GRANDE PRAIRIE REGIONAL COLLEGE

DEPT. OF SCIENCE & TECHNOLOGY

COURSE OUTLINE

ZO 2410
Animal Physiology I – Homeostasis

Georgia Goth
B.Sc.H., M.Sc., Ph.D.
Office: J222
Phone: 539-2827
e-mail: goth@gprc.ab.ca

Course Description:

This course examines how animals function at the organ/system level of organization. Particular attention is given to the adaptive significance of different modes of functioning. We explore how animals are able to survive in their individual environments. Comparing diverse mechanisms for solving problems, with examples taken from both vertebrates and invertebrates, provides the student with a broad understanding of animal physiology. All animals must solve similar problems related to regulating levels of gases, energy, temperature, water and ions. The process of natural selection has resulted in the formation of various solutions, enabling animals to occupy a wide variety of different habitats.

Prerequisite: Biology 1070

Transferability: Zoology 241, University of Alberta

Textbook: Sherwood, L, et al, 2005, Animal Physiology: From Genes to Organisms, Brooks/Cole, 759pp

Delivery Mode: Lecture and seminar delivery. In seminar delivery students will be expected to prepare material beforehand and answer questions orally in class.

Requirements:

This course is a 3-credit course that includes 3 hours of lecture and 1 hour of seminar each week, beginning on September 8th, 2010.
Participation in lectures and seminars is required and regular attendance is expected. Those who choose not to attend must accept the consequences. In this regard, your attention is directed to the *Academic Guidelines of Grande Prairie Regional College*.
All assignments must be completed on time. Late assignments **will not** be corrected. Each week, questions from the appropriate chapters in the textbook will be assigned to each student. Answers will be prepared and presented in the next seminar session. The purpose of these assignments is to help the student keep up with and understand the lecture material. Problems concerning the lecture material will be dealt with during the seminar sessions and, therefore, it is important to review lecture notes before attending tutorials.
Plagiarism will not be tolerated. Any student who plagiarizes will be given a zero on the assignment. A second case of plagiarism will result in expulsion from the course. The instructor reserves the right to use electronic plagiarism detection services.

Course Objectives:

To provide the student with an understanding of the functioning of various organ systems in a variety of animals of differing complexity; to show the student how variations in physiological functioning allow animals to adapt to various types of environments; to show students that adaptations come with both benefits and costs.

Evaluation:

Seminar Quizzes (2)	10%
Mid-term Exams (2):	40%
Research Papers:	10%
Final Examination:	40%

At the end of this course you will be assigned a letter grade. These letter grades correspond to percentages in the following way:

90-100 =	A+	67-69 =	C+
85-89 =	A	64-66 =	C
80-84 =	A-	60-63 =	C-
76-79 =	B+	55-59 =	D+
73-75 =	B	50-54 =	D
70-72 =	B-	0-49 =	F

***TOPIC OUTLINE*:**

1. Introduction to Physiology – Chp 1

A. What is physiology?
B. Subdisciplines of physiology
C. Structure-function relationships
D. Relationship between evolution and adaptations
E. Homeostasis and regulatory mechanisms
F. General models of equilibrium and regulation
G. Positive and negative feedback control systems

2. Overview of Enzyme Kinetics and Cellular Metabolism – Chp 2

A. Metabolism – general
B. Enzymes
   - enzyme kinetics [zero order, 1st order, 2nd order reactions]
   - substrate affinity
   - Km, V_{max}, Michaelis-Menton & Lineweaver-Burk equations
   - mechanisms of enzyme control [competitive, non-competitive and allosteric inhibition]
C. Energy carriers [energy-rich phosphates, nucleotides]
D. Aerobic and anaerobic metabolic pathways – a review

3. Energy Metabolism and Thermal Regulation – Chp 15

A. Laws of Thermodynamics
B. Basal and standard metabolic rates
C. Calorimetry
D. Metabolic rate & respiration as a function of body mass
E. Specific Dynamic Action
F. Energy Budgets
G. Principle of Q_{10}

H. Ectotherms, endotherms and heterotherms
    - energy costs and consequences
    - comparisons
I. Temperature preference, tolerance, resistance
J. Active and passive mechanisms for heat generation and loss
K. Thermal strategies in ectotherms
    - behavioural and metabolic compensation
    - dormancy
    - freeze avoidance & freeze tolerance
L. Thermal strategies in endotherms
    - environmental heat exchange
    - heat retention
    - heat generation
M. Control of thermoregulatory mechanisms
N. Thermal strategies for heterotherms
    - regional heterotherms
    - temporal heterotherms

MID-TERM EXAMINATION 1 (25%)

4. Circulation – Chp 9

A. Need for vascular systems
B. Components of the blood
C. A Survey of Circulatory Pumps
D. The mammalian heart
    - electrical activity (ECG)
    - mechanical properties and the cardiac cycle
E. Factors affecting heart rate and stroke volume
F. Blood flow [hemodynamics]
G. Cardiovascular control by the CNS
H. Open versus closed systems
I. Circulatory vessels
J. Regulation of capillary blood flow
K. Lymphatic system

5. Respiration - Chp 11

A. General considerations
B. Need for respiratory systems
C. Respiratory membranes in an aquatic environment
D. Respiratory membranes in a terrestrial environment
E. Mechanics of breathing in mammals
F. Lung volumes in mammals
G. Respiratory pigments
H. Gas exchange between respiratory surface and the blood
I. Gas exchange between tissue and the blood
J. Dissociation curves
K. Mammalian versus avain gas exchange
L. Gas exchange across gills

M. Regulation of gas transfer and respiration
N. Special adaptations

MID-TERM EXAMINATION II (25%)

6. Excetory Systems – Chp 12

A. Functions of the excretory system
B. Excretory surfaces
C. Metabolic end-products – which type to use
D. Excretory processes
E. The mammalian kidney
    - structure and function of the nephron
    - glomerular filtration
    - tubular reabsorption
    - tubular secretion
    - countercurrent exchange
    - production of a hypertonic urine
    - special case of a desert environment
F. Freshwater versus marine bony fishes
G. Renal glands & elasmobranches
H. Special adaptation of amphibians and reptiles
I. Salt glands of marine birds and reptiles
J. Survey of invertebrate excretory structures

7. Osmoregulation – Chp 13

A. Intracellular fluid (ICF versus extracellular fluid (ECF)
B. Osmoconformers versus osmoregulators
C. Survey of osmoregulation in major animal phyla
D. Hyperosmotic regulation (eg, freshwater bony fishes)
E. Hypo-osmotic regulation (eg, marine vertebrates)
F. Osmotic balance in mammals
G. Regulation of pH

8. Acquiring Energy: Feeding, Digestion and Metabolism – Chp 15

A. Feeding methods
B. Alimentary systems
C. Influence of diet on gut structure
D. Gastrointestinal secretions
E. Absorption

FINAL EXAMINATION (Cumulative)