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Physiology Study Guide

The following is not intended to be a list of specific questions that will be on the exam. Rather, it is a list of some of the basic terms and concepts which you need to know. Make sure you understand, can explain, and are able to relate each of the items on this list.

Introduction to Physiology

Explain homeostasis? How is homeostasis maintained?
What is a set point? Why is it important to know the set point for each value?
What is meant by a feedforward and adaptation mechanisms?
How is the scientific method used?
What are variables and controls?
What is a correlation study? When is it useful?

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Biological Chemistry

What are the different types of chemical bonds? What are the properties of each bond?
Be able to recognize each of the following molecular structures:
 pentose, hexose, disaccharide, polysaccharides (starch, glycogen, cellulose);
 amino acid, dipeptide, polypeptide, protein; fatty acid, glycerol, triglyceride,
 phospholipid, eicosinoid, steroid; nucleotide monophosphate, nucleotide
 diphosphate, nucleotide triphosphate.
What are the properties of the different polysaccharides?
What are the properties of the different fatty acids?
What are the different classes of amino acids?
How is a protein's structure determined?
Relate a protein's structure to its function.

Explain binding and how it works. What factors affect binding?
Define the law of mass action? How does the law of mass action relate to binding?
What is a catalyst? Why are catalysts important?
How do enzymes catalyze reactions?
How is enzyme activity regulated?

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Cell Structure and Function

Describe the structure of a cell membrane. What are the functions of each component of the membrane?

Why is it necessary to have different types of cell transport mechanisms?

Describe each of the mechanisms for moving material across membranes? How do each of the following mechanisms work: diffusion across the phospholipid bilayer; diffusion through channels; facilitated diffusion; active transport; cotransport; bulk transport

Why is it important to maintain the appropriate level of fluidity in the phospholipid bilayer?

Why is it necessary to maintain high surface-to-volume ratios?

Describe and explain the functions of the following cell structures and organelles: nucleus, nucleolus, ribosomes, rough endoplasmic reticulum, smooth endoplasmic reticulum, golgi complex, transport vesicles, lysosomes, peroxisomes, mitochondria, microtubules, microfilaments, intermediate filaments, cytosol.

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Genetics

What is the structure of the cell's genome? What is a gene?

Explain the process of transcription and translation.

Understand and be able to use basic genetic terms and solve basic genetics problems: gene, allele, homozygous, heterozygous, genotype, phenotype, dominant, recessive, autosomal chromosomes, sex chromosomes, sex linkage, incomplete dominance, codominance, polygenic traits, epigenetic traits.

What are mutations? How are they caused? What are the consequences of mutations?

Describe the stages of the cell cycle.

Describe the stages of meiosis and explain their importance.

Explain chromosomal translocation and chromosomal nondisjunction.

What is cancer? What are the causes of cancer?

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Metabolism

For each of the following processes, understand the the purpose of each process, and overall reactants and products and energetics of each process: glycolysis, Cori cycle, Krebs cycle, β - oxidation, transamination, deamination, electron transport

chain.

What determines whether a cell metabolizes aerobically vs. anaerobically?

How do all of these processes interact?

How are these processes regulated?

What is BMR and what factors affect BMR?

How does one measure fitness and why are there different fitness criteria?

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Communication and Information Processing

How do cells communicate?

Neurons

What is a membrane potential?

How does an action potential occur and how is it propagated?

What factors and drugs affect action potentials?

How does information cross a synapse?

What are the different post-synaptic potentials and why are they important?

What is a graded potential?

Explain how synaptic integration works and why it is important.

What is a reflex?

Why is measuring reflexes important?

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Sensory Physiology

What is a receptor potential? What are the differences between tonic and phasic and steady state receptors?

Describe receptor fatigue.

Explain the concepts of receptive fields and lateral inhibition.

Explain the purposes and expected results for each of the sensory tests we performed in lab: cutaneous sensory tests, visual acuity tests, hearing tests, etc.

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Central and Autonomic Nervous System

How do we map the functions of the brain?

What are the different parts of the brain and their functions?

What is an EEG and why is it useful?

What are the functions of the ANS

What are the different kinds of neurotransmitters and where are they used?

Name the drugs that affect the different neurotransmitters.

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Hormones

What are the properties of endocrine, paracrine and autocrine hormones?

How is the endocrine system regulated?
Describe the signal transduction mechanism of the following: steroid and thyroid hormones, eicosinoids, small polar molecules, polypeptide hormones
Explain why each of the above hormones works in a different manner.
How are membrane receptors regulated? How does this relate to desensitization?

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Muscle Physiology

Skeletal Muscle

Describe the mechanism of contraction of skeletal muscle.
What are the different types of skeletal muscle fibers?
Explain the following: twitch, summation, tetanus, fatigue.
What factors affect the strength of contraction?
How are different nutrients used by skeletal muscle and why?
How is movement controlled and coordinated?
Explain the purposes and expected results for each of the muscle physiology tests we did.

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Smooth Muscle

How does smooth muscle contraction occur?
What are the different types of smooth muscle and why is it necessary to have both?

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Cardiovascular Physiology

Heart

What are the functions of the various cardiac cells?
Describe how pacemaker cells regulate heart rate.
Describe the mechanism of cardiac muscle contraction.
How do the activities of the different cardiac cells relate to each other and to the ECG?
What are the component parts of an ECG recording? What information does ECG provide?

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Regulation of Blood Flow and Tissue Perfusion

What are the factors that determine cardiac output, heart rate, stroke volume?

Explain how each of the following terms relates to the other terms on the list: vascular reflexes, end diastolic volume, Frank Starling Law, venous return, afterload, vascular resistance, etc.
How is cardiac output regulated?
How is tissue perfusion regulated?
How is blood pressure regulated? What happens if blood pressure is not regulated?

What is arteriosclerosis and what are its effects?
What factors determine flow into and out of capillaries? What conditions affect this flow?

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Respiratory Physiology

How is oxygen transported in the blood?
What factors affect hemoglobin and oxygen transport?
How is carbon dioxide transported in the blood?
What factors affect carbon dioxide transport?
How is plasma pH regulated by the respiratory system?
What are the effects of high and low pressure on gas transport?
Describe the diseases and conditions which affect air flow into and out of the lungs.

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Immune System

How does blood clot? How are clots regulated?
How does the body prevent infection?
Identify the different types of leukocytes and describe their functions?
What are antigens and antibodies?
What are the roles of B cells? How do vaccines work?
What are the roles of T cells?
How is the immune system regulated?
What are allergies and autoimmune diseases?
What are immunoassays and how are they used?

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Renal Physiology

What are the functions of the different parts of the nephron?
How is glomerular filtration rate controlled? Why is that important?
What is a counter-current exchange mechanism?
Why is it important to control blood volume?
How is fluid volume regulated?
How is sodium ion concentration regulated?
How are potassium and hydrogen ion concentrations regulated?

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Digestion and Metabolism

How are carbohydrates, proteins and lipids digested and absorbed?
What are the mechanisms that regulate the activity of the GI tract?
How are plasma calcium levels regulated?
How is plasma iron levels regulated?
How are vitamins absorbed and used?

What mechanisms are used to maintain body temperature?
How do hormones regulate metabolism?

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Reproductive Physiology

Describe the process of puberty in males and females.
Explain the menstrual cycle and its control. How do the hormones of the menstrual cycle interact?
How do hormonal contraceptives work? What is their efficacy?
What physiological changes occur during pregnancy in the mother?
How is fetal physiology different from an adult?
How is milk production regulated?
Explain some of the special problems of neonatal physiology.

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