Summary of Topics for Bioengineering/Physiology 6000
System Physiology I
Final Exam, 2014 Edition, Apr 24

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Forward

The following is a list of topics that we covered in the final part of the semester in Bioengineering 6000 course. I expect students to be familiar with each of the concepts and ideas and will draw from this list for first midterm questions.

Note: this is a preliminary version of the list and may change after Wednesday's lecture.

1 The respiratory system

1. Gas transport
   - Gas laws
   - Mechanisms of oxygen transport, hemoglobin, respiratory pigments.
   - Type and role of respiratory pigments.
   - Oxygen transport, binding, and dissociation.
   - Carbon dioxide transport mechanisms: role of erythrocytes, and bicarbonate.
2. Ventilation
   - Overview of ventilation and gas exchange and functions of respiratory system.
   - Mechanisms of gas exchange (air breathers), role of the alveoli, bronchi, surfactants.
   - Ventilation anatomy, mechanics, pressures, resistance, and characteristic volumes.
   - Role of surfactants.
   - Respiratory heat and water loss.
   - Ventilation in bird and insects.
3. Control of respiration:
   - Mechanisms of central control of respiration.

- Role and mechanisms of sensors, feedback, control centers, *etc.*,.
- Roles and mechanisms of CO_2 (hypercapnea) and O_2 (hypoxia) in control of respiration.
- Pulmonary circulation, ventilation/perfusion (mis)matching.
- Diving and the effects of underwater breathing, the bends.
- Effects of altitude on respiration/cardiovascular system.

2 Osmotic Balance/Kidney Function

1. Osmosis in living system
   - Definitions of terms and basic concepts of osmosis.
   - Obligatory exchanges: water loss, mechanisms, aquaporin, respiratory water loss (again).
   - Controlled exchanges: osmoregulation challenges and mechanisms of different types of environments and species.
   - Osmotic challenges faced by different species.
   - Examples of animals dealing with dry conditions (camel, kangaroo rat, insects).
2. Kidney function
   - Structure of and high-level function kidney and nephron.
   - Overview of kidney function: filtration, reabsorption, secretion.

3 Background materials from the text

The following pointers are to sections in the Eckert Animal Physiology text that are recommended or required reading:

Chapter 13: pages 525–539, 545–559, 562–572.
Chapter 14: pages 579–592, 596–599 (up to glomerular filtration)

For other resources should you need more explanation please see here
`http://www.sci.utah.edu/~macleod/bioen/be6000/background.html`