This is just a study GUIDE. It is up to you how well you want to cover/understand the material. Remember all material from your slides and modules have the potential to be asked on the exam.

# LAB 1 - HOMEOSTASIS AND FUNDAMENTAL CELL PHYSIOLOGY

## LECTURE SLIDES

* What is the average body temperature? (both ℃ and ℉). Be able to label parts of the cell membrane.
* Understand and define the following terms:

Sensor (receptor)

Set-point

Controlled variable

Integrating center (control center)

Effector

Negative Feedback Mechanism

Positive Feedback Mechanism

* + Understand selective permeability and be able examples of molecules that can and cannot permeate the membrane.
  + *Assisted* vs. *Unassisted* Transport mechanisms
  + Understand and be able to define:

Active transport

Passive transport

Simple diffusion

Channel mediated facilitated diffusion

Carrier mediated facilitated diffusion

Osmosis

Isotonic solution

Hypotonic solution

Hypertonic solution

* + All components of Fick’s Law of Diffusion
  + What is the optimal (isotonic) concentration of NaCl for a normal RBC? What would happen to the cell if it were placed into an *isotonic*, *hypotonic*, and *hypertonic* solution?

## LAB MODULE

* + Understand and be able to critically think about the various negative feedback mechanisms utilized by the body to maintain homeostasis.
  + Be able to apply knowledge to clinical scenarios/Case-Studies.

# LAB 2 - ENZYMES AND METABOLISM

## LECTURE SLIDES

* + What properties affect the molecular activity of an enzyme?
  + How do enzymes function as biological catalysts?
  + Are they able to alter the nature of a reaction?
  + Can they induce chemical reactions to occur that don’t already occur spontaneously without an enzyme? Are they consumed by the reaction?
  + An enzyme’s 3D Ultrastructure allows it to bind its appropriate substrate with high affinity based on the elementary principle of *complementary shape*.
  + Cofactors are molecules that bind at various sites on an enzyme, which serve to activate the enzyme or improve its biological activity.

## LAB MODULE

* + Enzymes are able to breakdown carbohydrates, proteins, and lipids through a process known as enzymatic hydrolysis.
  + Know the substrate, enzyme, and products yielded by each reaction covered in the lab exercise.
  + What color indicators were used for each for the reaction? What do they indicate?

# LAB 3 - INTERACTIVE SKELETAL MUSCLE

## LECTURE SLIDES

* + - What are the characteristics and main functions of skeletal muscle fiber?
    - Understand and be able to identify the main properties of skeletal muscle fiber.
    - What is a sarcomere? What is the functional unit of skeletal muscle?
    - Understand and be able to explain the contraction cycle and sliding filament theory of muscle contraction.
    - Be able to identify each of the following structures:
      1. **H zone**
      2. **A band**
      3. **I band**
      4. **Z disc**
      5. **M line**
    - What is a motor unit? What is the significance of the precision ratio found when discussing the amount of fibers a motor unit innervates?
    - Understand and be able to explain each of the steps involved in a monosynaptic reflex and a crossed-extensor reflex.
    - Understand and be able to explain all clinical applications covered in book and PPT slides.
    - Understand and be able identify characteristics of each type of skeletal muscle fiber:
      1. **Slow Oxidative**
      2. **Fast Oxidative-Glycolytic**
      3. **Fast Glycolytic**
    - Understand and be able to critically think about each type of muscle contraction:
      1. **Isotonic Concentric contraction**
      2. **Isotonic Eccentric contraction**
      3. **Isometric contraction**

# LAB 4 - SKIN AND SENSORY PHYHSIOLOGY

## LECTURE SLIDES

* + Know functional categories of sensory receptors

Chemoreceptors

Photoreceptors

Thermoreceptors

Mechanoreceptors

Nociceptors

* + Skin receptors (function and location)
  + Explain the difference between *myelinated* and *unmyelinated* axons
  + Understand and be able to explain the differences between *phasic* and *tonic* receptors. How does each of receptors respond to a constant stimulus?
  + Principle types of cutaneous glands
  + Skin color (pigmentation)
  + Skin cells: keratinocytes, melanocytes, Langerhans cells, and merkel cells.
  + Understand what dermatomes are (don’t memorize the location of each)
  + Understand and be able to explain all clinical applications covered in book and PPT slides.
  + Given a light microscopy students should be able to identify each layer of the epidermis in both THICK and THIN skin.

Stratum basale

Stratum spinosum

Stratum granulosum

Stratum lucidum (thick skin only)

Stratum corneum

## LAB MODULE

* + Understand and be able to explain the concepts behind Two-Point Touch Threshold Testing.
  + Identify and match epidermal layers

# LAB 5 - ENDOCRINE SYSTEM

## LECTURE SLIDES

* + How does a hormone travel through the body?
  + What are the six anterior pituitary hormones?
    - “FLAT PIG”

**F**SH

**L**H

**A**CTH

**T**SH

**P**rolactin

I (doesn’t stand for anything)

**G**H

* + Understand how feedback control systems work in each endocrine gland
  + Which pancreatic cells secrete glucagon? Which secrete insulin?
  + What are the functions of both glucagon and insulin? How are they related?
  + How are blood glucose levels (mg/dL) effected by glucagon? Insulin?
  + Understand and be able to list the differences between Type I and Type II Diabetes Mellitus.
  + Understand and be able to explain all clinical applications covered in the book and PPT slides.

## LAB MODULE

* + Understand how glucose testing is performed using the fingerpick method.
  + What device is used to measure blood glucose?
  + What levels are normal in a fasted state? What about in fed state (or) after a meal?
  + What effects did exercise have on blood glucose concentration?
  + What is a ketone body? What is the role of ketones in energy metabolism?
  + What is the relationship between glucose levels and ketone bodies in a patient who is a fasted state? What about if they are in a fed state?
  + Understand how the insulin signaling cascade works.

# LAB 6 – BLOOD HISTOPATHOPHYSIOLOGY

## LECTURE SLIDES

* + What are the primary functions of blood? How do they contribute homeostasis?
  + Know the different parts of a whole blood sample; as well as the composition of each layer.
  + ABO Blood Grouping:
  + Understand and define antigen, antibody, agglutination reaction
  + Which antibodies are produced by each of three blood types?
  + Be able to explain concepts related to transfusion reactions.
  + Which blood type is the universal donor? Which is the universal recipient?
  + Define and differentiate between the two categories of leukocytes:
  + **Granulocytes**
    - 1. Neutrophil
      2. Eosinophil
      3. Basophil
  + **Agranulocytes**
    - 1. Monocyte
      2. Lymphocyte
  + Understand and be able to explain all clinical corrections covered in book and PPT slides.

## LAB MODULE

* + Understand how blood typing is performed using the agglutination reaction
  + What blood type is the universal donor? What blood type is the universal acceptor?
  + Understand genetics of ABO blood types.

# LAB 7 – THE HEART

## LECTURE SLIDES

* Describe the correct sequence of blood flow through the heart:
  + **Body Tissues and Organs (systemic circulation)🡪Superior & Inferior vena cavae and coronary sinus🡪right atrium🡪tricuspid valve🡪right ventricle🡪pulmonary semilunar valve🡪pulmonary trunk🡪pulmonary arteries🡪alveolar capillary network (pulmonary circulation)🡪pulmonary veins🡪left atrium🡪mitral valve (bicuspid)🡪left ventricle🡪aortic semilunar valve🡪aorta**
* Describe the correct sequence and be explain each phase of the cardiac contraction cycle.
  + Atrial systole:
  + Isovolumetric contraction:
  + Rapid ejection:
  + Reduced ejection:
  + Isovolumetric relaxation:
  + Rapid filling:
  + Reduced filling:
* Identify the correct sequence of the intrinsic conduction system and be able to explain each step.
* How does striated cardiac muscle tissue differ from striated skeletal muscle tissue?
* Understand and be able to explain all clinical applications covered in book and PPT slides.

## LAB MODULE

* What does an EKG measure?
* What does each of the waveforms represent?
* How is the cardiac contraction cycle related to the ECG reading?
* Identify and explain how a normal sinus rhythm looks on an ECG recording.
* Be able to identify and explain details about each cardiac arrhythmia discussed in the book and PPT slides.
  + Know difference between defibrillation and synchronized cardioversion.
    - **Defibrillation**: higher energy (200 J), unsynchronized shocks of energy
      * *Used to treat Ventricular fibrillation*
    - **Synchronized cardioversion**: lower energy (80 -100 J), synchronized shocks of energy at specific optimal moment in the cardiac cycle (synchronized with R wave).
      * *Used to treat Ventricular tachycardia*

# LAB 8 - URINARY SYSTEM

## LECTURE SLIDES

* Know primary functions of the kidney.
* What is the functional unit of the kidney?
* Know specific microanatomy of the kidney and renal blood supply
  + **Renal Artery🡪Interlobar Artery🡪Arcuate Artery🡪Interlobular Artery🡪Afferent Arteriole🡪Glomerulus🡪Efferent Arterioles🡪Peritubular Capillaries🡪Interlobular Vein🡪Arcuate Vein🡪Interlobar Vein🡪Renal Vein.**
* Know the differences between cortical nephrons and juxtamedullary nephrons.
* Know which substances are reabsorbed/secreted in each portion of the nephron:
  + **Proximal Convoluted Tubule**
  + **Descending loop of Henle**
  + **Ascending** **loop** **of** **Henle**
  + **Distal Convoluted Tubule**
  + **Collecting Duct**
* What is the function of Atrial Natriuretic Peptide [ANP]?
* What is the function of Aldosterone?
* What is the function of ADH?
* Which area(s) of the nephron are under hormonal control?
* Understand and be able to explain Glomerular Filtration? Be able to apply knowledge to answer clinical/case-study questions.
* Completely understand and be able to explain the **Countercurrent Multiplier System**. Be able to apply knowledge to assess and evaluate clinical/case-study questions.
* Which component of the nephron establishes the vertical osmotic gradient?
  + Which component *maintains* the gradient?
  + Which component *utilizes* the gradient?
  + Which component *establishes* the gradient?

## LAB MODULE

* Know and understand how a urinalysis is performed.
* Be able to explain each component in a typical urinalysis and what abnormal results for each measurement could indicate.