BBSG 503, 2008
Section 11: Systems Biology

Section Director: W.K. Samson, Ph.D.
Classes: April 14-30
Study Day: May 1
Progress Exam: May 2

Faculty:
W.K. Samson, Ph.D. Randy Sprague, M.D.
C-207A 977-8677 samsonwk@slu.edu M210 977-6458 spraguer@slu.edu

Alan Stephenson, Ph.D. Thomas C. Westfall, Ph.D.
M-205 977-6454 stephens@slu.edu M-362 977-6400 westfatzc@slu.edu

Resources: Goodman and Gilman (11th ed.) is available on line on the HSC Library Website. One copy each of Goodman and Gilman, West, Guyton and Hall, Berne and Levy, and Griffin and Ojeda will be available in C-207A. These resources are to remain in C-207A.

Lectures

April 14  9:00-10:00   Alan Stephenson, Ph.D.  Overview of the Cardiovascular System
  • Components of the Cardiovascular System
  • Functions of the circulatory system
  • Organization of the circuity
  • Determinants of blood flow
    o vascular diameter
    o wall thickness
    o lumen cross-sectional area
    o velocity of flow
  • Understanding how Poiseuille’s Law defines the determinants of blood flow

Assigned Readings: Berne and Levy, Cardiovascular Physiology 7th Edition, Mosby, Chapter 1 (pp 1-6); Chapter 5 (pp 113-131)
Additional Source Material: Guyton and Hall, Medical Physiology, 11th Edition, Saunders, Chapter 14 (pp 161-170)
April 14 10:00-11:00 Alan Stephenson, Ph.D.  The Heart and its Function
- The structure of the heart in relation to its function
- The Cardiac Cycle
- Pressure-volume loops
- The Frank-Starling relationship and how it relates to Cardiac Output
- Determinants of Blood Pressure

Assigned Reading: Berne and Levy, Cardiovascular Physiology 7th Edition, Mosby, Chapter 3 (pp 73-75); Chapter 6 (pp 140-147)
Additional Source Material: Guyton and Hall, Medical Physiology, 11th Edition, Saunders, Chapter 9 (pp 103-114)

April 15 9:00 – 10:00 Thomas Westfall, Ph.D. Anatomical and Physiological Considerations
- Anatomy of the Autonomic Nervous System
- Neurochemical Considerations
- Physiological Considerations


April 15 10:00 – 11:00 Thomas Westfall, Ph.D. Cholinergic Neurotransmission Synthesis
- Storage
- Release
- Inactivation
- Receptor Activation


April 16 9:00 – 10:00 Thomas Westfall, Ph.D. Adrenergic Neurotransmission
- Synthesis
- Storage
- Release
- Inactivation
- Receptor Activation

April 17  9:00-10:00 Alan Stephenson, Ph.D.  
Renal Perfusion and Filtration
- Know the anatomy of the kidney and nephron
- Understand the processes of filtration, reabsorption, and secretion
- Know the determinants of Glomerular filtration rate (GFR)
- Know the determinants of renal blood flow (RBF)
- Know how to determine renal clearance.

Assigned Reading: Guyton and Hall, 11th ed. Chapter 26: Urine formation by the kidneys I

April 18  9:00-10:00 Alan Stephenson, Ph.D.  Renal Tubular Function
- Identify the mechanisms of tubular reabsorption
- Detail the physical and hormonal factors that regulate reabsorption.
- Understand the countercurrent mechanism for urine concentration.

Assigned Reading: Guyton and Hall, 11th ed. Chapter 27: Urine formation by the kidneys II and Chapter 28: Regulation of Extracellular fluid osmolarity and sodium concentration.

April 21  9:00-10:00 W.K. Samson, Ph.D.  Cardiovascular Reflexes and Hormonal Control
- Role of local factors in control of regional blood flow
- Humoral factors that control blood flow
- CNS control of circulation/neural reflexes
- High and low pressure baroreceptors

Assigned Reading: Guyton and Hall, 11th ed. Chapter 17, p. 195-203; Chapter 18: p. 204-211.

April 22  9:00 -10:00 Randy Sprague, M.D.  Regulation of pH: Physiological Buffering
- Characteristics of buffer systems
- The Henderson-Hasselbach equation
- The buffer system of humans and other mammals
- The regulation of pH by the kidney
- The regulation of pH by the lung

Assigned Reading: Medical Physiology, Guyton & Hall 11th ed. Chapter 30, p. 383-400
April 23  10:00-11:00 Randy Sprague, M.D.  Pulmonary Vascular Resistance

- Determinants of Vascular Resistance
- Unique characteristics of the lung
- Recruitment and distension of pulmonary blood vessels
- What mechanisms keep resistance low in the lung?
- Causes of pulmonary hypertension: pre- and post-capillary
- Hypoxic pulmonary vasoconstriction
- Effect of lung volume on vascular resistance
- Vasoactive mediators in the lung

Assigned Reading: Respiratory Physiology, John B. West, Chapter 4

April 24  9:00-10:00 Randy Sprague, M.D.  Pulmonary Gas Exchange – Maintenance of Arterial Oxygen Tension

- The “ideal” matching of blood flow with gas flow – the concept of lung zones
- The alveolar gas equation
- Hypoxic pulmonary vasoconstriction
- Venous admixture
- Shunt

Assigned Reading: Respiratory Physiology, John B. West, Chapter 5

April 25  9:00-10:00 W.K. Samson, Ph.D.  Endocrinology (Anterior and Posterior Pituitary)

- The basic components of the endocrine system
- Anatomy of the hypothalamus and pituitary gland
- Anterior pituitary hormones and their basic regulation
- Posterior pituitary hormones: function and regulation

Assigned Reading: Griffin & Ojeda, Textbook of Endocrine Physiology, 5th ed., Chapter 1, p. 1-15

Additional Suggested Reading: Griffin & Ojeda, Chapter 6 (Anterior Pituitary) and Chapter 7 (Posterior Pituitary)
April 25 10:00-11:00 W.K. Samson, Ph.D.  Adrenal Physiology
- Anatomy of the adrenal gland
- Hormones of the adrenal cortex: regulation
- Physiology and Pathology of the glucocorticoids
- Physiology of the mineralocorticoids and adrenal androgens
- Adrenal medullary catecholamine production and actions
Assigned Reading: Griffin & Ojeda, Chapter 14 (The Adrenal Glands)

April 28 9:00-10:00 W.K. Samson, Ph.D.  Thyroid Physiology
- Synthesis and secretion of thyroid hormones
- Thyroid hormone metabolism
- Regulation of thyroid function
- Actions of thyroid hormones
Assigned Reading: Griffin & Ojeda, Chapter 13 (The Thyroid)

April 29 9:00-10:00 W.K. Samson, Ph.D.  Regulation of Calcium Homeostasis
- Calcium homeostasis (organs)
- Calcium homeostasis (hormone regulation)
- Disorders of calcium homeostasis
Assigned Reading: Griffin & Ojeda, Chapter 15, p. 349-368. (Calcium Homeostasis)

April 30 10:00-11:00 W.K. Samson, Ph.D.  Metabolism of Glucose and Other Fuels
- Anabolism versus catabolism
- Glycogenolysis versus gluconeogenesis
- Lipolysis and ketogenesis
- Proteolysis and gluconeogenesis
Assigned Reading: Griffin & Ojeda, Chapter 16 (Glucose, Lipid and Protein Metabolism)

May 1 Study Day
May 2 Exam