Phylum Rotifera (about 1,800 species)

- most are microscopic - largest up to about 2 mm in size

- multicellular animals, which have muscles, a complete digestive tract, and other more complicated structures. [Fig., not in book, but see fig. 33.13, p. 676].

- body fluids help serve as an hydrostatic skeleton.

- rotifer => “wheel bearer”

  - crown of cilia surrounding mouth. Use this to draw in water (and food).

  - food then enters jaw, which is part of the mastax (a characteristic grinding organ of this group).

- reproduction is unusual:

  - many use parthenogenesis:

    - females produce more females from unfertilized eggs (but eggs are diploid)

    - some, but not all, will produce degenerate males when conditions are bad.

    these males live just long enough to fertilize eggs [NOTE: many organisms use sexual reproduction when conditions are bad, and asexual reproduction when conditions are good - WHY?].

- some are suspension feeders, others raptorial (predatory).

- other features from overhead: toe, pedal gland.

- most can detach and swim.

Phylum Molluska (about 100,000 species)

Very large, successful group, even found on land. Clams, snails, slugs, octopus, etc.

All have a similar arrangement of body parts [Fig. 33.15, p. 678]:

1) ventrally, a muscular foot
2) a dorsal covering, the mantle
3) in between -> visceral mass, which contains internal organs

Most have a shell (derived from the mantle):
- usually external, but sometimes internal (squid).

- some have lost shell (octopus)

Some other features:

- many have a radula (scraping tongue)

- recognizable internal organs

- their exact relationship to other animals is still debated. Have a larval form (trochophore) very similar to that of annelids, but lack any kind of segmentation.

Very diverse group - 8 classes - of which we’ll just look at five (book lists four in table 33.3, p. 678):

- Briefly - Scaphopods, or “tusk shells” [this class is not in the text].
  - look like a very small elephant tusk (in lab!)
  - single shell, open at both ends, bilateral,
  - benthic (live in mud and slime), marine [picture?]
  - heartless

- Polyplacophora (chitons) [Fig., not in text, but see fig. 33.16, p. 678]:
  - use muscular foot to attach themselves to rocks
  - eight (rarely seven) dorsal plates.
  - grazers -> use radula to eat algae.
  - marine, but most are intertidal (i.e., stay out of water at low tide).
  - found in many parts of the world (incl. U.S.)

- Gastropoda (snails and slugs) [Fig., not in text, but see fig. 33.17, p. 679]:
  - most marine, but there are also freshwater and terrestrial species.
  - torsion - the entire visceral mass has been twisted 180 degrees. Anus is located over head [Fig. 33.18, p. 678]
- shell coils forms a conical spiral. Have a great variety of forms

- slugs, too, can have many bizarre and pretty (colorful!) forms

- terrestrial snails lack gills - instead the lining of the mantle cavity functions as a kind of lung

- feed by using radula to get chunks of food. Will feed on animals or plants. Some (cone shells) can even be dangerous to humans who pick them up accidentally (use a “poison” dart to inject prey with venom).

- Bivalvia (clams, scallops, mussels, oysters, etc.) [Fig., not in text, but see 33.19, p. 679]
  - no radula
  - do not show much variety
  - are almost all filter feeders
  - shells have TWO halves (hence the name)
  - some attach, but some (like scallops) can actively move by “flapping their shells”.

  - [Fig. 33.20, p. 679]
    - mention muscles, water flow, gills.

- Cephalopoda (squid, octopus, etc.)
  - most highly developed mollusks.
  - have a decent brain - fairly intelligent (comparatively)
  - complex eye - similar to ours, but this is again due to convergence (details of structure are quite different).
  - closed circulatory system (accessory hearts for gills)
  - very active predators
  - tentacles, usually suckers, beak, muscular esophagus
  - jet propulsion
- water is drawn into mantle cavity, then forced out through siphon.

- many also have fins

- range up to 17m for the largest giant squid (found washed ashore in New Zealand in the late 1800’s), though it is suspected that there are larger squid out there.

- have a beak which they use to inject venom into prey. Blue ringed octopus (Australia) is quite small, but deadly.

- several groups [fig., similar to 33.22, p. 658]:

  - Squid/Octopus/Nautilus/Ammonites

Phylum Arthropoda (900,000 species known, but maybe up to several million in existence)

- the most successful group of animals out there.

- incredibly diverse.

- major characteristics:

  - exoskeleton - made up of chitin. Sometimes called a cuticle.

    - because this is a hard shell, animal often needs to molt as it grows (actually, we do to, but in our case we don’t replace everything at once).

    - helps to prevent water loss.

  - jointed appendages. Arthro-pod (explain derivation)

    - occur in pairs.

    - can be modified for feeding, movement, gills, sensory, etc.

- other characteristics:

  - open circulatory system (only a few big vessels).

  - terrestrial forms may have a tracheal system or some other method of moving air around the body.

- thought to be related to annelids (e.g., think of annelids and millipedes), but this is not clear.
- Four major subphyla:

  - Trilobites [OVERHEAD, not in book, but see fig. 33.27, p. 684].
    - extinct/compound eyes/three longitudinal body parts.
    - incredibly common during Cambrian to the end of Paleozoic - numerous fossils.

  - Chelicerates (spiders, ticks, scorpions, etc.)
    - have chelicerae -> a modified first set of claw like appendages (don’t confuse these with other claw like appendages (e.g. scorpions)).
    - lack antennae
    - two main groups:
      - horseshoe crabs - aquatic scavengers [Fig., similar to fig. 33.30, p. 686]
      - arachnids:
        - almost all carnivorous (or parasitic):
          - scorpions/ticks/spiders/mites, etc. [Fig., not in text]
          - feeding - details a little later, but essentially capture prey, in some cases inject venom (some spiders are dangerous (scorpions use venom more to kill or defend themselves)), then liquify contents of prey and suck up the contents.
        - mostly terrestrial (but: sea spiders).
        - may have “book lungs” (and/or trachea).

  - Crustaceans (crabs, lobster, isopods, etc.)
    - two pairs of antennae.
    - biramous appendages (appendages are branched - have two branches).
    - most have compound eyes (sometimes on a stalk).
    - some examples [Fig., not in book, but see Fig. 33.38, p. 692]:
- water fleas, brine shrimp, krill

- isopods - terrestrial crustaceans (sow bugs, pill bugs, wood lice, whatever)

- barnacles

- decapods

- Uniramians (millipedes, centipedes, insects!!)
  - appendages not branched (Uni-ramous)
  - single set of antennae (unique feature)
  - mostly terrestrial.

- Myriapods - “myriads (=many) of legs” [Fig., similar to figs. 33.33 & 33.34, p. 687]
  Millipedes (Class Diploda) - two sets of legs/segment. Eat decaying plant material. Some can be very toxic (give of hydrogen cyanide).
  Centipedes (Class Chilopoda) - one set of legs/segment. Can inject venom into prey.

- Insects (Class Insecta)- the most successful group of animals. Period.
  - three pairs of legs
  - head/thorax/abdomen
  - many have wings (important to their success). One of the first insects to fly were dragonflies. Wings have been highly modified in the different groups.
  - metamorphosis (two types):
    - incomplete or gradual - young resemble adults (e.g. grasshoppers)
    - complete - young are totally different, for example, maggot, grub, caterpillar.
- in this case:

egg -> larvae -> pupae -> adult

(may go through several larval stages)

- internal anatomy:

  - [OVERHEAD, fig. 33.35, p. 688]

  - point out heart, dig. system, dorsal artery, malpighian tubules, tracheal tubes.

  - many of these systems will be discussed in more detail later in the semester when we do comparative anatomy.

- great diversity in groups:

  - [table 33.37, pp. 690 - 691.]

- humans and insects:

  - beneficial - pollinators, decomposers, etc.

  - harmful - destroy crops, disease vectors, etc.

    - fighting back to our pesticides by becoming resistant!

  - see quote in text on p. 689:

    “Bugs are not going to inherit the Earth. They own it now.”

    (Thomas Eisner, Cornell University).