

Spring 2002	P. Cnidaria	P. Platyhelminthes	P. Annelida	P. Mollusca	Arthro.-Crustacea	Arthro. - Insecta	P. Echinodermata	Subp. Vertebrata
<b>examples</b>	hydra/anemones jellyfish/coral	tapeworm/ <b>planaria</b> liver flukes	<b>earthworm</b> /leech polychaetes	<b>clam</b> /squid/snail slugs/mussels	<b>crayfish</b> / brine shrimp	<b>cockroach</b> /fly mosquito/ticks	<b>starfish</b> /urchins/ sea cucumber	<b>rat</b> /frog/chick
<b>symmetry</b>	radial	bilateral	bilateral	bilateral	bilateral	bilateral	radial (adults) bilateral (larva)	bilateral
<b># germ layers</b>	2 (diploblastic)	3 (triploblastic)	3 (triploblastic)	3 (triploblastic)	3 (triploblastic)	3 (triploblastic)	3 (triploblastic)	3 (triploblastic)
<b>metamorphosis</b>	hydra = none (others have larva)	turbellaria (direct), trema. & cestodes. complicated life cycles (indirect)	none (direct in oligo & hirudinia) larva forms (indirect) in polycheat.	indirect in most, larvae very similar to annelid larva. Direct in ceph & land forms.	Crayfish direct but other crustaceans have larval stages. Exoskeleton constraints.	varies- some direct, others indirect. Exoskeleton requires molting.	indirect. Pluteus larvae in urchins (bilateral symmetry).	direct
<b>metamerism</b>	none	some internally	very evident	only in 1 genus	yes	yes	yes, repetition gonads, etc.	yes
<b>coelom</b>	none	none	very evident	very reduced, small around the heart, kidneys & gonads.	reduced coelom	reduced coelom	huge - subdivided: water-vascular system & perivisceral	yes - divided into several cavities: abdominal/thoracic
<b>skeletal</b>	none to hard CaCO <sub>3</sub> skeleton (corals) Mesoglea	none, trema/cestodes w/ hardened integument (to resist digestion)	fluid filled hydroskeleton	none, external shell in most. Ceph. lack shell except Nautilus.	body = head, thorax and abdomen. Chitinous exosk..	body = head, thorax and abdomen. Chitinous exosk.	endoskeleton (CaCO <sub>3</sub> ) plates, epidermis on top.	endoskeleton -cart. and calcified
<b>cephalization</b>	none	yes, eye spots,	yes, suprapharyngeal ganglion	minimal in bivalves extensive ceph.	lots	lots- complex social patterns	none	yes
<b>nervous</b>	diffuse nerve net & sensory cells	nerve ladder, eye spots (reduced sensory in parasites)	brain connected to ventral nerve cord	varying degrees depending upon class w/in mollusks	true ganglia, true brain	true ganglia, true brain	Nerves diffuse but more around mouth.	yes
<b>digestion</b>	gastrovascular cavity (GVC), gland cells in gastrodermis secrete digestive enzymes = extracellular digest. & nutritive-muscular cells phagocytose food (intracellular)	turb. - pharynx extend. enzymes released, extra and intracellular (food vacuoles), branched GVC, parasites - trematodes similar digestion (mostly) cestoda - no digestive system (absorption from host)	GI tube with typhlosole, enzymes secreted. External digestion.	clam-cilia on ctenidia create current, food trapped on ctenidia. Mucus secretions help cilia beat food to mouth. Food enters stomach, digestive glands secrete enzymes. Wastes empty out the anus into excurrent siphon.	chela used in offense & defense, mandibles & maxillipeds force food in mouth- to esophagus to anterior (cardiac chamber) where it is ground by teeth of gastric mill. To pyloric chamber then to intestine and out the anus. Digestive gland secretes enzymes & stores glycogen.	Cockroach takes food in & some fragmentation with mandibles. Stored in crop, proventriculus (gizzard) grinds food. Gastric caeca secrete digestive enzymes. Malpighian tubules empty wastes into hindgut (colon) and out anus w/ feces	Starfish -feed on clams, etc. Capture prey with tube feet, slowly open clam. Evert cardiac stomach - secretes mucus & digestive enzymes (from hepatic caeca). Food taken in to cardia/pyloric stom.	review lectures.
<b>circulatory</b>	none - diffusion	none	closed	Open, except ceph. which have systemic and branchial hearts.	Open. Sinuses for nutrient/gas exchange.	Open. Sinuses for nutrient/gas exchange.	water-vascular system & coelomic fluid.	Closed system. Varying #'s of chambers.
<b>respiratory system &amp; pigment</b>	none	none	Use skin (gills) & dissolved hemoglobin	ctenidia in most, land snails vascularize mantle cavity (lung). Hemacyanin (some hemoglobin)	gills for gas exchange. Hemacyanin.	spiracles/tracheoles None.	Coelom extends into dermal branchia. Some across tube feet. No pigment.	gills/lungs hemoglobin/myoglobin
<b>excretory</b>	none - diffusion	turb. - protonephridia with flame cells	nephridia removes waste from coelom & blood, usually 1/somite	nephridia (variable #) remove wastes	green gland	malpighian tubules empty into digest. tract	Osmoconformers.-No special system. Wastes diffuse from skin.	kidneys
<b>sexual cycle &amp; sex organs</b>	Hydras - monoecious, other cnidarians di. Testis - sperm, ovary -egg (not true organs)	monoecious, fertilization internal. Ovary/testis and complicated in cestoda	monoecious & direct in oligo & hirudinia. Cross fertilization. Diecious and indirect in polycheate.	dioecious (a few = mono in land snails). Indirect development in all except ceph. and pulmonata (land snails).	dioecious. Direct fertilization internal (sperm stored in sperm receptacle).	diocious. fert. is internal.	Dioecious. External fertilization. Indirect development. Deutero. like chordates.	dioecious. External and internal fertilization. Think of classes.
<b>asexual cycle</b>	budding,	fission and budding (some) some parthenogenesis, like most parasitic forms	some oligo & polychaetes capable of budding & fission (mostly aquatic)	none	none (regeneration of limbs)	parthenogenesis.	Most regenerate parts & some an entire organism.	Rare groups parthen., some change sex.
<b>locomotion</b>	tumbling, some psuedopod extension of basal disk cells gas bubble	ciliated ventral surface in turb., some muscular movement. Parasitic use larval and intermed. hosts.	setae (earthworm) & hydroskeleton.	usually slow moving via the foot or cilia & mucus. Ceph. fast via jet propulsion.	exoskeleton with jointed appendages variable locomotion	exoskeleton with jointed appendages variable locomotion	move via water-vasc. & tube feet (suction tip -adhesive). Madreporite.	Variable.
<b>other note</b>	tissues yes, NO organs UNIQUE = cnidocytes with nematocysts > 10,000 species	flattened dorsoventrally first organs, complicated life cycles in parasites parasites many defenses against hosts immune, 12,000	metamerism hydrostatic skeleton poly - many setae, often on parapodia, hirudinea -no setae, 15,000 sp.	>80,000 species (2nd) most diverse, wide diversity of habitats. 3 unique features: mantle, radula (- inbivalves) & ctenidia.	largest # of species, most diverse, 3 subphyla: 1) trilobites extinct, 2) chelicerata-spiders, scorpions, horseshoe crab, ticks & mites.	3) Mandibulates Crustaceans & Insecta (only invert. can fly).	Note pedicellaria (pinchers) and dermal branchia (resp.) Regeneration of lost parts. Pentamerous.	Diverse Classes. See lab. manual and text. Notocord, dorsal hollow nerve chord, pharyngeal gill slits, post-anal tail.