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A plan to assess student learning in a University General Education Core Curriculum course: BIOL1603/BIOL1601L, Principles of Zoology.

WHAT UNIVERSITY GENERAL EDUCATION OUTCOMES GUIDE STUDENT LEARNING IN COURSES THAT CARRY NATURAL SCIENCES CREDIT?

A primary goal of these courses is to develop an appreciation of the basic principles that govern natural phenomena and the role of experiment and observation in revealing these principles. Students should acquire an understanding of the relationship between hypothesis, experiment, and theory, and develop the skills common to scientific inquiry, including the ability to frame hypotheses and defend conclusions based on the analysis of data. These courses are designed to prepare a student for informed citizenship by illustrating the importance of science and technology to the present and future quality of life and the ethical questions raised by scientific and technological advances.

Upon completion of eight hours of science courses, students will:

- NSLO1a - Understand how scientific inquiry is performed.
- NSLO2a - Understand the boundaries of scientific data.
- NSLO3a - Have a basic working knowledge of a few areas of science.
- NSLO4a - Be able to make better-informed decisions regarding potential government policies that involve science.
- NSLO5a - Have improved problem solving skills.
- NSLO6a - Be able to identify challenges created by society's increasing reliance upon technology.

HOW DOES THE DEPARTMENT OF BIOLOGICAL SCIENCES INTEND TO ASSESS STUDENT LEARNING OF THESE OUTCOMES IN BIOL1603/1601L

BIOL1603/BIOL1601L (Principles of Zoology) is a university core class that focuses on a basic understanding of zoological principles relating to cells, organ systems, development, genetics, ecology, and animal phyla. The assessment consists of a pre-test at the start of the semester followed by a post-test near the end of the semester. Assessment exams included 36 questions composed and agreed upon by the faculty teaching BIOL1603/1601L. The questions were designed to be overarching and related to broad thematic components of the course. Analysis of student performance will be based on overall performance on the exam, not on the individual questions. The same assessment exam will be used for multiple semesters so that performance over time can be compared.

**HOW IS THE ASSESSMENT INSTRUMENT KEYED TO THE UNIVERSITY
GENERAL EDUCATION CORE CURRICULUM LEARNING OUTCOMES FOR THE
NATURAL SCIENCES?**

Principles of Zoology Assessment

- 1) Soft bodied animals are poorly documented in the fossil record. This may be a result of:**
- a) Soft tissues do not fossilize well.
 - b) Historically there were fewer soft bodied animals than hard bodied animals.
 - c) Soft bodied animals did not live in habitats conducive to fossilization.
 - d) All of the above.
 - e) None of the above.

NSLO1a; NSLO2a; NSLO3a

- 2) Morphological variation in an interbreeding population is the result of:**
- a) Genetic variation.
 - b) Environmental variation during development.
 - c) Potentially both genetic variation and environmental variation during development.
 - d) Neither.

NSLO3a; NSLO4a; NSLO6a

- 3) Nervous systems evolved twice.**
- a) True.
 - b) False.
 - c) This topic is currently under scientific debate, and cannot be definitively classified as true or false at this time.

NSLO1a; NSLO2a; NSLO3a

- 4) Which of these is not a form of animal reproduction?**
- a) Cyclical hermaphrodites
 - b) Budding
 - c) Parthenogenesis
 - d) None of the above

NSLO4a

- 5) **A yellow winged butterfly is mated with a white winged butterfly. All F1s are white winged. 2 F1s are crossed, and they produce 40 offspring. Of these...**
- a) 20 are white winged, 20 are yellow winged
 - b) 10 are white winged, 30 are yellow winged
 - c) 30 are white winged, 10 are yellow winged
 - d) There is not enough information to determine the numbers of white and yellow winged offspring.

NSLO1a; NSLO3a; NSLO5a

- 6) **Sex can be determined by sex chromosomes, autosomal genes, or environmental conditions.**
- a) True.
 - b) False.
 - c) This statement is currently under scientific debate, and cannot be conclusively considered true or false at this time.

NSLO2a; NSLO3a

- 7) **Which of the following is not an example of asexual reproduction?**
- a) A coral branch breaking off in a storm and settling in a new location.
 - b) A daphnia female laying unfertilized diploid eggs.
 - c) An ascidian brooding an egg fertilized by its own sperm.
 - d) All are examples of asexual reproduction.

NSLO3a

- 8) **Mammals are direct developers. However, many pest species are not. Which of the following is a possible trade-off of pest management?**
- a) Reduction in pollinator populations in response to pesticide use.
 - b) Reduction in fish populations in response to mosquito eradication.
 - c) Changes in shellfish production due to modification of ocean plankton populations.
 - d) All of the above.
 - e) None of the above.

NSLO4a; NSLO6a

- 9) Four colonies of sessile colonial invertebrates of unknown relatedness, A, B, C, and D, are growing near each other on the side of a rock. When they come in contact, A fights with C but fuses with D; D fuses with B but fights with C; and B and C fight with each other. Are they all the same species?**
- a) Yes.
 - b) No.
 - c) There is not enough information to determine whether the four colonies are the same species.

NSLO1a; NSLO3a; NSLO5a

- 10) Which of these animals is not a mollusc?**

- a) Octopus
- b) Chiton
- c) Brachiopod
- d) Nudibranch

NSLO3a

- 11) Cubazoids, cephalopods, and vertebrates have camera-like eyes. This suggests that:**

- a) They are closely related taxonomic groups.
- b) Camera-like eyes have evolved multiple times.
- c) Camera-like eyes evolved once and were lost multiple times.

NSLO1a; NSLO3a; NSLO5a

- 12) Which of the below taxa have coeloms?**

- a) Polyclad worms.
- b) Trematods.
- c) Rotifers.
- d) Polychaetes.
- e) None of them have coeloms.

NSLO3a

13) Tardigrades, nematodes, and arthropods look dramatically different, however all three groups of animals molt their cuticle as they grow. This molting process is associated with the hormone ecdysone in all animals tested to date. Which of the following statements is therefore true?

- a) Tardigrades, nematodes, and arthropods may have a common ancestor that molted its cuticle as it grew.
- b) These three groups of animals may have similar genetic sequence driving the connection between ecdysone and molting.
- c) It is possible that future testing will reveal a tardigrade, nematode, or arthropod that does not have ecdysone mediated molting.
- d) All of the above.
- e) None of the above.

NSLO1a; NSLO2a; NSLO4a; NSLO5a

14) In echinoderms, the blastopore becomes the anus later in development. This means that echinoderms are:

- a) Protostomes
- b) Deuterostomes
- c) Diplobasts
- d) Triplobasts

NSLO1a; NSLO3a; NSLO5a

15) All animals have ectoderm, endoderm, and mesoderm.

- a) True
- b) False
- c) We currently do not have enough data to conclusively call this statement true or false.

NSLO2a; NSLO3a

16) Ascidians, lancelets, salps, birds, and mammals are all:

- a) Vertebrates
- b) Tunicates
- c) Chordates
- d) These five groups of animals are not part of a monophyletic group.

NSLO3a; NSLO4a; NSLO5a

17) Most marine animals do not have internal fertilization. How do these animals with external fertilization enhance their fertilization success?

- a) Synchronized mass spawning events.
- b) Elaborate mating displays and recognition systems.
- c) Develop symbiotic relationships.
- d) a and b
- e) a,b, and c

NSLO1a; NSLO3a; NSLO4a; NSLO5a

18) Arthropods are the most specious and abundant group of animals on the planet. What is one way arthropods differ from vertebrates?

- a) Arthropods do not exhibit parental care.
- b) Arthropods rarely have complex nervous systems.
- c) Arthropods have open circulatory systems.
- d) Arthropods all undergo direct development.

NSLO3a; NSLO5a

19) You are walking in a field and come in contact with a 10 lb cat and a 10 lb bird of prey. Which one's body has greater volume?

- a) The bird of prey
- b) The cat
- c) There is not enough information to answer this question.

NSLO1a; NSLO3a; NSLO5a

20) Swim bladders, cycloid scales, and flexible dorsal fins are common characteristics of:

- a) Lobe-finned fishes
- b) Chondrichthyes
- c) Teleosts

NSLO3a

21) Feathers, paired internal nares, and pharyngeal baskets are all examples of:

- a) Exaptation.
- b) Sensory organs.
- c) Diagnostic characters of Aves.
- d) None of the above.

NSLO3a; NSLO5a

22) You are watching a vertebrate embryo develop along the longitudinal axis, and you see the scapula move below the ribs. You are watching the development of a:

- a) Bird
- b) Mammal
- c) Lizard
- d) Turtle
- e)

NSLO1a; NSLO5a

23) Both arthropods and vertebrates moved on land. While arthropods are far more numerous than vertebrates, they also tend to be smaller. What is a primary reason arthropods are not as large as vertebrates?

- a) The chitin cuticle of arthropods does not facilitate as much gas exchange as vertebrate lungs and epidermis.
- b) It is easier to make a large internal skeleton than a large external skeleton
- c) Arthropods have slow, continuous growth, and do not live long enough to get as large as most vertebrates.

NSLO3a; NSLO4a

24) Numerous animal species, across many taxonomic groups, exhibit parental care. However, there are also many species, across this same set of taxonomic groups, that do not exhibit parental care. You are presented with two species, from the same taxonomic group, which are identical in every way except that one has parental care while the other does not. Which do you expect to have more offspring in a single reproductive bout?

- a) The species with parental care.
- b) The species without parental care.
- c) They will have equal numbers of offspring.

NSLO1a; NSLO3a; NSLO5a

25) In an aquarium, there are five clownfish- one female and four males. The female clownfish dies. What will be the sex of the four remaining fish a month later?

- a) Four males
- b) One female and three males
- c) Two females and two males
- d) three females and one male

NSLO1a; NSLO4a; NSLO5a

26) Salt glands in birds, kidneys in mammals, and skin in amphibians are all organs used for:

- a) Osmoregulation
- b) Protection from the elements
- c) Allorecognition
- d) Reproduction

NSLO3a; NSLO4a

27) Many animals migrate. Which of the below are reasons for migration?

- a) Escape from predation
- b) Following food sources
- c) Escape from extreme temperatures
- d) All of the above

NLSO1a; NSLO4a; NSLO5a

28) Fan worms, flamingos, mussels, blue whales, and barnacles are all:

- a) Herbivores
- b) Filter feeders
- c) Chordates
- d) Shredders

NSLO2a; NSLO4a; NSLO5a

29) Ctenophores and cnidarians have nerve nets, while annelids, arthropods, and vertebrates have bilateral nervous systems. What is one testable hypothesis for why these animals have different types of nervous systems?

- a) Annelids, arthropods, and vertebrates are more complex than ctenophores and cnidarians.
- b) Ctenophores and cnidarians have radial symmetry and do not move through their environments with the same amount of directionality as annelids, arthropods, and vertebrates.
- c) Both a and b are testable hypotheses.
- d) Neither a nor b are testable hypotheses.

NSLO1a; NSLO2a; NSLO4a; NSLO5a

30) All animals have sensory systems; however sensory systems may differ across animal taxa, which can influence animal perception. For example, if a human sat with a parrot and dog, and all three looked out of the window, they would not see the same thing.

This difference in perception is the result of:

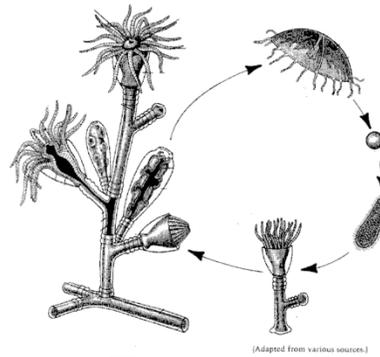
- a) Variation in brain size.
- b) Variation in photoreceptors.
- c) Variation in chemoreceptors.
- d) Variation in motor neurons.
- e)

NSLO3a; NSLO4a; NLSO5a

31) This is the life cycle of a:

- a) Clam
- b) Sponge
- c) Bryozoan
- d) Hydroid

NSLO3a



32) Trematodes are parasites, many of which have vertebrate hosts. Intermediate hosts for human trematode parasites include:

- a) Mollusks
- b) Mollusks and fish
- c) Annelids

NSLO3a; NSLO4a

33) In 2004 a massive earthquake occurred off the coast of Sumatra, causing a large tsunami and washing up numerous species of marine animals new to science. These specimens highlighted:

- a) Vertebrate diversity
- b) The importance of fishing
- c) How little we know about deep sea ecosystems
- d) All of the above

NSLO2a; NSLO4a; NSLO6a

34) Amphibians

- a) All have lungs
- b) All have external fertilization
- c) All have limbs
- d) None of the above

NSLO3a

35) Hox genes are

- a) Developmental patterning genes found in most animals
- b) Genes that control reproductive behavior
- c) Neurotransmitter genes
- d) Genes that influence the placenta

NSLO2a; NSLO4a

36) Therapods includes a large group of living animals.

- a) True
- b) False
- c) We do not have enough data to conclusively determine this statement to be true or false.

NSLO2a; NSLO3a

HOW WILL THE DEPARTMENT OF BIOLOGICAL SCIENCES USE THE DATA GENERATED BY THIS INSTRUMENT TO PLAN CURRICULAR AND PEDAGOGICAL CHANGES THAT MIGHT BE NECESSARY IN BIOL11603/BIOL1601L?

Analysis of student performance was based on overall performance on the exam, not on the individual questions. Faculty review the exam results annually, including responses on individual questions and will modify some questions for the assessment to better respond to the Natural Science Learning Outcomes. The faculty will discuss the results of the assessment process to identify problem areas in the course that can be addressed through implemented curricular modification including changes to course content or structure, and delivery mechanisms necessary to meet the needs of the target audience and fully address the Natural Science Learning Outcomes.