

EEB 4275 (Invertebrate Zoology)
Fall, 2015
Final Study Guide Exam 1

What is an “invertebrate”? Do the “invertebrates” constitute a monophyletic group? Approx. number of phyla; Domain and Kingdom to which “invertebrates” belong and their basic features. Five levels of organization/complexity exhibited by “invertebrates” (i.e. cytoplasmic, cellular, tissues, etc.), their basic features and exemplar phyla; do these levels represent monophyletic sets of taxa? 3 basic categories of aquatic habitats (littoral zone, etc.) and their subcategories (supralittoral, etc.).

NOTE: For each “invertebrate” phylum, IN ADDITION TO THE INFO OUTLINED BELOW, you should know the common name, distinguishing characteristics (synapomorphies if they exist), approximate range in size, position within the general scheme of “invertebrate” organization with respect to the major subgroupings of “invertebrates” i.e. body cavity configuration (acoelomate vs. blastocoelomate vs. eucoelomate), symmetry, protostome vs. deuterostome; level of organization (i.e., cell, tissue, organ/organ system etc.), general habitat (e.g. freelifing/parasitic; marine, etc.), solitary/colonial, etc. You should have some idea of diversity in each phylum, class, subclass, etc (if covered). You should know how each phylum generally handles locomotion, feeding (food acquisition, digestion, etc.), respiration, circulation, excretion, reproduction, development, sensory perception, and defense and developmental stages (i.e., larval type, if any) of each.

Choanoflagellata- habitats and distinguishing characteristics; collar and its function; potential close relatives. Difference between a flagellum and an undulopodium.

ANIMALIA (=Metazoans): General features (e.g., possession of collagen, develop from embryos, etc.), potential synapomorphies. Are the metazoans monophyletic? Major subdivisions (parazoans, radiatans, bilaterians) and their distinguishing features; level of complexity/organization of phyla covered to date.

Porifera- distinguishing characteristics; potential synapomorphy? Cell totipotency and aggregation properties; cell layers (pinacoderm, etc.) and their cell types (amoebocytes, choanocytes, pinacocytes, etc.); functions of each cell type and their positions in the body wall. Sponge body types (asconoid, syconoid, leuconoid) and their implications for sponge body size, water flow through each sponge body type; be able to illustrate a labeled example of each; parts of the body (osculum etc.); asexual reproduction- gemmules; sexual reproduction, parenchymula and amphiblastula larvae; 3 primary (i.e., most diverse) classes of sponges and their distinguishing characteristics, body type, spicule types, etc. Phylogenetic implications of the Homoscleromorpha.

Cnidaria- distinguishing characteristics; synapomorphy; tissue level of organization; extracellular digestion; 2 tissue layers and their embryonic germ layer origins; distinction between mesoglea vs. mesenchyme- embryonic layer of origin; cell types and their locations and functions in each tissue layer; 2 basic body forms (polyp vs. medusa) and how emphasized in different classes; 2 types of polymorphism (simultaneous vs. sequential) and an example of each; 4 classes (don't worry about Staurozoa) and their distinguishing characteristics, spicule types, location of cnidocytes and gonads in each, life styles, etc.; gastrozooid vs gonozooid; life cycle of *Obelia* (be able to reconstruct); colonial components of *Physalia*; life cycle of *Aurelia* (be able to reconstruct); what is a rhopalium? Concept of a stomodeum; 2 subclasses of Anthozoans and their basic features.

Ctenophora- basic characteristics; synapomorphies, orientation relative to cnidarian medusae and other features useful for separating the 2 phyla (e.g. larval stage, ctenes, colloblasts, etc.); number of tissue layers; kleptocnidae; colloblasts; comb plates; cydippid larva.

Invertebrate architecture: types of symmetry (spherical, radial, biradial, bilateral, etc.), know and be able to recognize examples of each; planes of sectioning (frontal, cross, sagittal, etc.); formal distinction between a colony and a constituent individual; distinguish diploblasty from triploblasty; know examples of phyla exhibiting each configuration; basic development of an embryo from zygote through gastrula in diploblastic and triploblastic organisms— including the arrangement of the ectoderm, endoderm, and mesoderm (if relevant) and various body cavities in each; fates of 3 embryonic germ layers (i.e. tissue types produced by each); be able to illustrate the different configurations of the body cavity (acoelomate, blastocoelomate, eucoelomate) and associated germ layers.

Basic features of Bilateria; understand acoelomate condition; be able to draw frontal section through acoelomate gastrula and cross section through corresponding adult form. 5 phyla currently considered to be at least functionally “acoelomate”; do they collectively comprise a monophyletic group? Distinction between true acoelomate vs. functionally acoelomate condition.

Platyhelminthes- distinguishing characteristics; basic organ systems; central nervous system and cephalization (what is it?), musculature; structure and function of a protonephridium; difference in structure of the epidermis of “turbellarians” and the tegument (=neodermis) of neodermatans; characteristics of the “turbellarians” and the 3 orders covered; non-

monophyly of “turbellarians”; Mueller’s larva; 3 classes and 2 subclasses of subphylum Neodermata and the basic and distinguishing features of each, host associations; unique larval types in each (i.e., miracidium, cercaria, oncomiracidium, hexacanth); cephalization in each group.

Nemertea- distinguishing characteristics; locomotion, understand details of the proboscis and rhynchocoel; circulatory system and its elements; complete digestive system; asexual reproduction, sexual reproduction (dioecy, etc.); pilidium larva. Why considered eucoelomates by some?

Gastrotricha- distinguishing characteristics; reproduction, monoecious; direct development, locomotion (ventral cilia and adhesive tubes, etc.); complete digestive system.

Gnathostomulida- distinguishing characteristics, pharyngeal jaw apparatus; monoecious; direct development, locomotion (ventral cilia); complete digestive system.

Micrognathozoa- most recently recognized phylum (2000!); complicated jaws; locomotion; do they possess a complete gut?

Understand blastocoelomate condition; be able to draw frontal section through blastocoelomate gastrula and cross section through blastocoelomate adult; 9 phyla currently considered to exhibit this body cavity type; do they collectively comprise a monophyletic group?

Nematoda- distinguishing characteristics; potential synapomorphy? Exceptionally wide diversity of habitats; unusual arrangement of musculature relative to nerves, parts of a muscle cell; basic structure of reproductive, nervous, excretory, and digestive systems; typical life-cycle and developmental stages; eutely; outer body layers and their functions.

Nematomorpha- distinguishing characteristics; how differ from nematodes? Host associations and habitats occupied by larvae vs. adults; generalized life-cycle; sexual dimorphism.

Rotifera- distinguishing characteristics; body parts (e.g. corona and its trochal discs and cingulum; mastax and its trophi, etc.) and their functions; diversity of feeding modes and associated modifications of feeding structures; 2 Classes and their general types features; how monogonontans and digonatanans differ wrt reproduction and life-cycles; be able to reconstruct the asexual and sexual phases of the life cycle of a monogonatan; role of mictic versus amictic eggs; what is parthenogenesis?; monophyly relative to “acanthocephalans”; outer body layer.

Acanthocephala- distinguishing characteristics; host associations; basic life-cycle; parts of the body; feature(s) uniting and distinguishing the group; outer body layer.

Kinorhyncha- distinguishing characteristics (zonites, scalids, segmental ganglia, etc); body regions; habitat.

Priapula- distinguishing characteristics; body regions; predatory (how?); larval stage; habitat.

Loricifera- distinguishing characteristics; body regions; larval stage; habitat.

What phyla constitute the Cycloneuralia?; feature(s) uniting these groups. What phyla constitute the Scalidomorpha?; feature uniting these groups?

Cycliophora- distinguishing characteristics; habitat; complexity of life cycle; postulated affinities?

Eucoelomates: what is a eucoelom? 2 main types (i.e., protostomes and deuterostomes) and 5 ways they differ (e.g. spiral vs. radial cleavage, etc); be able to diagram the embryonic formation of a schizocoelom and an enterocoelom, in each case illustrating the position of the three embryonic germ layers and eucoelom.

Mollusca- distinguishing characteristics of phylum and its 7 classes and approximate diversity; candidate synapomorphies of the phylum and their issues; what is a radula?; basic molluscan body form (head, foot, etc.) and elements emphasized in each class; cephalization in molluscs?; layers of the shell and their composition; mantle- what is it? Where is it?

Understand which cavities represent true eucoelom; embryonic origin of the haemocoel; morphology and components of the digestive system (including odontophore structure and its distribution among the 7 classes); nervous system- nerve cords, paired ganglia and the portions of the body they each innervate; structure and function of a metanephridium (how does it differ from a protonephridium?); respiration and basic ctenidial structure, osphradium and its function; circulatory system (open!) and blood flow, and its relationship to the respiratory, excretory, and reproductive systems, and body “cavities”; reproduction, molluscan life-cycle stages (trochophore, veliger, etc.) and their presence among mollusc classes; Scaphopoda- general and distinguishing features, habitat; Aplousobranchia- general and distinguishing features, habitat; Monoplacophora- general and distinguishing features, which structures are repeated? (explanation of term “segmented mollusc”); Polyplacophora- general and distinguishing features, habitat, which structures are repeated?, habitat; Bivalvia- general characteristics, body plan compared to the basic molluscan body plan; role of ctenidia in water movement, food acquisition, and respiration; gill structure; Cephalopoda- general characteristics, body plan compared to the basic molluscan body plan; functional vs. anatomical orientation of cephalopod body; general characteristics (circulation, respiration, prey capture, etc.) of 2 extant cephalopod subclasses (i.e., Nautiloidea and Coleoidea), shell in each, buoyancy

compensation and/or movement in each (differences among squid vs. cuttlefish vs. octopus). Gastropoda- basic features, 3 main stages in torsion (ventral flexure, contraction, etc.); know how the contorted body plan compares to that of the basic un-torted molluscan body plan (i.e. morphological consequences of torsion), advantages of torsion?; terms associated with various configurations of shells (dextral, planospiral, etc.); variation in respiratory structures across the class; Interesting associations between mollusks and other organisms (e.g. in blue ringed octopus, deep sea bivalves, shipworms, etc.).

Six intriguing associations of molluscs with other organisms, and the functions those organisms perform for the molluscs.

Terms for which you should be prepared to provide a definition and an example:

protostome	diploblastic	schizocoely
Parazoa	spongion	endoderm
undulopodium	osculum	nephrostome
bilaterian	mesoderm	spicule
protonephridium	ctenidium	polyp
enterocoely	operculum	nephridiopore
monoecious	ectoderm	mictic female
acoelomate	exhalent siphon	pinacocyte
cephalization	inhalent siphon	schizocoel
blastocoelomate	torsion	triploblastic
eucoelomate	syconoid	mesoglea
eulittoral	metanephridium	gastrodermis
enterocoel	choanocyte	glochidium larva
pinacoderm	cnida	amoebocyte
rhopalium	collenocyte	microsclere
triploblastic	cephalized	siphuncle
archenteron	gastrovascular cavity	epidermis
cuttlebone	eucoelom	gastric shield
velum	chitin	detorsion
hemocoel	crystalline style	gasterozoid
planospiral shell	bipectinate ctenidium	amictic female
medusa	mesenchyme	trochophore
veliger	open circulatory system	strobila
cydippid larva	foot	prismatic layer
periostracum	nacreous layer	gonozoid
megasclere	asconoid	oncomiracidium
gemmae	blastocoel	osphradium
mesohyle	ephyra	mastax
radula	odontophore	ink sac
lemnisci	blastocoel	mantle cavity
mantle	cnidocyte	amphibastula larva
archaeocyte	porocyte	scyphistoma
parenchyma	gorgonin	Metazoa
chromatophore	trochus	pneumostome
spermatophore	leuconoid	rhynchocoel
blastula	spongocoel	hypodermis
errant	planula larva	umbo
sedentary	stylet	beak
visceral mass	blastopore	scalid
haptor	pilidium larva	parthenogenesis
neodermis	zonite	lorica
cingulum	dioecious	trophi
cyncytium	cercaria	blasocoel
Mueller's larva	scolex	corona
dactylozoid	hexacanth	archenteron
gastrula	plankton	sublittoral
epifaunal	blastomere	necton
pelagic	supralittoral	benthic
eulittoral	cercaria	meiofaunal
pilidium larva	gastrulation	cuticle
proglottid	parenchymula larva	Higgins' larva