

Reg. Office

GRANDE PRAIRIE REGIONAL COLLEGE
DEPARTMENT OF SCIENCE
ZOOLOGY 2410 - VERTEBRATE PHYSIOLOGY
FALL 1996

INSTRUCTOR: PAUL LEMAY J224 Phone: 539-2863 (O) 532-3766 (H)

CLASSES: Lecture: Tuesday - Thursday 13:30 - 14:50 P.M. Room J202
Seminar: Thursday 10:00 10:50 A.M.
(First Term 3-0-1) UT (3)

COURSE OBJECTIVES: Functional biology at the organ system level is explored.

COURSE DESCRIPTION: A review of the general concepts in animal physiology with an emphasis on structure and function and adaptive significance to the animal in its own environment. This course will cover systems that regulate levels of gases, food, energy, temperature, water, and ions. The mammals including man, will be used frequently to illustrate the relevance of basic physiological and biochemical mechanisms governing bodily functions.

PREREQUISITES: Zoology 1070.

TEXT: Schmidt-Nielsen, K. 1990 Animal Physiology: Adaptation and Environment, 4th Edition. Cambridge University Press.

REFERENCE TEXT: Eckert, Randall and Augustine Animal Physiology, Freeman W.H.

GRADE DISTRIBUTION:

Quizzes	35%
Mid-Term Exam	25%
Final Exam	40%

COURSE OUTLINE:

1. Introduction to Physiology
 - The discipline of physiology
 - Physiological systems
 - Homeostasis
 - negative feedback
 - positive feedback
 - Examples of general models of equilibrium and balance
2. Enzyme kinetics and cellular metabolism:
 - Free energy and entropy: energy transfer principles by coupled reactions.
 - Laws of thermodynamics
 - Enzymes (Protein)
 - structure, mechanism of action, catalytic activity, specificity
 - factors affecting rate
 - temperature, pH, cofactors
 - enzyme substrate affinity
 - enzyme inhibition (competitive vs noncompetitive, allosteric)

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Enzymes (continued)

K_m, V_{max}, Michealis-Menton, Lineweaver-Burk.

Energy carriers

energy rich phosphates and nucleotides

Cellular metabolic pathways

anaerobic and aerobic

glycolysis, TCA cycle, beta-oxidation

3. Whole organismism energy metabolism and thermal regulation

Calorimetry and metabolic rate

Principle of Q₁₀

Respiratory quotient

Factors affecting metabolic rate:

a) body size

b) temperature

c) location

Temperature relationships of:

a) ectotherms

b) heterotherms

c) endotherms

Thermostatic regulation of body temperature

active and passive mechanisms for heat generation and heat loss

metabolic heat production and sites of heat production, shivering

vs non-shivering

counter current heat exchangers and vascular shunting

insulation and evaporative cooling

behavioral adaptations; acclimation and acclimatization

torpor, hibernation, aestivation

fever

control, sensory and integration systems for thermoregulation

4. Osmoregulation and ionoregulation

Physiology of osmoregulatory organs and ionoregulatory organs

vertebrate kidney

epithelial cell types

diuresis, natriuresis, and pH

other osmoregulatory organs

salt glands, chloride cells, frog skin, urinary bladder

5. Respiration:

General considerations

The gas laws

Gases in the blood

oxygen carriers

factors affecting the oxygen dissociation curve

transport of CO₂

The vertebrate lung

The vertebrate gill

Regulation of gas transfers and respiration

Regulation of body pH

6. Circulation:

- The mammalian heart
- Electrical activity of the heart
- Mechanical properties of the heart
- Morphology of other vertebrate hearts
- Cardiac output
- Factors affecting heart rate and stroke volume
- Haemodynamics
- Regulation of capillary blood flow
- Cardiovascular control by CNS