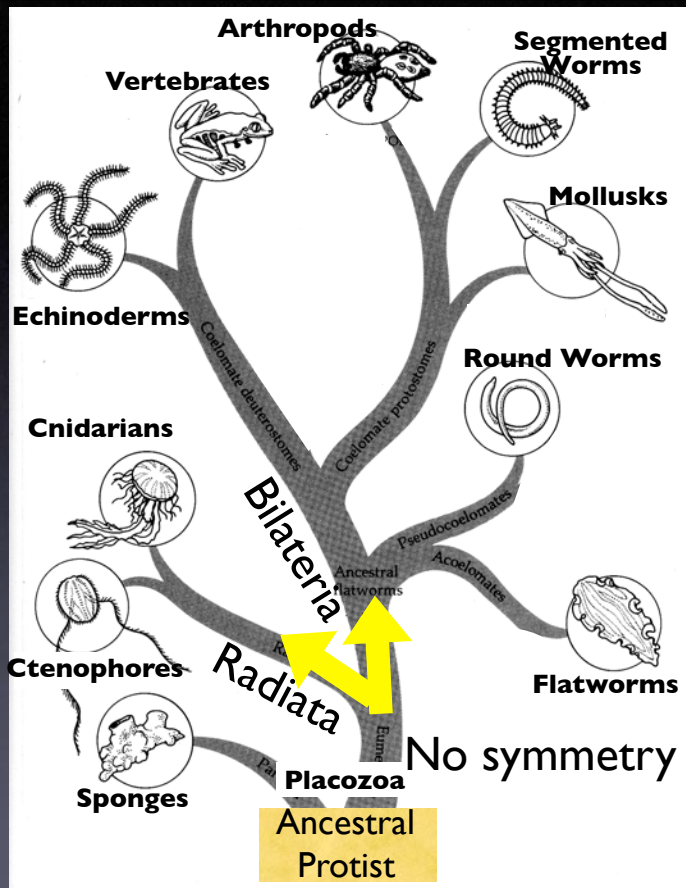
I. The Invertebrates



The Animal Family Tree

36 animal phyla

~ 10 phyla dominate and are particularly important in marine systems

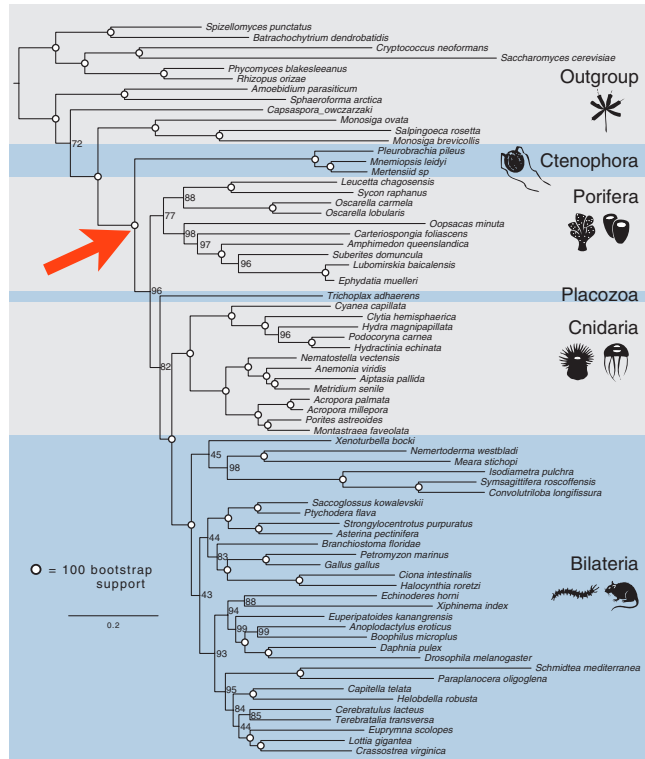
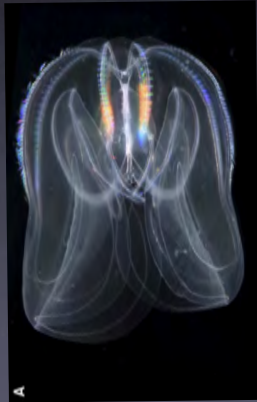


RESEARCH ARTICLE SUMMARY

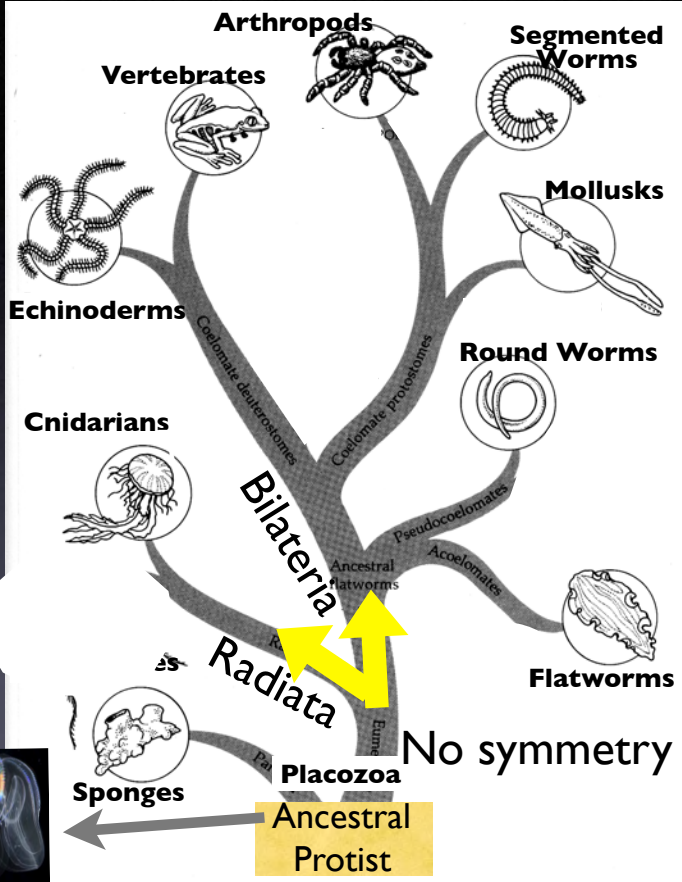
The Genome of the Ctenophor *Mnemiopsis leidyi* and Its Implications for Cell Type Evolution

Joseph F. Ryan, Kevin Pang, Christine E. Schnitzler, Anh-Dao Nguyen, F. David K. Simmons, Bernard J. Koch, Warren R. Francis, Paul Havlak, NISC Comparative Sequencing Program, Stephen A. Smith, Nicholas H. Steven, H. D. Haddock, Casey W. Dunn, Tyra G. Wolfsberg, James C. Mul. Mark Q. Martindale, Andreas D. Baxevasis*

(Science 2013)



The Animal Family Tree



ctenophores

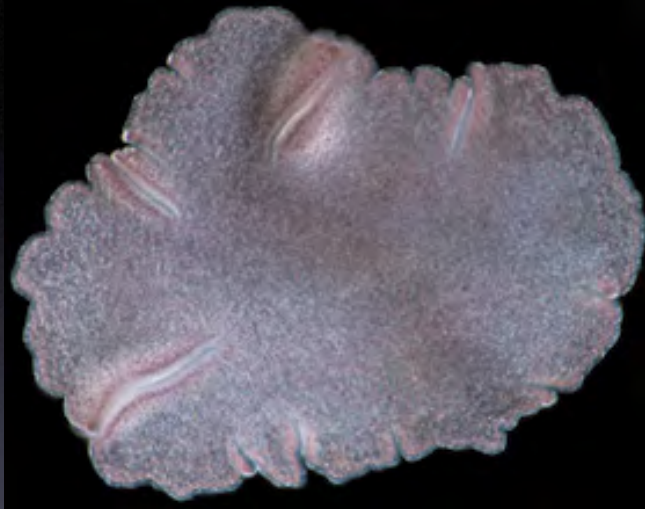


Invertebrate Phyla

- Placozoa
- Porifera (sponges)
- Cnidarians (jellyfish, corals, hydroids)
- Ctenophores (comb jellies)
- Flat Worms
- Round Worms
- Molluscs (clams, snails, squid, octopi)
- Segmented Worms
- Arthropods (copepods, crabs, shrimp)
- Echinoderms (sea stars, brittle stars)

Placozoa

- Simplest animal?
- Lacks symmetry
- Only four cell types
- No tissues or organs
- Found on surfaces
- Probably feeds on surface algae and bacteria
- Can fold itself to create a digestive pocket



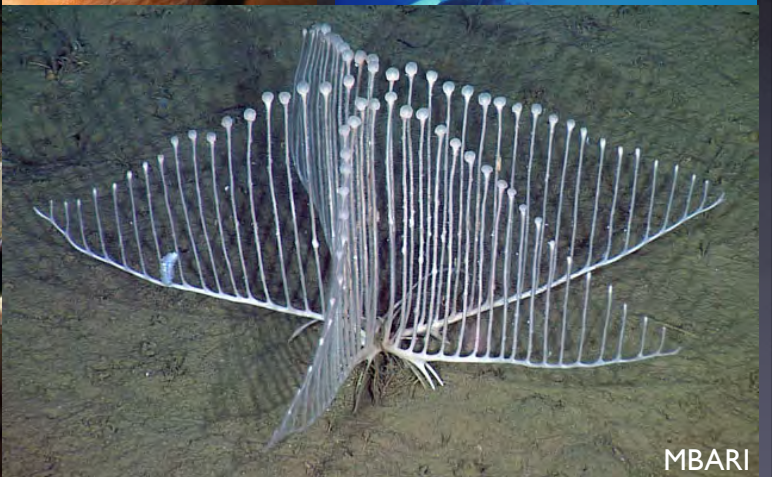
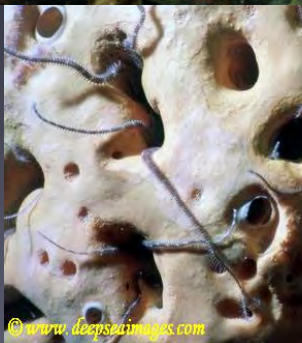
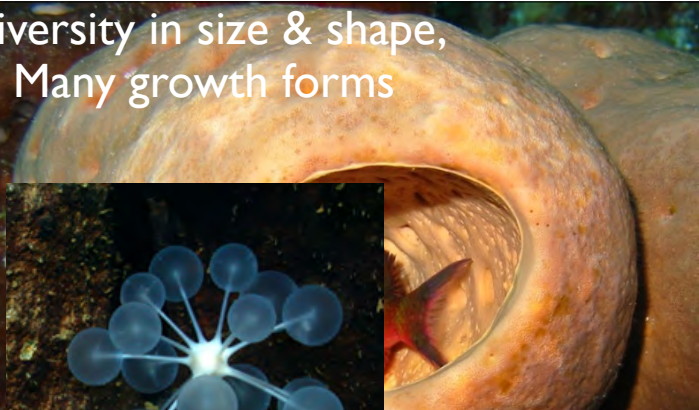


Porifera (sponges)



- “Skeleton” may be calcareous or silica spicules, or entirely of the protein collagen
- Benthic -- intertidal to abyssal, all latitudes
- Suspension Feeders (feeding on plankton, bacteria. A few exceptions)
- Large range of cell types, lack of tissue types
- Source of many bioactive compounds

Diversity in size & shape,
Many growth forms



Sponge Skeletons

Natural Sponge



collagen

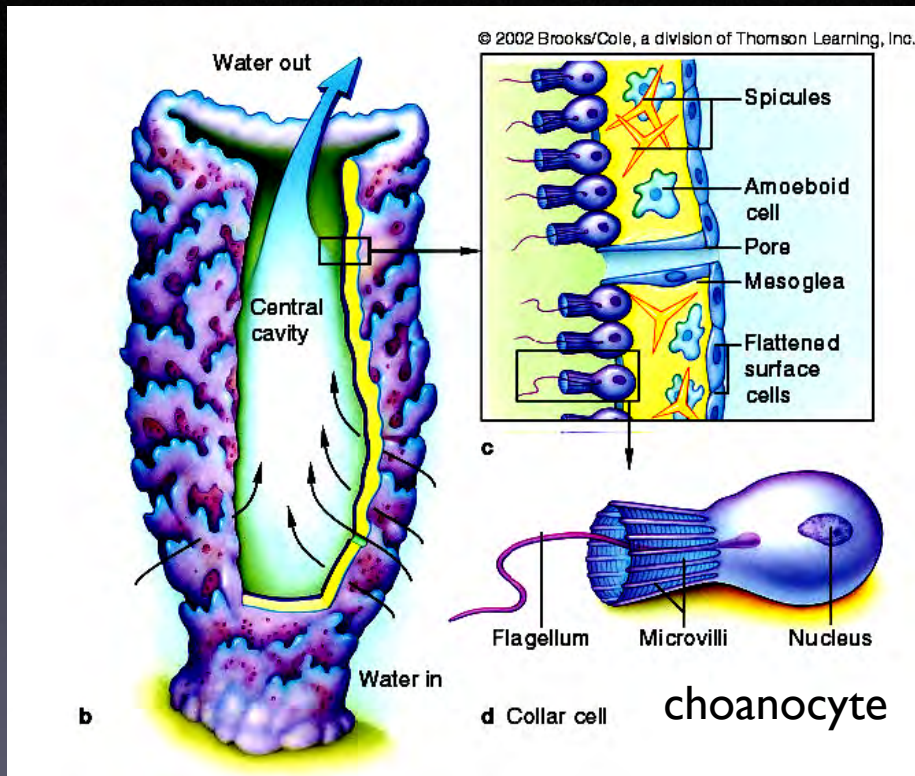
Calcareous Sponge



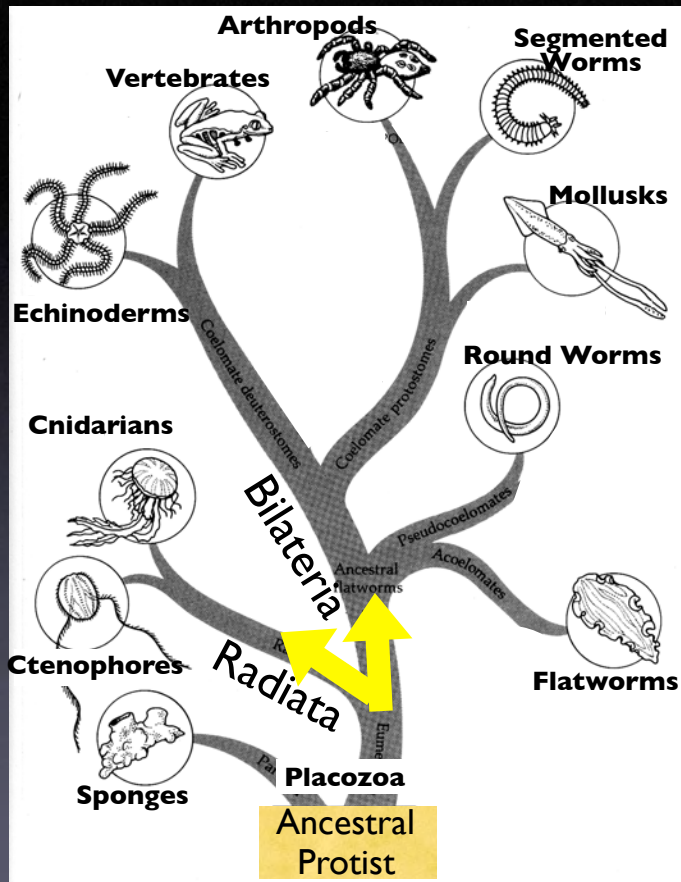
Glass sponge
(Venus' Flower Basket)



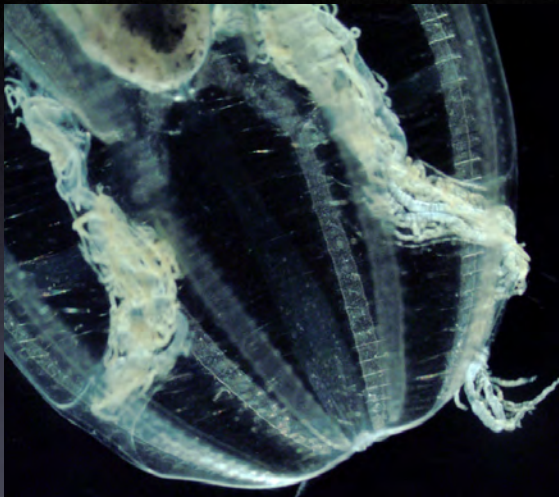
Sponge Anatomy



The Animal Family Tree



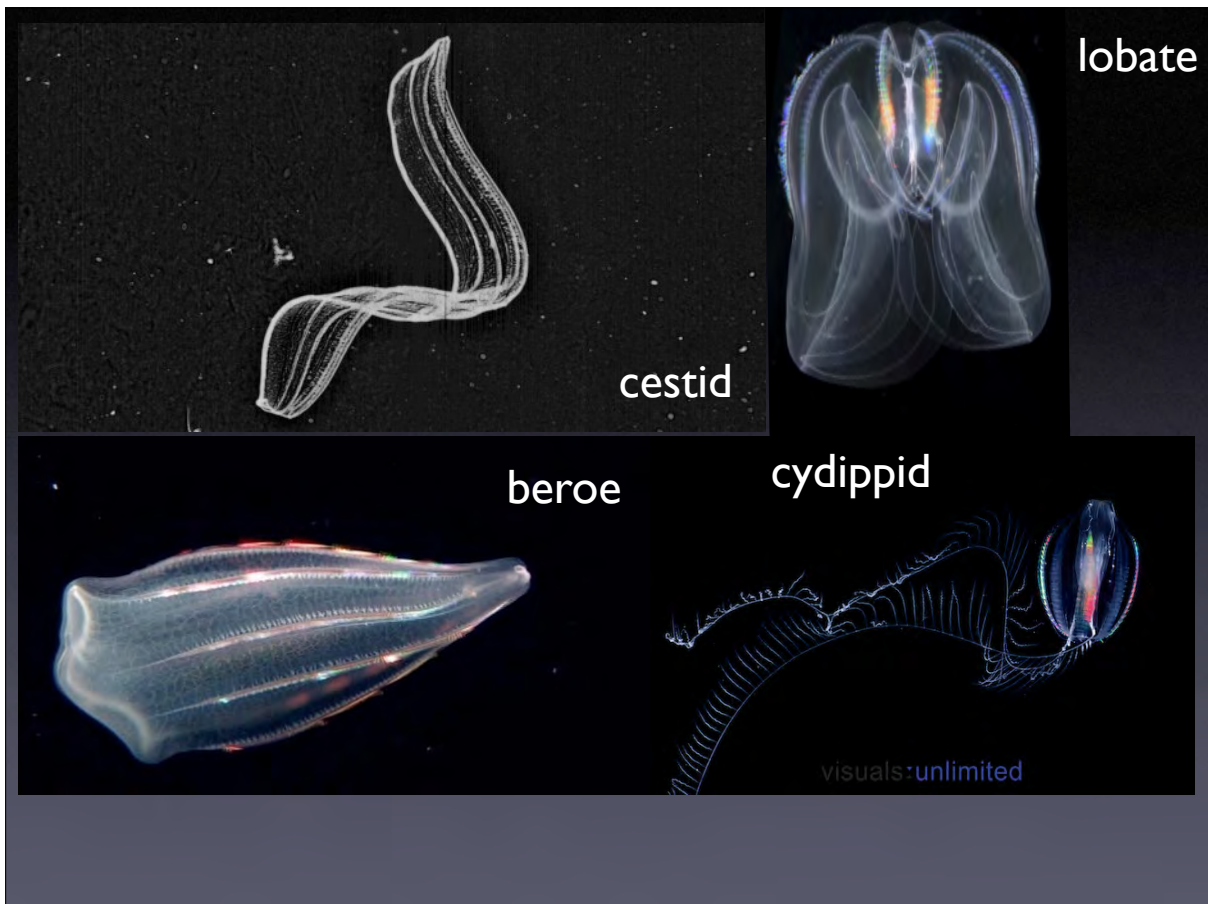
Ctenophores (comb jellies)



Ctenophores

(comb jellies)

- All are marine
- Pelagic from 0 to >3000 m (few benthic creepers)
- Have eight rows of cilia (comb rows)
- Carnivorous
 - Use tentacles with sticky colloblasts
 - Some directly ingest prey (*Beroe*)
- Can be invasive (e.g., Black Sea)

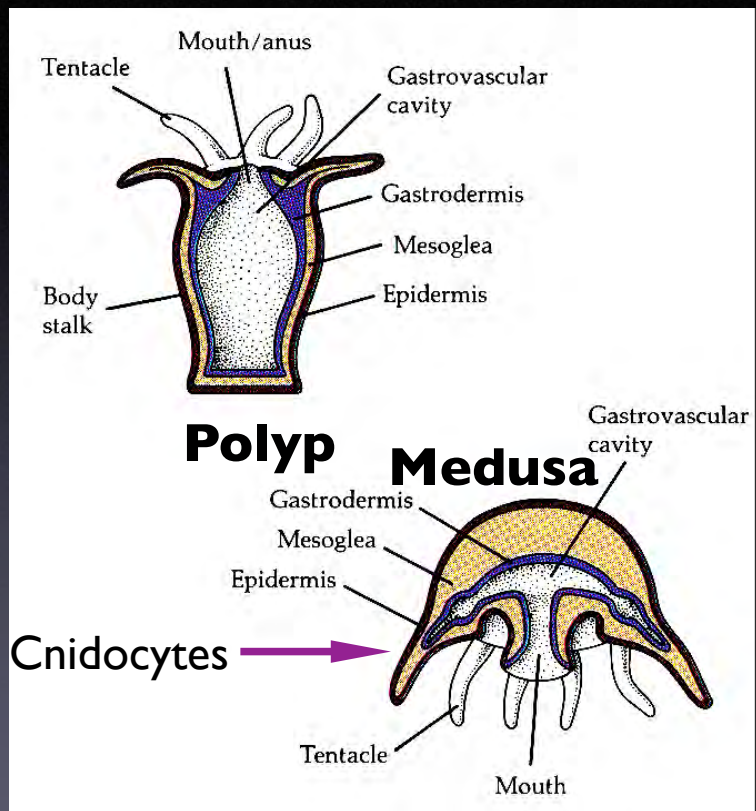


Cnidarians

(anemones, corals, jellyfish)

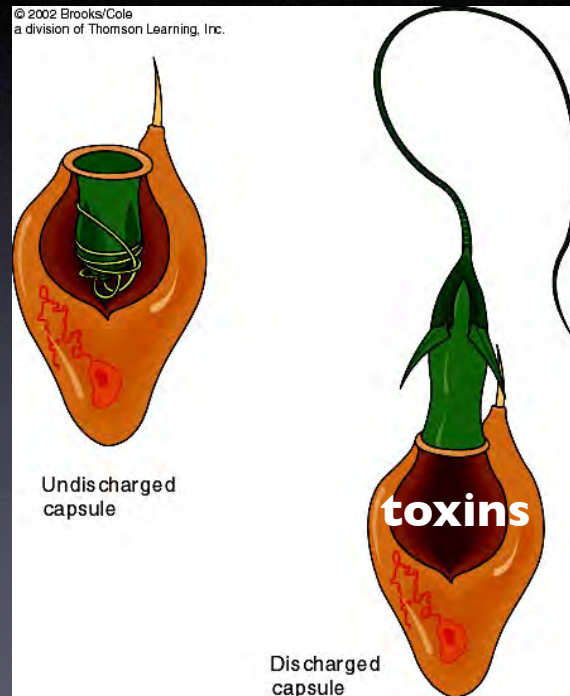
- Named for the stinging cells (cnidocytes)
- Radial symmetry
- Two forms: polyps and medusae
- Asexual and Sexual Reproduction

- Radial symmetry
- Simple Digestive system (blind sac)
- No circulatory, respiratory or excretory systems
- carnivores/detritivores
- Primitive nerve networks



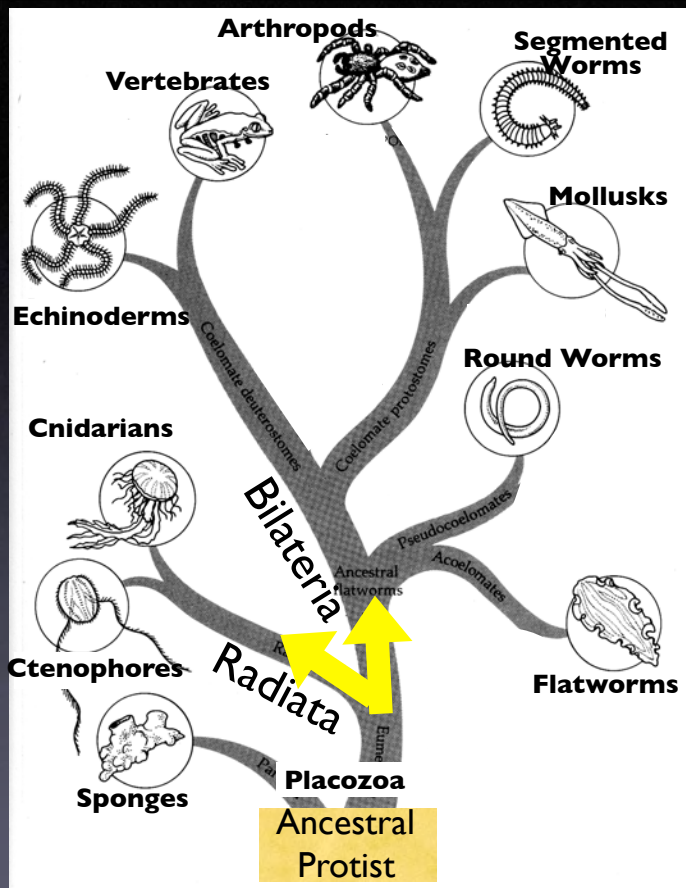
Cnidocytes

- Prey capture
- Turf wars
- Defense





The Animal Family Tree

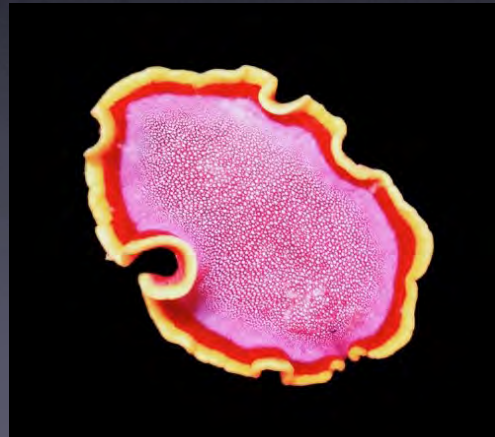


Flatworms

(Platyhelminthes)



- Turbellarian flatworms are marine, benthic
- Infauna from intertidal to deep sea
- Carnivorous or herbivorous
- Move by cilia or undulations
- Mouth but no anus
- Cephalization



Roundworms

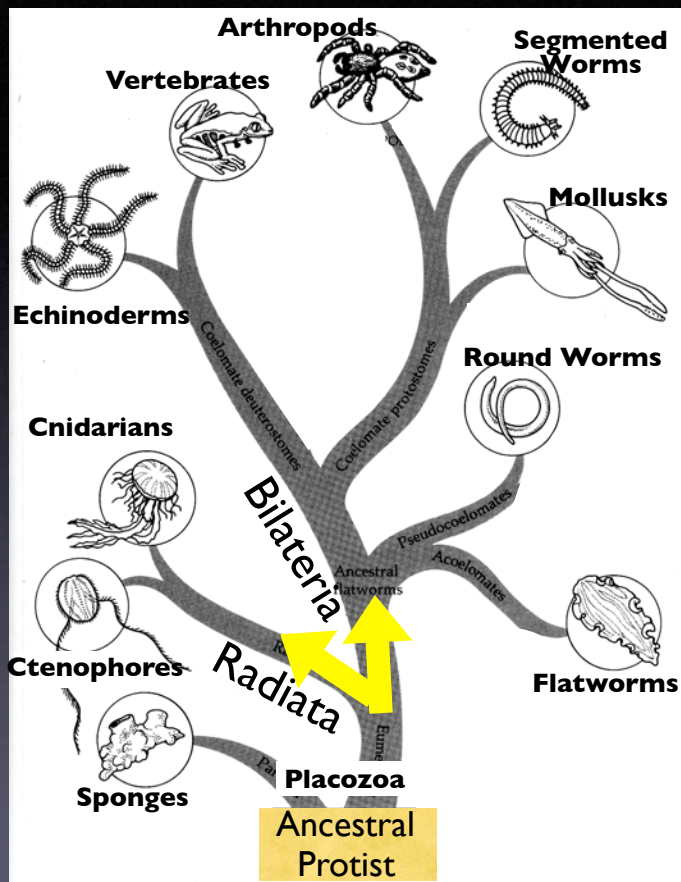
(Nematodes)

- Flow-through digestive system!
- Found all over (terrestrial, freshwater, marine)
- VERY abundant free-living in benthic infauna
- Many other types are parasitic
- Many are deposit feeders, detritivores



Image source: Juergen Berger & Ralph Sommer, Max-Planck Institute for Developmental Biology

The Animal Family Tree



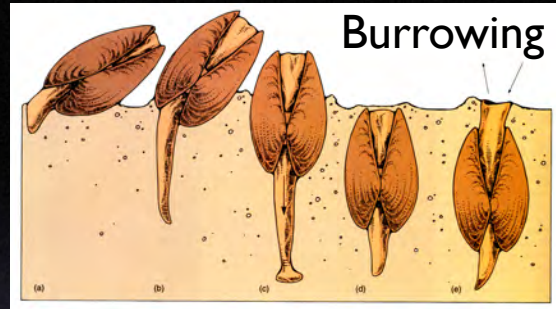
Molluscs

MAJOR CLASSES

- Bivalvia (Clams, oysters, mussels)
- Gastropoda (snails, nudibranchs)
- Cephalopoda (squid, octopus, nautilus)



Bivalves



- Many burrowing and boring
- Others attach to rocky surfaces
- Suspension feeding or selective deposit feeding

Gastropods



- Many with shells (snails, whelks, etc.) some types without shells (e.g. nudibranchs)
- Some planktonic forms (e.g. pteropods)
- Herbivores and carnivores, deposit and suspension feeders
- Have a radula (a toothed scraper)

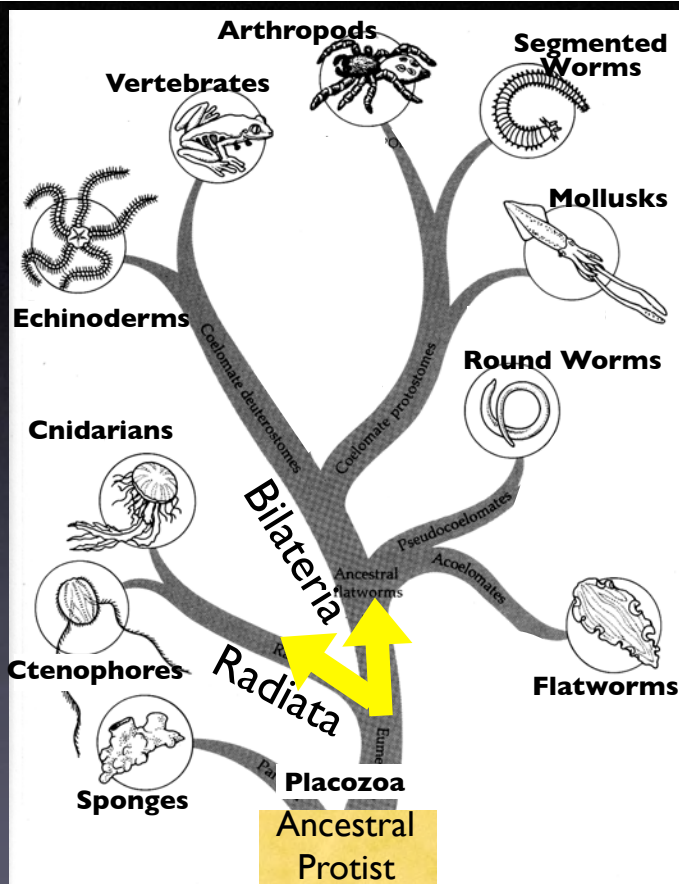


Cephalopods



- Well developed brains and eyes
- Many have ink sacs
- Only one type still has external shell (Chambered nautilus)
- Carnivores; Use radula and beak for tearing food
- Many can rapidly change colors (camouflage, communication)

The Animal Family Tree



Segmented Worms (Annelids)

- Major Class: the **Polychaetes**
- Mostly benthic, a few planktonic
 - predatory epifauna
 - tube-dwelling infauna (deposit/
suspension feeders)



well developed
central nervous
system



Polychaetes

Food capture & Gas Exchange

Christmas
tree worm



tube dwelling

Arthropoda

(jointed feet)



- Exoskeleton (protection, leverage)
- Striated Muscle (quick, powerful)
- External Skeleton requires molting
- Herbivores, carnivores, omnivores

Arthropoda: Crustacea

Malacostraca

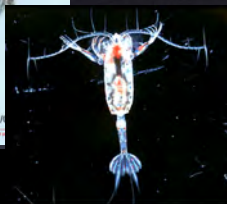
branchiopods



ostracods



copepods



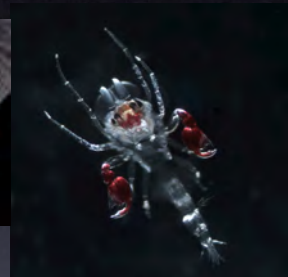
isopods



mysids



amphipods

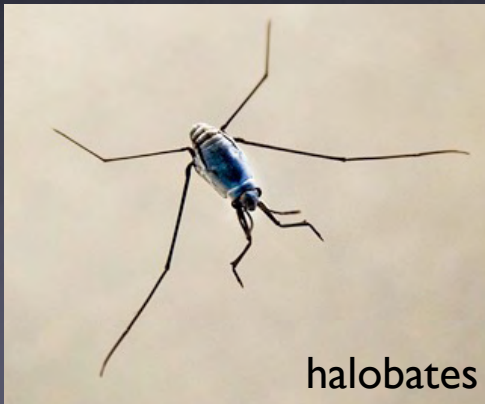


decapod

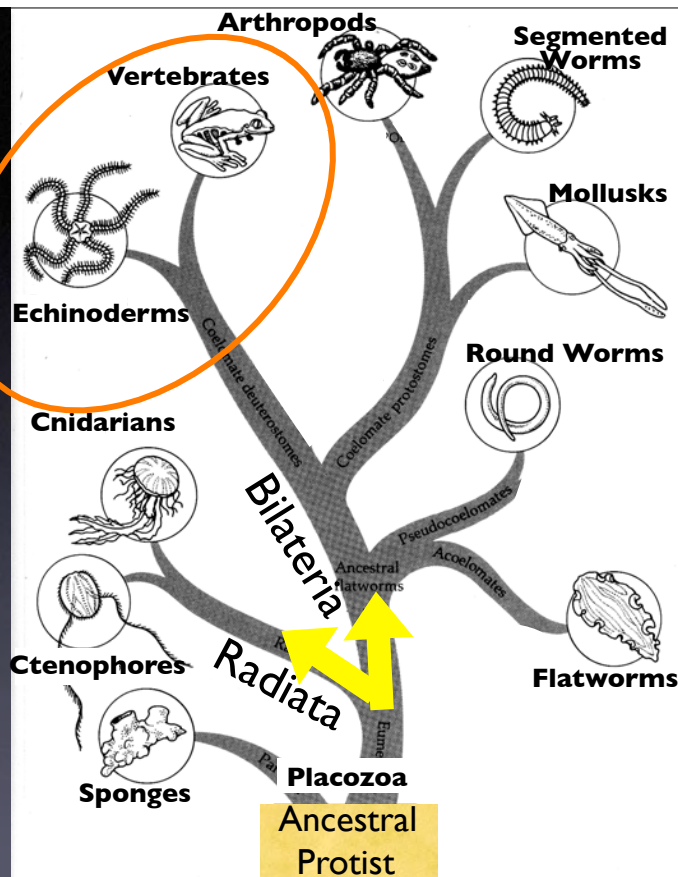


Arthropoda

- Vast majority of marine arthropods are crustaceans
- Exceptions: marine insects, chelicerates (e.g., horseshoe crabs, pycnogonids)



The Animal Family Tree



Echinoderms

- Echino derm = spiny skin
- Most are suspension or deposit feeders, some grazers (e.g., kelp), sea stars also predatory
- From intertidal to abyssal depths, benthic, often have planktonic larvae
- Have tube feet
- Bilaterally symmetric as larvae, adults pentaradially symmetric

Echinoderms

Sea Stars

Sea Cucumbers

Brittle Stars

Sea Urchins

tube feet

Crinoids

(C) American Museum of Natural History

Echinoderms



Questions?