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A plan to assess student learning in a University General Education Core Curriculum course: BIOL2213/BIOL2211L Human Physiology/Human Physiology Laboratory.

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 BIOL2443/BIOL2441L?

BIOL2213/BIOL2211L (Human Physiology and Human Physiology Laboratory) is a lecture and laboratory course. 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 25 questions composed and agreed upon by the faculty teaching BIOL2213. 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?

Human Physiology Assessment

1. Which of the following uses energy?

- A. Simple diffusion
- B. Osmosis
- C. Na⁺/K⁺ pumps
- D. Facilitated transport

NSLO1a, NSLO3a

Lesson Outcome: Compare and contrast facilitated diffusion, simple diffusion, primary active transport and secondary active transport and identify an example of each.

Blooms taxonomy: Analyze

2. A _____ solution has a non-penetrating solute concentration lower than that found in cells and the cell will swell.

- A. Isotonic
- B. Hypertonic
- C. Hypotonic

NSLO1a, NSLO5a

Lesson Outcome: Define and apply the terms hypotonic, isotonic, or hypertonic to a solution.

Blooms taxonomy: Apply

3. Which is a major function of the plasma membrane?

- A. storing calcium ions
- B. storing organic chemicals for metabolism
- C. providing genetic information
- D. generating ATP
- E. regulating the passage of molecules into and out of the cell

NSLO5a

Lesson Outcome: Describe the structure and functions of the plasma membrane and organelle membranes

Blooms taxonomy: Understand

4. Movement of substances from the capillary to the lumen would be done via:

- A. excretion
- B. absorption
- C. secretion

NSLO1a, NSLO3a

Lesson Outcome: Recognize filtration, reabsorption, and secretion as the three basic processes that lead to the formation of urine and describe the direction of movement of each process.

Blooms taxonomy: Understand

- 5. During inspiration, alveolar pressure _____ and the diaphragm _____.**
- A. decreases, contracts
 - B. decreases, relaxes
 - C. increases, contracts
 - D. increases, relaxes

NSLO5a

Lesson Outcome: Describe the processes of inhalation/inspiration and exhalation/expiration. Describe the changes that occur in intrapleural pressure, transpulmonary pressure, and alveolar pressure, and lung volume during ventilation.

Blooms taxonomy: Analyze

- 6. Which concept is the defining feature of the discipline of physiology?**
- A. descent with modification
 - B. homeostasis
 - C. evolution
 - D. dimorphism
 - E. differentiation

NSLO Goal: 3

Lesson Outcome: Define homeostasis.

Blooms taxonomy: Remember

- 7. Which describes the response of the voltage-gated channels when an axon is stimulated to threshold?**
- A. K^+ channels open before the Na^+ channels.
 - B. Na^+ channels are activated.
 - C. K^+ channels open at the same time as the Na^+ channels.
 - D. K^+ channels are opened when Na^+ binds to the channel.

NSLO2a, NSLO5a

Lesson Outcome: Discuss the importance of ligand-gated channels and mechanically-gated channels to the initiation of an action potential and the importance of voltage-gated channels to the excitability of the membrane.

Blooms taxonomy: Apply

- 8. Myelin sheaths do all of the following except:**
- A. Speed up signal transduction
 - B. Reduce leakiness of neurons
 - C. Increase sensitivity of neurons to stimuli
 - D. Allow for smaller neuron sizes

NSLO1a

Lesson Outcome: Describe the mechanism by which action potentials are propagated. Differentiate between action potential propagation in myelinated axons and in unmyelinated ones.

Blooms taxonomy: Analyze

9. Reflex responses are a process involving a stimulus, sensory neuron, central nervous system, motor neuron and _____.

- A. integrating center
- B. receiving organ
- C. afferent neuron
- D. effector organ

NSLO3a

Lesson Outcome: Define a reflex and list the components of the reflex arc—stimulus, receptor, afferent pathway, integrating center, efferent pathway, effectors, response.

Blooms taxonomy: Remember

10. Which ion is responsible for binding to troponin to move tropomyosin and expose actin binding sites?

- A. Cl^-
- B. K^+
- C. Ca^{2+}
- D. Na^+

NSLO2a, NSLO3a

Lesson Outcome: Discuss the roles of tropomyosin, troponin, and Ca^{2+} in regulating skeletal muscle contraction.

Blooms taxonomy: Understand

11. The renal system has a role in all of the following physiological activities EXCEPT for:

- A. Regulation of pH
- B. Regulation of blood pressure
- C. Production of hormones
- D. The renal system does all of the above activities

NSLO1a, NSLO5a

Lesson Outcome: List the basic functions of the kidneys.

Blooms taxonomy: Remember

12. The absorption of most substances in the digestive system occurs in the _____.

- A. Mouth
- B. Stomach
- C. Small intestine
- D. Large intestine

NSLO3a

Lesson Outcome: Describe the different types of motility that occur in the small intestine, their functions, and how they are controlled.

Blooms taxonomy: Understand

13. The _____ includes special cells that depolarize faster than other cells in the system and also determines heart rate.

- A. Bundle of his
- B. Purkinje fibers
- C. Sinoatrial Node
- D. Atrioventricular Node

NSLO5a

Lesson Outcome: Describe the entire path of the spread of excitation from the SA node through the atria and then into the ventricles. Note the refractory periods and ion movements.

Blooms taxonomy: Understand

14. What causes the valves of the heart to open?

- A. Changes in the pressure gradient between atria and ventricles.
- B. An increase in volume of blood flow
- C. The frequency of electrical activity of the atria
- D. Electrical activity of the brain

NSLO5a

Lesson Outcome: Describe the events in the cardiac cycle, relating the movements of the valves, changes in pressure and volume and timing.

Blooms taxonomy: Analyze

15. Which of the following produce hormones?

- A. Organs
- B. Glands
- C. Neurons
- D. All of the above

NSLO1a, NSLO5a

Lesson Outcome: Name the organs that are most important for the metabolism and excretion of hormones.

Blooms taxonomy: Remember

16. Which of the following is an example of a somatic reflex?

- A. Patellar reflex
- B. Salivary response
- C. Sweating
- D. Peristalsis

NSLO1a

Lesson Outcome: Distinguish between a basic reflex and a learned reflex.

Blooms taxonomy: Analyze

17. Negative feedback processes

- A. work in anticipation of changes in regulated variables.
- B. are identical to positive feedback processes
- C. lead to instability of the regulated variable
- D. tend to force physiological variables back to set point, opposite direction of deviation
- E. tend to force physiological variables away from their set point, further deviating it

NSLO1a, NSLO5a

Lesson Outcome: Define homeostatic control systems: negative feedback, positive feedback systems, feedforward regulation

Blooms taxonomy: Remember

18. What is the major hormone responsible for mediating the body's general response to stress?

- A. thyroid hormone
- B. growth hormone
- C. testosterone
- D. aldosterone
- E. cortisol

NSLO3a

Lesson Outcome: Recognize physiological *stress* as an environmental change that must be adapted to if health and life are to be maintained. State that stress increases cortisol secretion.

Blooms taxonomy: Remember

19. How does the body sense fluctuation in blood pressure?

- A. Hair cells
- B. Utricle
- C. Rhodopsin
- D. Baroreceptors

NSLO1a

Lesson Outcome: Explain how baroreceptor reflexes are short-term regulators of arterial pressure and how they can adapt to a maintained change in blood pressure.

Blooms taxonomy: Understand

20. In an ECG, the T-wave corresponds to:

- A. atrial depolarization
- B. ventricular depolarization
- C. ventricular repolarization
- D. atrial repolarization

NSLO2a, NSLO6a

Lesson Outcome: Identify the components of a normal ECG recording.

Blooms taxonomy: Understand

21. Sexual differentiation of the embryo is normally determined by:

- A. the presence of the Y chromosome, which directs the undifferentiated gonads to develop into testes (when there is one X chromosome present as well).
- B. hormones produced by the placenta.
- C. the presence of two X chromosomes, which causes the primordial testes to degrade.
- D. the number of chromosomes, with males having 22 pairs and females having an extra pair of XX chromosomes.

NSLO2a, NSLO4a, NSLO6a

Lesson Outcome: Recognize that the genetic difference between males and females is the difference in one chromosome.

Blooms taxonomy: Remember

22. After phagocytosis of a microbe, vesicles called phagosomes combine with intracellular organelles called _____, resulting in destruction of the microbe.

- A. ribosomes
- B. lysosomes
- C. autosomes
- D. mitochondria

NSLO3a, NSLO4a

Lesson Outcome: Describe the process of phagocytosis. Describe how phagocytes can kill microbes extracellularly as well as intracellularly.

Blooms taxonomy: Understand

23. B cells that differentiate during an initial immune response but remain dormant until being activated during a subsequent exposure to an antigen are called:

- A. T-cells.
- B. memory cells.
- C. macrophages.
- D. monocytes.

NSLO2a, NSLO4a, NSLO6a

Lesson Outcome: Recognize the names and general functions of the major types of cells that mediate immune defenses.

Blooms taxonomy: Understand

24. Which is TRUE regarding fertilization and transport of an egg?

- A. Fertilization occurs in the uterus, and must occur within 24-48 hours of ovulation.
- B. Fertilization can occur any time with 7 days after ovulation, and it generally takes 10-14 days for the fertilized zygote to reach the uterus.
- C. Fertilization occurs in the Fallopian tube, and it takes about 4 days to reach the uterus.
- D. Fertilization must occur while the follicle is still attached to the ovary, and transport of the fertilized zygote to the uterus takes 24-48 hours.

NSLO6a

Lesson Outcome: Describe how fertilization occurs.

Blooms taxonomy: Understand

25. What term describes hormones secreted by the hypothalamus that regulate the secretion of hormones from the anterior pituitary gland?

- A. growth factors
- B. paracrine factors
- C. hypophysiotropic hormones
- D. metabotropic releasing factors

NSLO1a, NSLO5a

Lesson Outcome: Describe the sequence of events that influence the secretion of hypophysiotropic hormones.

Blooms taxonomy: Understand

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 BIOL2213/BIOL221L?

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.