Invertebrate Zoology
Midterm Exam 3- Fall 2012

You have one hour to complete this portion of the exam. After one hour your paper will be collected and you will be given the second, comprehensive essay portion of the exam. If you finish this portion early, you may request the second portion before the end of the first hour. However, you may not look at this portion again.

Read through the exam before you begin. The exam consists of FIVE (5) parts. You must provide answers for each part, but you are required to answer only a SUBSET of the questions in each part. If you answer more questions than indicated, your answers will be graded in order, and you will be graded only on the number of questions you are required to answer. Feel free to use diagrams to augment your answers.

Part I. Answer nine (9) of the following twelve (12) questions: (18 points; 2 points each)

1. Identify a morphological feature that is considered to represent a synapomorphy for the Urochordata + Cephalochordata + Vertebrata.

2. Identify TWO classes of echinoderms that include species that possesses pedicellaria.

3. Identify a phylum of predators, once considered to be deuterostomes, whose phylogenetic relationships among metazoan phyla are now uncertain.

4. Identify a phylum whose members possess a 4 pairs of non-articulated appendages and that you might expect to find living following exposure to liquid nitrogen.

5. Identify a synapomorphy for the Echinodermata.

6. Identify the novel Kingdom to which some researchers believe the invertebrates of the Ediacaran fauna belong.

7. Identify a taxon that exemplifies a modern phylum present during the Cambrian Period AND identify the phylum to which that taxon belongs.

8. What function does the lophophore perform in phoronids?

9. Identify a class of deuterostomes that possess pharyngeal gill slits as adults.

10. After much discussion in the literature, it turns out that *Xenoturbella* is most likely related to what invertebrate taxon/taxa afterall?

11. Identify a class of echinoderm that is typically oriented with its oral surface down, but in which elements of the water vascular system do NOT play a major role in locomotion.

12. Identify TWO phyla that belong to the Ecdysozoa.

Part II. Answer six (6) of the following seven (9) questions regarding invertebrate life-cycle stages. (12 points; 2 points each)

1. Identify an echinoderm larval stage that bears paired arms stiffened by rods.

2. Do members of the phylum Chaetognatha possess a larval stage? If so, name it.

3. Identify an asteroid echinoderm larval stage that lacks arms.

4. What larval stage is a key element of the Lophotrochozoa hypothesis?

5. In what echinoderm class would you expect to find an auricularia larva?

6. Identify the MINIMUM number of phyla represented by the following selection of larvae: tornaria, ophiopluteus, brachiolaria, trochophore, lobate larva, cyphanautes.

7. Identify a type of larva found in the phylum that includes freshwater species that produce statoblasts.

8. An echinopluteus larva is characteristic of what class of invertebrates?

9. Identify a deuterostome phylum (sensu Brusca & Brusca, 2004) that lacks a distinct larval stage.

Part III. And now for some questions from Dennis. Answer four (4) of the following seven (7) questions. (16 points; 4 points each)

1. In his wanderings along the seashore, Dennis has collected the following specimens: a snail shell, a sea urchin spine, the upper valve of a brachiopod, and part of the test of a sea biscuit.

   a. How many deuterostome phyla would the authors of your textbook consider are represented by Dennis' collection?

   b. List one of these deuterostome phyla.

2. Dennis is excited about his class field trip to Woods Hole as it will involve all sorts of collecting on a real research vessel off the coast! For each of the following invertebrate taxa indicate whether it is possible that Dennis' class will encounter the group on their field trip (circle YES or NO). If NO, explain your answer. If YES indicate the type of sample in which Dennis and his classmates might encounter the taxon.

		Type of sample
a. crinoid	YES/NO	_____
b. onychorphoran	YES/NO	_____
c. enteropneust	YES/NO	_____
d. appendicularian	YES/NO	_____

3. Dennis and his friend have developed a new, really fun game involving invertebrate zoology trading cards. The goal of the game is to obtain cards representing as great a diversity of invertebrates as possible. By the end of the last hand, Dennis' friend Toni has the following 6 cards: an asteroid, a sea urchin, a crinoid, a pterobranch, an ascidian, and a holothuroid. Dennis' 6 cards consist of: an enteropneust, a thaliacean, an articulate brachiopod, a sand dollar, an inarticulate brachiopod, and a sea urchin.

   a. Has Dennis or Toni won the points for the greatest number of invertebrate Classes? Explain your answer.

   b. Has Dennis or Toni won the points for the greatest number of invertebrate Phyla? Explain your answer.

4. Last summer Dennis visited the Monterey Bay Aquarium and was fascinated by their exhibit on pelagic invertebrates. That having been said, he was not able to identify some of the creatures he saw. Based on the information provided by Dennis below identify each of the unknown creatures; common name is fine.

   a. Tiny little animals with 8 arms that were stiffened by rods. The arms looked like they were covered with many little hairs. (Dennis had to use the microscope provided by the aquarium to see these ones!)

   b. A smallish creature with spines on its head that made it look sort of like it had a moustache. It had fins and shot through the water chasing prey really fast, like a little arrow.

   c. A creature that looked like a clear jelly tube that was open at both ends; it moved by shooting water out of one of the openings.

   d. A little tadpole like creature that lived in a beautiful jelly house equipped with tiny internal net, apparently for feeding.

5. Dennis is considering a new pet. Select a pet for Dennis from one of the non-arthropod phyla covered in the last third of the course and describe how Dennis should go about housing, feeding and caring for his creature. Would Dennis' mother approve of his pet? (Explain your answer).

6. Dennis remains pretty unclear about the water vascular system of sea stars. Describe its different parts to him in simple terms and explain how it functions. (A picture might help your explanation).

7. Dennis used his birthday money to purchase fossils at a recent mineral show in Boston. He was particularly thrilled with 4 of his fossils, but when he got home he realized that he had forgotten to ask about the relative age of each! Based on the information provided by Dennis below, rank his fossils in order from oldest (1) to youngest (4) in the blanks provided.

a. a large, lobe-limbed arthropod with a mouth that looks sort of like a pineapple _____

b. a beautiful crinoid _____

c. a fractal formed soft-bodied invertebrate with no evidence of a mouth or gut _____

d. a fossil clam shell with a very symmetrical hole right in the middle _____

Part IV. Identify the function(s) of eight (8) of the following twelve (12) structures. In each case identify an invertebrate Phylum in which it is found; if a structure is found in only a subset of taxa in a phylum ALSO identify a Class in which it is found. (24 points; 3 points each)

1. stomochord Phylum/Class: _____

2. papulla Phylum/Class: _____

3. respiratory tree Phylum/Class: _____

4. Aristotle's lantern Phylum/Class: _____

5. avicularia Phylum/Class: _____

6. endostyle Phylum/Class: _____

7. chelicerae Phylum/Class: _____

8. lophophore Phylum/Class: _____

9. petaloid Phylum/Class: _____

10. proboscis Phylum/Class: _____

11. polian vesicle Phylum/Class: _____

12. mutable collagen Phylum/Class: _____

Part V. Answer five (5) of the following eight (8) questions. (30 points; 6 points each)

1. Based on a consensus of the various hypotheses of invertebrate phylogenetic relationships, circle the groupings of invertebrate phyla that are emerging as monophyletic from the list below.

a. Ecdysozoa	e. acoelomates
b. Blastocoelomates	f. protostomes (sensu Brusca & Brusca, 2004)
c. deuterostomes (sensu stricto)	g. lophophorates
d. Lophotrochozoa	h. Radiata

2. The "Cambrian Explosion" is considered by some workers to represent an unprecedented event in the history of the earth, largely because of its implications for invertebrate taxa.

a. Approximately when did the Cambrian Explosion occur?

b. Describe why it is considered to be such an important event in the history of animal evolution.

3. Select 3 classes of echinoderms and describe locomotion in each.

   a. Class: _____

   b. Class: _____

   c. Class: _____

4. For each of the following indicate whether the feature listed represents a synapomorphy for the group indicated. In each case, explain your answer.

   a. Echinodermata: water vascular system

   b. Hemichordata: pharyngeal gill slits

   c. Chordata: notochord

5. Select 3 extant orders of Cheliceriformes and describe habitat and diversity in each.

a. Order: _____

b. Order: _____

c. Order: _____

6. Select a phylum of protostomes (sensu Brusca & Brusca, 2004) and for that phylum provide the following information:

Name of phylum _____

a. Total number of species known to date. _____

b. Primary mode of locomotion in adult stage. _____

c. Larval stage(s) if any (indicate if none). _____

d. Whether it includes terrestrial species or not. _____

e. Whether it includes colonial species or not. _____

7. From the following list, circle all taxa that are known to NOW occupy marine habitats. In the case of the marine taxa, identify where in that habitat you would expect to find representatives of each group.

a. Chaetognatha _____

b. Asteroidea _____

c. Tardigrada _____

d. Pogonophora _____

e. Enteropneust _____

f. Onychophora _____

8. Compare and contrast feeding in an asteroid with that in a regular echinoid echinoderm.

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Bonus: Over the course of the semester, Dennis has collected the following organisms: a sea star, sea urchin, sea squirt, sea cucumber, sea gooseberry, sea horse, sea pen, sea hare, sea anemone, and a sea spider. According to the authors of your textbook (i.e., Brusca & Brusca, 2004) how many phyla of PROSTOSTOMES do Dennis' collections represent.