Major groups of animals

I. Phylum Porifera

A. no true tissues
B. cell types
   1. pinacocytes (pinacoderm - incipient tissue)
   2. archaeocytes - in mesohyl
   3. choanocytes
C. Body forms
   1. Asconoid
      a) water flow —> ostia - spongocoel - osculum
      b) choanocytes line spongocoel
   2. Syconoid
      a) water flow —> ostia - radial chamber - spongocoel - osculum
      b) choanocytes line radial chambers in body wall
   3. Leuconoid
      a) water flow —> ostia - inhalant canal - choanocyte chamber - exhalant canal - osculum
      b) no real spongocoel
      c) choanocytes in chambers dispersed throughout body
D. asexual or sexual reproduction
   1. budding / gemmules
   2. mostly monoecious

II. Phylum Cnidaria

A. general characteristics
   1. cnidocytes (with nematocyst)
   2. radial symmetry
   3. tissue-level development - diploblastic
      a) body two cell layers thick
      b) epidermis - mesoglea - gastrodermis
   4. gastrovascular cavity
   5. two body forms: polyp / medusa

B. Class Hydrozoa

1. solitary or colonial
2. e.g. hydra, *Obelia*, portuguese man o' war

C. Class Anthozoa

1. Corals and Anemones
2. colonial

D. Class Cubozoa

1. box jellies

E. Class Scyphozoa

1. true jellies

III. Phylum Ctenophora

A. general characteristics
   1. move with cilia - comb plates
   2. biradial symmetry

3. diploblastic
4. collenchyme
5. monoecious - sexual reproduction
6. paired tentacles with colloblasts

BILATERIA (all of the rest of the phyla are bilaterians)

LOPHOTROCHOZOA (platyhelminthes, annelids, molluscs, *et al.*)

IV. Phylum Rotifera

A. general characteristics
   1. wheel organ / corona
   2. mastax
   3. eutely

V. Phylum Platyhelminthes

A. general characteristics
   1. free-living or parasitic (many)
   2. acoelomate
   3. bilateral symmetry
   4. organ-level development
   5. syncytial tegument
   6. gastrovascular cavity (or none)

B. Class Turbellaria

   1. mostly free living
   2. planaria
   3. regeneration

C. Class Trematoda

   1. flukes
   2. diverse life cycles related to parasitism / hosts
      a) egg - miracidium (larva) - sporocyst (adult) - redia (adult) - cercaria (larva) - metacercaria - fluke (adult)
      b) intermediate host often a gastropod

D. Class Monogenea

   1. monogenic flukes
   2. attachment organs: prothaptor - opisthaptor
   3. ectoparasites
   4. oncomiracidium larva

E. Class Cestoda

   1. tapeworms
   2. scolex - proglottids
   3. scolex homologous to opisthaptor
   4. no gut - microtriches
   5. monoecious

VI. Phylum Mollusca

A. general characteristics

1. eucoelomate
2. bilateral symmetry
3. open or closed (in cephalopods) circulatory system
4. ctenidial gills
5. radula for feeding
6. mantle - generates shell
7. huge, diverse group - probably 3rd largest phylum

B. Class Gastropoda

1. snails and slugs
2. torsion
3. single valve (sometimes reduced or missing)

C. Class Bivalvia

1. two halves to shell
2. suspension feeders
3. 3 chambered heart (open circulatory)
4. very specialized for filter feeding

D. Class Cephalopoda

1. squid, octopus, cuttlefish
2. closed circulatory
3. little or no shell (except chambered nautilus)
    a) if shell is present, mainly used for buoyancy

VII. Phylum Annelida

A. general characteristics

1. closed circulatory
2. eucoelomate
3. gills or epithelial gas exchange
4. setae / chaetae - chitinous bristles
5. proteinaceous cuticle

B. Class Polychaeta (polyphyletic)

1. lots of setae (chaetae)
2. parapodia
3. gills or parapodia used for gas exchange
4. very diverse (10,000+ species)
5. strong cephalization (prostomium, peristomium, eversible pharynx, jaws)

Clade CLITELLATA (oligachaetes, hirudinea)

C. Class Oligochaeta (paraphyletic)

1. earthworms and others.
2. mostly terrestrial, some aquatic
3. no parapodia
4. few setae (chaetae)
5. deposit feeders
6. epithelial gas exchange
7. monoecious

D. Class Hirudinea

1. leeches - often ectoparasites

2. reduced or lost septa
3. no setae or parapodia
4. anterior and posterior suckers
5. mostly freshwater, some marine, some terrestrial

ECDYSOZOA (nemata, arthropods, *et al.*)

VIII. Phylum Nemata

A. general characteristics
1. some parasitic, but many free-living
2. probably second biggest phylum (probably at least 500,000 species)
3. eutely
4. collagenous cuticle
5. pseudocoelomate
6. only longitudinal muscles

IX. Phylum Arthropoda

A. general characteristics
1. chitinous exoskeleton - molting (ecdysis)
2. metamorphosis
3. metamerism
4. tagmatization
5. jointed limbs

B. Subphylum Chelicerata

1. general characteristics
   a) chelicerae
   b) 2 tagmata
   c) no antennae, no mandibles
   d) 6 pairs of limbs on prosoma
   e) diverse and commonly encountered group

2. Class Arachnida

   a) spiders, scorpions, mites, ticks, opilionids, etc.

C. Subphylum Pancrustacea [Crustacea (paraphyletic)]

1. general characteristics
   a) 2 or 3 tagmata, 2 pairs of antennae
   b) heavily calcified exoskeleton
   c) ancestrally biramous appendages

2. Class Malacostraca

   a) most of the large crustaceans
      (1) shrimp, crabs, lobsters, crayfish, isopods
   b) 3 tagmata (head, abdomen, thorax)
   c) some biramous appendages
   d) generally aquatic (most diversity in marine ecosystems)

3. Class Insecta

a) general characteristics
   (1) 3 tagmata
   (2) 4 (or 2) wings
   (3) 6 legs
   (4) uniramous appendages
   (5) mostly terrestrial or freshwater aquatic
   (6) metamorphosis
   (7) tracheal system
   (8) malphigian tubules

DEUTEROSTOMIA

X. Phylum Echinodermata

A. Class Asteriodea

1. sea stars
2. pentaradial symmetry
3. gastric eversion

B. Class Ophiuroidea

1. brittle stars
2. pentaradial symmetry
3. closed ambulacrum
4. excellent regeneration
5. highly motile
6. articulated ossicles

C. Class Echinoidea

1. sea urchins, sand dollars, sea biscuits
2. Aristotle's lantern
3. test

D. Class Holothuroidea

1. reduced ossicles
2. soft bodied
3. bilateral symmetry

E. Class Crinoidea

1. filter feeders, somewhat sessile
2. many arms, ciliated ambulacrum

XI. Phylum Chordata

A. general characteristics
   1. dorsal hollow nerve cord
   2. notochord
   3. post-anal tail
   4. pharyngeal slits
   5. endostyle

B. Subphylum Urochordata

1. general characteristics
    a) sea squirts, tunicates
    b) filter feeders, sessile adult
    c) cellulose tunic

C. Subphylum Craniata (alt. Vertebrata)

1. Class Myxini

a) hagfish

2. Class Petromyzontes

a) lampreys

3. Class Chondrichthyes

a) cartilage fish
b) sharks, skates, rays, chimera
c) no swim bladder or lungs

4. Class Actinopterygii

a) ray-finned fish (most fish)
b) operculum covering gills
c) dermal scales
d) with swim bladder or lungs

5. Class Sarcopterygii (polyphyletic/paraphyletic)

a) lobe-finned fish (needs to include the Amphibia, Mammalia, Reptilia, and Aves)
b) dermal scales
c) contains groups ACTINISTIA, DIPNOI, and the tetrapods (Amphibians, Mammals, Reptiles, Birds)

6. Class Amphibia (polyphyletic/paraphyletic)

a) monophyletic if just the modern ones (lissamphibia)
b) usually no scales

7. Class Mammalia

a) hair, mammary glands

8. Class Reptilia (paraphyletic)

a) crocodilians, squamates, tuatara, turtles
b) need to include the birds
c) epidermal scales

9. Class Aves

a) birds
b) birds actually dinosaurs, belong inside the Reptilia