

Name \_\_\_\_\_

**Ecology & Evolutionary Biology 2245/2245W**  
**Exam 1**  
**09 February 2012**

**READ THE EXAM OVER CAREFULLY BEFORE YOU BEGIN. IT CONSISTS OF A TOTAL OF 16 QUESTIONS; YOU MUST ANSWER EACH QUESTION. IN THE CASES OF QUESTIONS INVOLVING TRUE/FALSE ANSWERS (i.e., Nos. 8 and 10) FEEL FREE TO PROVIDE AN EXPLANATION FOR YOUR ANSWER.**

1. Use the following list of fossil taxa to answer questions a through g below. You may use the same fossil more than once if appropriate. (8 points)

<i>Latimeria</i>	<i>Anomalocaris</i>	<i>Eubrontes</i>	<i>Homo floresiensis</i>
<i>Ichthyostega</i>	mastodon	eurypterids	<i>Pikaia</i>
<i>Cooksonia</i>	pterosaur	ostracoderm	stromatolite
<i>Marella</i>	<i>Archaeopteryx</i>	<i>Australopithecus afarensis</i>	

- a. From the list above, identify a non-chordate metazoan that occurred during the Cambrian Period.
- b. Identify **two** taxa from the list above that **co-occurred** in the same Epoch of the Tertiary Period.

\_\_\_\_\_

- c. From the list above, identify the taxon that exhibited the following suite of characters: a marine, armored, jawless vertebrate, known from but not necessarily originating in, the Silurian Period.
- d. Identify the **oldest** taxon from the list above.
- e. From the list above, identify a flighted diapsid that was **NOT** of the dinosaur lineage.
- f. Identify the **youngest extinct** taxon from the above list.
- g. Identify the only non-animal eukaryote on the list above.

2. Complete twelve (12) of the sixteen blank cells in the following table; each row must represent a different species. (Note that if you complete more than 16 cells, only the first 16 (in order from left to right, top to bottom) will be graded (12 points))

Primate species	Epoch in which lived	Cranial capacity	Found outside of Africa? (yes/no)	Birth canal configuration (round/oval)	Notable feature
		900–1100 cm <sup>3</sup>			used fire
	Pliocene			oval	no gap between canines & incisors
<i>Homo habilis</i>	Pliocene/ Pleistocene			round	
	Pleistocene			round	ceremonial burials
		380–450 cm <sup>3</sup>	No		first hominid

**3. For each of the following pairs of taxa and/or characters, CIRCLE the one that came FIRST in evolutionary time. (10 points)**

- a. lobe-finned fishes or amphibians?
- b. hominoids or anthropoids?
- c. tailed pterosaurs or amniotes?
- d. *Archaeopteryx* or pterosaur?
- e. Laurasia or Pangaea?
- f. prokaryotes or an aerobic environment?
- g. Bryophytes or ferns?
- h. pterosaurs or birds?
- i. chloroplasts or mitochondria?
- j. flowering plants or dinosaurs?

**4. You have been sent fossils by an amateur fossil collector seeking information on his find. The fossils are petrified pelvic (i.e., hip) bones of a dinosaur. Answer the following questions about these specimens. (4 points)**

- a. From what Era of geological time do these fossils come?
- b. Given that the pubis appears to be oriented parallel to the ischium, to which of the 2 dinosaur lineages does this specimen belong?
- c. Given the configuration of its hips, provide an example of a dinosaur that these fossils could possibly represent.
- d. The fossil collector also sent along 3 skulls, one of an anapsid, one of a synapsid and one of a diapsid, wondering whether any of them might belong to his dinosaur. Which of these skulls is the only candidate?

**5. Your graduate student Orise has been to the recent East Coast Mineral and Fossil Show in Toronto, Canada and was excited to return to your Paleontology lab having purchased the following 7 excellent fossils:**

(1) a sheet of sedimentary rock bearing the impression of trilobite, (2) a compression of a fossil fern, (3) a little dragonfly preserved in a chunk of amber, (4) a small piece of an Egyptian mummy from a tomb in Cairo (wow!), (5) a block of sedimentary rock that looks like it bears the burrow of an animal from the Ediacaran fauna, (6) a petrified leg bone from a therapsid, (7) a cast of a blastoid. Answer the following questions based on the fossils your grad student has purchased:

- a. Although you are excited about the diversity and quality of the fossils your graduate student has purchased, none of the fossils can be dated using K40/Ar40. Why not? (2 points)
- b. Identify the **two (2)** fossils from the list from which the extraction of DNA would be **MOST** likely to be possible. (2 points)
- c. Identify a fossil that would be categorized as a trace fossil. (1 point)
- d. Assuming that the compression of the fern and the impression of the trilobite come from the same sediments, from what **Era** of geological time did they both come? Justify your answer (2 points)
- e. Identify one of the 7 fossils for which you should be able to determine an approximate age using carbon dating methods. (1 point)

**6. Dr. Honarali Bitato has received a grant from the National Geographic Society to support her fieldwork. She has discovered a very productive site that appears to include fossils of both marine and terrestrial taxa. All of the rocks from the site have been dated to be between 280 and 260 million years old. (4 points)**

- a. The Society is hoping to feature her results in an article describing life in a specific Period of geological time. What Period of Geological time should be the focus of their article describing her finds?
- b. Should she expect to find fossils of trilobites at this site?
- c. Should she expect to find fossils of flowering plants at this site?
- d. Should she expect to find fossils of synapsids at this site?

7. On his visit to the American Museum of Natural History, Dennis visited the gift shop and purchased a set of plastic “dinosaur” figurines which include a: *Tyrannosaurus*, pterosaur, *Stegosaurus*, *Archaeopteryx*, therapsid, *Tricerotops*, *Dimetrodon*, synapsid, and an anapsid. This is terrific because Dennis plans to use his new figurines for a project on dinosaurs that he has to do for school. However, upon further research, Dennis is a little less enthusiastic about his collection of “dinosaurs.” Assuming that his teacher is very particular about accuracy, list 3 of Dennis’ figurines that he should NOT include in his project. (3 points)
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8. Identify whether each of the following statements about the Cenozoic Era is True or False in the blank provided. In each case, feel free to justify your answer. (8 points)

- a. The Pleistocene is the last Epoch of the Tertiary Period. \_\_\_\_\_
- b. The end of the Mesozoic Era was marked by a major extinction event associated with an asteroid impact \_\_\_\_\_
- c. The Cenozoic Era began with the Quarternary Period. \_\_\_\_\_
- d. The Cenozoic Era is characterized by a climate that became warmer and wetter throughout its duration. \_\_\_\_\_
- e. The continents had reached their modern day positions by the end of the Eocene Epoch.  
\_\_\_\_\_
- f. The Great American Exchange occurred when the marsupials of North America displaced the placental mammals of South America during the Pliocene Epoch. \_\_\_\_\_
- g. The evolution of heterodonty is considered to have been a major factor contributing to the radiation of mammals. \_\_\_\_\_
- h. We currently live in the Holocene Epoch, which represents an interglacial period.  
\_\_\_\_\_

**9. Dr. Torongo has had an interesting collection of fossils donated to his University. In the letter associated with the fossils, the donor indicated that the fossils had been collected from sites representing at least two different Periods of Geological Time. The fossils include: (i) the permineralized skeleton of a non-dinosaur diapsid with a prominent head crest and no tail; (ii) several gloriously well-preserved impressions of what appear to be early eurypterids; (iii) a compression of a magnolia-like flower; (iv) an impression of a very early liverwort; (iv) a permineralized skull of saber toothed cat. (6 points)**

- a. Identify TWO of Periods of the Mesozoic represented by these fossils; in each case list a fossil, or series of fossils, that *unambiguously* support(s) the time Period you have identified.

Time Period	Fossil(s)
_____	_____
_____	_____

- b. For ONE of the Periods you have listed above (name it)\_\_\_\_\_

Provide the approximate date ( $\pm 10$  my) in millions of years since it BEGAN \_\_\_\_\_.

Provide the approximate date ( $\pm 10$  my) in millions of years since it ENDED \_\_\_\_\_.

**10. Identify whether each of the following statements about the Cambrian is True or False in the blank provided.** In each case, feel free to justify your answer. (4 points)

- a. The Cambrian explosion provides a good example of early metazoan life on land.

\_\_\_\_\_

- b. The Cambrian explosion occurred before the evolution of the Tommotian fauna.

\_\_\_\_\_

- c. The Cambrian explosion included the evolution of taxa such as *Marella* and *Anomalocaris*.

\_\_\_\_\_

- d. The Cambrian is generally considered to have included a greater number of animal phyla than currently exist today. \_\_\_\_\_

**11. Answer the following questions with respect to the GREATEST of the 5 mass extinctions that occurred over the history of the earth. (3 points)**

- a. Identify the Period of geological time that was brought to an end by this extinction event.
- b. Identify a taxon that went extinct as a result of this event.
- c. Did *Latimeria* survive this event?

**12. In your position at the British Museum of Natural History, you have been asked to develop an exhibit focusing on a Period of the geological time that would illustrate BOTH the development of what ultimately would yield rich coal deposits as well as the move of vertebrates on land, completely away from water.**

- a. What Period would you choose as the focus of your exhibit? Explain your answer. (3 points)
- b. Would mammals figure in your exhibit? Explain your answer. (2 points)

**13. Answer the following questions with respect to the serial endosymbiotic theory:**

- a. This theory explains the origins of what two (2) types of organelles from what free-living prokaryotic taxa as a result of primary endosymbiosis? (4 points)

organelle

free-living prokaryote

\_\_\_\_\_ from \_\_\_\_\_

\_\_\_\_\_ from \_\_\_\_\_

- b. Which of these two types of organelles then went on to colonize organisms in other lineages in events of secondary endosymbiosis? (1 point)



**14. Circle ALL of the intervals of geological time from the list below that ENDED with a mass extinction event. (4 points)**

Silurian	Proterozoic	Cenozoic
Miocene	Cretaceous	Mesozoic
Devonian	Cambrian	

**15. The evolution of key innovations has played a major role in allowing organisms to expand to take advantage of previously unoccupied niches (i.e., habitats, food resources, etc.). For each of the following periods of time, identify a key innovation and a taxon in which that innovation arose. (8 points)**

	Key innovation	Taxon
Triassic	_____	_____
Carboniferous	_____	_____
Cretaceous	_____	_____
Devonian	_____	_____

**16. Number the following in the blanks provided in the relative order in which they occurred. NOTE: number them in order from 1 to 8, with 1 being the earliest and 8 the latest event/taxon. (8 points)**

Ediacaran fauna \_\_\_\_\_

Photosynthesis \_\_\_\_\_

Earth's atmosphere changes from anaerobic to aerobic \_\_\_\_\_

first prokaryotes \_\_\_\_\_

Acritarchs \_\_\_\_\_

Tommotian fauna \_\_\_\_\_

Conodonts \_\_\_\_\_

Placoderms \_\_\_\_\_

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**BONUS QUESTION:** Which of the 5 famous Evolutionary Biologists who have visited class to date this semester did you find to be the most interesting (last name only is fine)? Justify your answer. (1 point total)