

## **Systems Processes and Homeostasis (SPH)**

### **Course Objectives**

1. Explain the concept of homeostasis and how diseases and drugs alter homeostasis for each physiological system studied in SPH.
2. Explain the origin of the electrical properties of cells and the role of ion channels (conduction and gating) in producing physiological changes in membrane potential and in the actions of hormones, neurotransmitters and drugs.
3. Compare and contrast: 1) smooth, cardiac and skeletal muscles with respect to structure, function and regulation; and 2) the autonomic, enteric and motor nervous systems with respect to structure and function.
4. Describe the role of feed-forward and feedback mechanisms in terms of homeostatic control of the cardiovascular and motor systems.
5. Understand the physical principles and cellular mechanisms underlying cardiac and blood vessel function and their normal regulation by the autonomic nervous system and hormones.
6. Explain the basic physiological processes of gastrointestinal motility, secretion, digestion, and absorption, and how motility and secretion are regulated by the nervous system and hormones to bring about proper digestion and absorption.
7. Describe the hemodynamic and cellular mechanisms by which sodium, chloride, water, hydrogen ion and potassium are handled by the renal tubule, and how nerves and hormones regulate these processes so that homeostasis is maintained.
8. Describe the function of the pulmonary system in the context of mechanical properties, gas exchange, nervous control and acid base balance.
9. Understand the principles of pharmacodynamics, pharmacokinetics (including hepatic drug biotransformation and renal drug excretion), toxicokinetics, and pharmacogenetics, and explain how disease, age, toxins, and drug-drug interactions can alter these processes.
10. Integrate your SPH knowledge by discussing in detail how physiological systems and drugs attempt to restore homeostasis for each of the following three complex disorders: 1) congestive heart failure, 2) hemorrhage, and 3) acid-base imbalance.
11. Define and give examples of selectivity and selective toxicity with respect to drugs, neurotransmitters, and poisons you have studied.
12. Recognize each generic drug name or toxin on the official Drug List for the course. For each compound on the list make sure that you know the mechanism of action; therapeutic category; and any pharmacodynamic and pharmacokinetic points emphasized in lectures, tutorials, POPS sessions,

and/or demonstrations.

13. Explain how drug therapies and herbal remedies are determined to be effective and safe including the use of clinical case reports, the Controlled Clinical Trial (CCT), the Retrospective Case Controlled Study (RCCS) and the Prospective Cohort Study (PCS).

14. Demonstrate the ability to access and critically read the primary medical literature during the implementation of the SEFOM project. Be sure to articulate the knowledge gaps that exist in the area you investigated. Know the importance of hypothesis formation for future progress in this area of investigation, how experiments are designed, and how data is collected and analyzed. Be sure you understand the process of deriving sound conclusions from the available data.