LEcTure/DaTe   ThEoP   ChAPteR IN SIverTHoRN (7eD)
01 Mon 09  July Introduction - Basis of animal function (pre-requisite) 1-5
02 Tue 10  Membranes - Movement across them (pre-requisite) 1-5
03 Wed 11  Homeostasis - Mechanisms and signal transduction 6
04 Thu 12  Endocrine communication, principles of hormonal systems 7
05 Mon 16  Neural communication, mechanisms and sensory systems 8-11
06 Tue 17  Muscle contraction and the control of body movement 12-13
07 Wed 18  Circulation and the design of cardiovascular (CV) system 14
08 Thu 19  REVIEW - Material from lecture #1 through lecture #6 1-13
09 Mon 23  EXAM #1 - 33% of final grade (lectures #1 through #6) 1-13
10 Tue 24  Integration of CV function in health and disease conditions 14-16
11 Wed 25  CV integration / Basics of respiratory system mechanics 17-18
12 Thu 26  Gas transport and control of respiration / The renal system 18-19
13 Mon 30  The kidney, clearance and the countercurrent mechanism 19
14 Tue 31  Clearance and the regulation of water and inorganic ions 19-20
15 Wed Aug 01  Gastrointestinal motility, secretion, digestion and absorption 21
16 Thu 02  REVIEW - Material from lecture #1 through lecture #14 1-20
17 Mon 06  EXAM #2 - 33% of final grade (lectures #1 through #14) 1-20
18 Tue 07  Control of organic metabolism, energy balance and growth 21-23
19 Wed 08  Integration: temperature, food intake, immunity and exercise 23-25
20 Thu 09  Integration: from sex differentiation to adult reproduction 26
21 Mon 13  Integration: control of reproduction and the menstrual cycle 26
22 Tue 14  REVIEW - Material from lecture #1 through lecture #21 1-26
23 Wed 15  EXAM #3 - 33% final grade (lectures #1 through #21) 1-26

Lecture and office hours: Lectures are Mon, Tue, Wed, Thu from 10:40 AM to 12:30 PM in Busch Campus. Immediately after each lecture the instructor will hold a voluntary recitation / office hour, in the same lecture hall. In addition, and on a prearranged basis, TAs might provide extra-help sessions in the same room until 4:00 PM. Please remember that you have to schedule these extra-help sessions in advance with the TAs.

Exams and grades: There are no make-up exams. If a student has a valid problem with an exam date, this must be discussed with the course instructor BEFORE the exam. If a student fails to do so, and does not show up to take the exam at the appointed time, at the discretion of the instructor, a grade of “F” might be assigned for the missing exam. Students will have the opportunity to review / discuss exam after a week, during the recitation period. Letter and % grade equivalence, for a final 75% class average corrected grade, are as follows: A=91-100%; B+= 86-90%; B= 81-85%; C+= 76-80%; C= 71-75%; D= 61-70%; F=0-60%.

Textbook: “Human Physiology, 7ed, by Dee Ungleb Silverthorn, Pearson, Benjamin Cummins Publishers (2016). The 6th ed. of this book (2013) is also acceptable for this course. All students are required to have access to this text. This book is available at the Rutgers Fennem Mall College Bookstore.

Preparing for this course: Students are encouraged to review background material before the course starts (pre-requisite, lectures 1-2 which deals with chemical composition, cell structure, protein activity / cellular metabolism, and genetic information / protein synthesis from your basic Biology courses). The first five chapters of the Silverthorn’s text cover this information.

Type of exams questions: They will be multiple-choice questions as that shown below. Each test has 100 questions and all tests are cumulative. About 30% of the material in each test corresponds to material in previous tests. For example: In the fluid mosaic membrane model: a) proteins are in a bilayer formation, b) lipids are rigidly bound in place, c) “mosaic” refers to cholesterol, d) all of the above, e) none of the above.
The recitation section of the Physiology course

In the first recitation meeting we will review main concepts about active learning. The goal of the recitation questions is to review and pinpoint the main “take home message” of the lecture topics. During the summer session, students do not have to submit answers to these recitation questions since they are presented only as discussion topics for the recitation meetings. The short 6 weeks summer session do not allow enough time for students to spend the considerable amount of time needed to edit answers to these questions, as during the fall course, but they are a good guide for students to study the course material. The answer for each recitation question has four sub-questions, as follows:

a) Name the structure and the function on which your overall answer will be based? Be as specific as you can in delimiting the boundaries of your example (the most important part of your answer, since the following b, c, & d sub-questions are based on your answer to this first sub-question, a).

b) Why do you think that your structure and your function are related? Support your contention based on 3 lines of evidence on the chemistry, physics, anatomy or physiology involved in your example.

c) Which are the levels of organization involved in your example? Cite events occurring at its main level of organization and indicate how they relate to the whole body homeostatic level.

d) Which are the main feedback mechanisms involved in your example (cite at least two)? Expand on one of them and indicate an absolute requirement for that feedback to be operational.

These answers will be discussed at the end of each lecture. This discussion can be used to write summary answers of the lecture material. Please notice that these answers will not be found in your book as "copy and paste" answers. What they have in common is that they require an understanding of the lecture topic to be able to answer them.

The recitation questions are as follows:

**Question #01: Introduction to this lecture / recitation course (pre-requisite material)**

Please remember that your answers for questions #1 and #6 do not follow the structural answer defined above but they have their own formats. The question for this week is as follows: An “active learning” process is the best approach to study, physiology. This first recitation uses the first two lectures to outline and practice an active learning process technique. In your report for recitation #01 provide a list of 5 questions that in your opinion, summarize the prerequisite lecture material (first two lectures), as well as that provided in the assigned chapters of the course textbook (first five chapters). Answer each of these five questions using no more than 10 sentences per question. Then start editing your answer for each question, if it is possible, into a single sentence. Keep in mind that it is quite difficult to summarize information into a single sentence, since it requires that you comprehend the material you are studying. Thus, accept that if you are not able to write an answer initially using less than 10 sentences and then editing this answer into a single sentence, you have not yet fully understand the topic and keep trying, or ask help from your instructor. It is important you attempt to master this technique (or a similar one) ASAP. Please remember that the best answers for each of your 5 questions for this report are at the most 2 sentences long.

**Question #02: Membrane and Homeostasis / related events**

The question for this week is as follows: Select a homeostatic event and/or physiological system in which you can show the importance of structure/function relationship, organization levels, and feedback control. Your answer must follow the outline shown in the introduction (sub-questions a, b, c, d, see above). Please notice that in this question you select both the structure and the function on which your answer will be based. Hint: think on “the circle”.

**Question #03: Endocrine and Neural Physiological Communication**

The question for this week is as follows: Select a neuroendocrine event in which you can show the importance of structure/function relationship, organization levels, and feedback control. Your answer must follow the outline shown in the introduction (sub-questions a, b, c, d, see above). Please notice that in this question you select both the structure and the function on which your answer will be based. Important hint for your answer: “what does a neuroendocrine event means” ???. Hint: think on “the circle”.

Question #04: Heart and Blood Pressure - related functions
The question for this week is as follows: Select four characteristics of cardiocytes not present in skeletal muscle cells, in which you can show the importance of structure / function relationship, levels of organization, and feedback control. Your answer must follow the outline shown in the introduction (sub-questions a, b, c, d, see above). Please notice that in this question both the structure and the function of the four characteristics on which your answer will be based, were presented in the heart lecture. Please remember that your answer should be structured as follows: Characteristic #1 (answers a,b,c,d); characteristic #2 (answers a,b,c,d); characteristic #3 (answers a,b,c,d); and characteristic #4 (answers a,b,c,d). Hint: think on “the circle” for each one of these four characteristics.

Question #05: CV Integration and the Respiratory System
The question for this week is as follows: Select a position on the question “how good an athlete is the horse”. Do you think the respiratory limitations of this species (e.g. pulmonary hypertension, exercise induced pulmonary hemorrhage or EIPH) are expression of physiological compensation for a fit athlete, or are they manifestation of a system being “run down to the ground in a very stressed athlete”? Your answer must follow the outline shown in the introduction (sub-questions a, b, c, d, see above). Please notice that in this question both the structure and the function you are asked to select must be related to the EIPH syndrome. Hint: think on “the circle”.

Question #06: Basic functions of Renal, CV and Respiratory Systems
The question for this week is as follows: Name the physiological responses and/or the relationships among buffers, respiratory, circulatory and renal systems involved in the homeostatic control following a metabolic acidosis. It is an absolute requirement that you answer this question based on the outline below. Precede each section of your answer with its heading, and make sure you answer ALL aspects outlined in each section. Hint: for this question you really have to think on “the circle”. The following are the section headings and their requirements:

a) the example: which are the physiological responses and/or relationships among buffers, respiratory, circulatory and renal systems on which your answer will be based. Which was the origin of the metabolic acidosis in your example. Be as specific as you can in delimiting the boundaries of your example and the level(s) of organization your example will involve.

b) the buffer involvement: how does the buffer system attempt to control the homeostatic variable (blood pH). Which, how and where is the signal to the buffer system recognized as input (receptors, afferent loop, and integration center), and how did the output of the integration center reached their targets (efferent loop, targets). The response this signal elicits is an acute (fast) or chronic (slow) compensatory mechanism.

c) the respiratory involvement: how does the respiratory system attempt to control the homeostatic variable (blood pH). Which, how and where is the signal to the respiratory system recognized as input (receptors, afferent loop, and integration center), and how did the output of the integration center reached their targets (efferent loop, targets). The response this signal elicits is an acute (fast) or chronic (slow) compensatory mechanism.

d) the circulatory involvement: how does the circulatory system attempt to control the homeostatic variable (blood pH). Which, how and where is the signal to the cardiovascular system recognized as input (receptors, afferent loop, and integration center), and how did the output of the integration center reached the targets (efferent loop, targets). The response this signal elicits is an acute (fast) or chronic (slow) compensatory mechanism.

e) the renal involvement: how does the renal system attempt to control the homeostatic variable (blood pH). Which, how and where is the signal to the renal system recognized as input (receptors, afferent loop, and integration center), and how did the output of the integration center reached the targets (efferent loop, targets). The response this signal elicits is an acute (fast) or chronic (slow) compensatory mechanism.

f) the integration pathways: how (the sensor, afferent, integrator, efferent, effector and feedback signals) and in which order (buffers, respiratory, cardiovascular, kidney) were the physiological systems involved, and recruited to participate in the homeostatic response to a metabolic acidosis. The most important component of this answer is: Why do you think such a sequential order in this homeostatic response was achieved? Please notice that this subquestion does NOT ask you to tell me what is the order, but it asks why that order occurred.

Question #07: Physiology of Metabolism, Food intake AND Energy Balance
The question for this week is as follows: The neuroendocrine control of food intake AND thyroid function involves neurotransmitters / neuropeptides as inputs and outputs to an integrator located in the PVN (paraventricular nucleus of the hypothalamus, a main integrator center). From a conceptual view of cell connectivity and function, describe a possible circuitry consisting of neuronal and endocrine signals to and from the PVN integrator, operating during a typical Thanksgiving day, an hypermetabolic AND thermogenic condition. Your answer must follow the outline shown in the introduction (sub-questions a, b, c, d, see above). Please notice that in this question the structure is defined as the PVN integrator in relation to food intake AND thyroid involvement. You should define a
function associated to the PVN in relation to this hypermetabolic condition (hint: TRH cell bodies are located in the PVN). **Hint:** think on “the circle”. This question is an attempt to make you navigate through two circles. The answer will be achieved if you are able to transform these two circle into one. It’s a good exercise and summary.

**Question #08: Basic physiology of the Reproductive System**
The question for this week is as follows: From a conceptual view of nerve cell connectivity and function describe a mechanism that would allow for a hypothalamic network of GnRH (or two GnRH sub-networks e.g. tonic vs. phasic) to synchronize both its tonic (or basal pulsatile gonadotropin release) and its phasic (or preovulatory surge like release of gonadotropin) operation, as it is observed during the estrous or menstrual reproductive cycles. Consider how the pulsatile output of such hypothalamic network might affect gonadotropin release during puberty, reproductive adulthood and menopause (aging). Your answer must follow the outline shown in the introduction (sub-questions a, b, c, d, see above). Please notice that in this question the structure is defined as the GnRH neuronal network (or two GnRH sub-networks e.g. tonic vs. phasic) and you should define a specific function common to puberty, reproductive adulthood and menopause (aging). **Hint:** think on “the circle”.

**Question #09: Case Studies on Stress, Growth and Meat Production**
The question for this week is as follows: Select an homeostatic event and/or physiological system or question in which you can show the importance of structure/function relationship, levels of organization, and feedback control related to the use of Ractopamine, a beta-agonist, as a growth promoter in both animals and humans. Your answer must follow the outline shown in the introduction (sub-questions a, b, c, d, see above). Please notice that in this question you should define both a structure and a function associated to the use of Ractopamine as a growth promoter (remember which was the main punch-line of the growth and production lecture). **Hint:** think on “the circle”.

**Question #10: Case Studies on Stress, Milk and Egg Production**
The question for this week is as follows: Select a homeostatic event and/or physiological system or question in which you can show the importance of structure / function relationship, levels of organization, and feedback control related to the toxicity induced by fescue in dairy cows. Your answer must follow the outline shown in the introduction (sub-questions a, b, c, d, see above). Please notice that in this question you should define both a structure and a function associated with the thermogenic effect of fescue toxicity in dairy cows (remember which was the main punch-line of the stress and production lectures). **Hint:** think on “the circle”.