BIOSC 1080 Human Anatomy and Physiology

SUMMER 2013
M.T.Th.F 8:30 – 10:55
6 CREDITS

INSTRUCTOR:
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Lecture Notes at www.dr.borecky.net
Office hours: One hour before lecture or by appointment

SCOPE OF COURSE

This course is a comprehensive introduction to the study of human anatomy and physiology. The goal is to present a balance of chemical, cellular, histological, gross anatomical, physiological, and clinical information. The large amount of material that will be presented forms the foundation for a sound understanding of human structure and function.

Required text: Seeley’s Essentials of Anatomy and Physiology
VanPutte, Regan, and Russo McGraw Hill

GRADING POLICY

During this 8 week course there are 4 quizzes, 3 lecture exams and a final. Consult the syllabus for the dates. You will receive one letter grade for this course and this grade will be determined on the basis of 3 quizzes, 2 lecture exams, and the final. There will be a total of 425 available points distributed as follows: Each quiz is worth 25 points for a total of 75 points; each lecture exam is worth 100 points for a total of 200 points; the final is worth 150 points. If you take all 4 quizzes, the lowest quiz grade will be dropped, if you take the 3 lecture exams, the lowest of these grades will be dropped. All students are required to take the final, which will consist of both questions from the material covered after exam 3 as well as comprehensive questions. The format for quizzes and lecture exams will be some combination of multiple choice, true or false, and matching questions. There will be no make-up quizzes or make-up exams in this course.

Final letter grades will be determined by adding the numerical scores from 3 quizzes, 2 lecture exams and the final. Your final grade will be your total summed points as a percentage of the 425 points available in the course. No extra credit (papers, projects, etc.) can be earned.

Letter Grades:

A. 94-100%  B+ 87-89%  C+ 77-79%  D+. 67-69%
A- 90-93%     B  84-86%   C  74-76%   D  64-66%
B-  80-83%    C-  70-73%  D-  60-63%
             F  59% and below
Make-up for final exam
Should an emergency arise that causes you to miss the final on July 5th, you should not delay in contacting me by phone or by email, and you must submit in writing, a request for an excused absence from the final date. This written request must include the appropriate supporting documentation (doctor’s excuse, copy of an obituary, etc.) Should an excusable absence be granted, a make-up final will be arranged. If you do not receive an excused absence, you will receive a 0 for the missed final.

The policy for granting “G” grades (“incomplete”) is strictly by the book. “A G grade is to be given only when students who have been attending a course and have been making regular progress are prevented by circumstances beyond their control from completing the course after it is too late to withdraw” (see The Bulletin). A “G” grade will be granted if an emergency arises that prevents you from attending the final exam on July 5th, 2013. Again, you must submit to me, in writing, a request for an excused absence (see above). Should a G grade be granted, the missed final will be made up at a time convenient to the instructor and the student.

Attendance
Attendance of the lectures is strongly urged, but ultimately it is at the discretion of the student. Missing lectures will hurt your course grade, not by direct penalization, but by compromising your comprehension of the extensive material covered in class. So make it a point to come to class.

Academic Conduct
The University of Pittsburgh’s Student Code of Conduct prohibits all forms of academic dishonesty (Please refer to The Bulletin, for an overview of student responsibilities and reference to University publications that explain student obligations of academic integrity). Academic misconduct (cheating or permitting another student to cheat) during exams will result in an F for the course and/or referral of the case to the Judicial System with the possible penalty of dismissal from the University.

Lecture Outline
The Human Organism

Anatomy and Physiology
   The link between form and function

Structural and Functional Organization

Characteristics of Life

The Concept of Homeostasis
   Positive and negative feedback mechanisms
Tissues, Glands, and Membranes

Epithelial Tissues
Functions
Classification
Glands

Connective Tissues
Functions
Classification

Muscle Tissues
Functions
Skeletal muscle
Visceral muscle
Cardiac muscle

Nervous Tissues
Functions
The neuron
Neuroglial cells

Membranes
Mucus membranes
Serous membranes
Synovial membranes

The Inflammation Response and Tissue

The Integumentary System

Functions of the Integument

The Hypodermis (subcutaneous tissue)

The Skin
Structure and functions of the epidermis
Structure and functions of the dermis

Accessory Structures of the Integument
Hair
Nails
Glands
Sebaceous glands
Sudoriferous glands
Mammary glands
Ceruminous glands

Clinical Considerations
Diagnostic tools
Burns
Cancer
Bones and Skeletal Tissues

Functions of the Skeletal System

Osseous Tissue
   Lamellar and cancellous bone tissue

Basic Bone Anatomy
   Classification of bone types
   Basic bone features

Bone Growth and Development
   Endochondral and Intramembranous ossification
   Epiphyseal growth
   Periosteal growth
   Medullary growth

Joints

Articulations and Movements

Classification of Joints
   Classes based on movement
      Synarthroses
      Amphiarthroses
      Diarthroses

   Classes based on structure
      Fibrous
      Cartilage
      Synovial

Joint Movements

Clinical Considerations

Muscles and Muscle Tissue

Functions of the Muscular System

Characteristics of Skeletal Muscle
   Ultrastructure of the muscle cell
   The gross anatomy of skeletal muscles
   Membrane potentials and muscle contraction
   Nerve supply for muscle contraction
   Muscle twitch, summation, tetanus and recruitment
   Muscle energy requirements and muscle fatigue
   Muscle tone

Fundamentals of the Nervous System and Nervous Tissue

Functions of the Nervous System
   Reception
   Conduction
   Integration
   Stimulation
Organization of the Nervous System
CNS and PNS
Somatic nervous system
Autonomic nervous system

Cells of the Nervous System
Neurons
Neuroglial cells
Astrocytes
Ependyma
Microglia
Oligodendrocytes
Schwann cells
Neurolemma cells

Structure and Functions of Myelin Sheaths

The Nerve Impulse
Resting membrane potentials
Depolarization
Immediate repolarization
Long-term repolarization

The Structure and Functions of the Synapse
EPSP
IPSP
Neurotransmitters

Types of Neuronal Circuits

The Central Nervous System

The Central Nervous System (CNS)
The Brain – regions and functions
Medulla
Pons
Midbrain
Thalamus
Hypothalamus
Cerebrum
Cerebellum

The Meninges and Cerebrospinal Fluid (CSF)
The spinal cord
Gross anatomical structure
Cross sectional anatom

The Peripheral Nervous System and Reflex Activity

Sensory Receptors
Mechanoreceptors
Thermoreceptors
Photoreceptors
Chemoreceptors
Nociceptors
Sensation and Perception

Cranial Nerves

Spinal Nerves and Spinal Nerve Plexuses

Spinal Reflexes

The Autonomic Nervous System

The Autonomic Nervous System (ANS)
  Sympathetic division
    Structure and functions
  Parasympathetic division
    Structure and functions

The Special Senses

The Special Senses
  Olfaction

Gustation

Vision
  Tunics of the eye
    Fibrous tunic
    Vascular tunic
    Nervous tunic

  Chambers of the eye
    Anterior cavity
    Posterior cavity

  Functions of the eye
    Visual problems

Gustation and Olfaction

Hearing
  Outer ear
  Middle ear - ear ossicles
  Inner ear
    Cochlea – hearing
    Semicircular canals – balance and equilibrium

The Endocrine System

Functions of the Endocrine System

The Nature of Chemical Messengers

Cell Membrane Receptor Sites

The Chemical Nature of Hormones
Major Endocrine Glands and Their Hormones

The Hypothalamus
- HRF’s and HIF’s
- Oxytocin and Antidiuretic Hormone

The Anterior Pituitary
- Growth hormone (GH)
- Thyroid stimulating hormone (TSH)
- Adrenocorticotropic hormone (ACTH)
- Luteinizing hormone (LH)
- Follicle stimulating hormone (FSH)
- Prolactin (PRL)
- Melanocyte stimulating hormone (MSH)

The Posterior Pituitary
- Oxytocin (OT)
- Antidiuretic Hormone (ADH)

The Thyroid Gland
- Thyroxine (T3 and T4)
- Calcitonin

The Parathyroid Glands
- Parathyroid hormone (PTH)

The Adrenal Glands
- Adrenal cortex
  - Glucocorticoids
  - Mineralocorticoids
  - Gonadocorticoids
- Adrenal medulla
  - Adrenalin (epinephrine and norepinephrine)

The Pancreas
- Islets of Langerhans
  - Insulin
  - Glucagon

The Testes
- Testosterone

The Ovaries
- Estrogens
- Progesterone

The Thymus Gland
- Thymosin

The Pineal Gland
- Melatonin
The Cardiovascular System: The Blood

Physical Characteristics of the Blood

Functions of the Blood

1. Transport
2. Regulation
3. Protection

Components of the Blood

Formed Elements

1. Erythrocytes (red blood cells or R.B.C.’s)
2. Leucocytes (white blood cells or W.B.C.’s)
3. Thrombocytes (platelets)

Plasma - The liquid component of the blood

Composition of plasma

1. Water - 91.5%
2. Plasma proteins
3. NPN (Non-protein nitrogen)
4. Nutrients
5. Regulatory substances
6. Respiratory gases
7. Electrolytes

Homeostasis - Control of blood ions

Factors that control blood loss after damage to vessels

1. Vascular spasms
2. Platelet plug
3. Coagulation
   - Extrinsic Pathway
   - Intrinsic Pathway

Fibrinolysis
Blood clot terminology

Thrombosis
Thrombus
Embolus
Embolism

Anticoagulants

Heparin
Warfarin (Coumadin)
Clot dissolving drugs

Blood banking

Common calcium binding agents

CPD – citrate phosphate dextrose
ACD – acid citrate dextrose
EDTA – ethylenediamine tetracetic acid

Blood Disorders

Anemia – a reduction in red blood cell count or hemoglobin level

Nutritional anemia
Pernicious anemia
Hemorrhagic anemia
Hemolytic anemia
Aplastic anemia
Sickle cell anemia

Polycythemia
Mononucleosis
Leukemia
Leukopenia
Leukocytosis

Blood Typing

The Cardiovascular System: The Heart and Blood Vessels

Pericardium

Parietal pericardium
Fibrous layer
Serous pericardium

Visceral pericardium
Pericardial space

Myocardium

Endocardium
Basic Heart Anatomy – Chambers, Valves, and Vessels

Outline of Blood Flow (Pulmonary and Systemic Circuits)

Blood Supply to the Myocardium

The Conduction System of the Heart

Components of the Conduction System of the Heart

SA node
AV node
Atrioventricular Bundle
Right and Left Bundle Branches
Purkinje Fibers

The Conduction System and the ECG

Heart Sounds and Murmurs

Cardiac Output (CO)

Factors that influence rate and force

Autonomic Controls of Heart Rate and Force of Contraction

Medulla- Cardioregulatory Center

Control of the Cardioregulatory Center

The Shock Cycle

Blood Pressure and Regulation

Factors Influencing Blood Pressure

Control of Blood Pressure
Vasomotor Center of the Medulla

Blood Pathways
Portal Circulation
Fetal Circulation

The Lymphatic System

Functions
WBC production
Drainage
Filtration
Fluid Return
Fat Transport

Lymph Capillaries – blind ended
Lymph Organs

Spleen
Thymus
Tonsils
    Pharyngeal
    Palatine
    Lingual

Lymph Nodes

The Respiratory System

Functions of the Respiratory System
Gas Exchange
pH Regulation
    \[ CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow H^+ + HCO_3^- \]
Venous pump

Terminology Associated With Respiration

Breathing (ventilation
External respiration
Internal Respiration
Cellular respiration

Structural Components of the Respiratory System

Nostrils (external nares)
Nasal Cavity
Nasal Sinuses
The Pharynx
    Nasopharynx
    Oropharynx
    Laryngopharynx
Epiglottis
Glottis
Larynx (voice box
Trachea (wind pipes
Bronchi
    Primary bronchi
    Secondary Bronchi (lobar bronchi
    Tertiary Bronchi
Bronchioles
Alveoli

Mechanics of Breathing

Pulmonary Volumes

Exchange of Respiratory Gases
Dalton’s Law of Partial Pressure

Transport of Oxygen

Factors Influencing the Oxygenation of the Blood

Hypoxia - low oxygen levels in the blood, tissues, and cells
  
  Hypoxic hypoxia
  Anemic hypoxia
  Stagnant hypoxia
  Histotoxic hypoxia

Control of Breathing

  Medullary Rhythmicity Center - basic breathing rhythms
  Pons – alters basic breathing rhythms

  Regulation of the Respiratory Centers

The Digestive System

Factors Influencing Feeding

  The Hypothalamus
    Feeding Center
    Satiety Center
  Control of the Hypothalamus

The Digestive Process

  Ingestion
  Peristalsis
  Digestion
    Mechanical digestion
    Chemical digestion
  Absorption
  Elimination

Basic Anatomy of the Digestive Tract

  Mouth and Oral Cavity
    Mouth
    Oral Cavity
    Cheeks and Lips
    Oral Vestibule
    Hard Palate
    Soft Palate
    Palatoglossal arch
    Palatopharyngeal arch
    Tonsillar fossa
    Fauces
Tongue
Teeth

Salivary Glands
- Parotid salivary glands
- Submandibular salivary glands
- Sublingual salivary

Esophagus

Stomach
- Cardia
- Fundus
- Body
- Pylorus
- Pyloric sphincter

Functions of the Stomach

Functions of the Pancreas

Ducts of the Liver and Pancreas
- Bile ducts
- Pancreatic ducts

Functions of the Liver

The Small Intestine
- Functions
- Regions of the Small Intestine
  - Duodenum
  - Jejunum
  - Ileum

The Large Intestine (Colon)
- Regions of the Colon
- External Features of the Colon
- Functions of the colon

The Excretory System
- Basic Functions of the Excretory System
- Basic Components of the Excretory System
External Anatomy of the Kidney

Internal Anatomy of the Kidney
- Renal cortex
- Renal Medulla
- Renal pyramids
- Renal papillae
- Renal columns
- Renal Pelvis

Blood flow to and from the nephron

Microscopic Anatomy of the Kidney
- Structure and functions of the nephron

Urine Transport and Storage
- Ureters
- Bladder
- Internal sphincter
- External sphincter

Abnormal Urine Components
- Glycosuria
- Albuminuria
- Bilirubinuria
- Hematuria
- Hemoglobinuria
- Pyuria
- Ketonuria (acetonuria)
- Casts
- Calculi

The Male Reproductive System

Structure and Functions of the Male Reproductive System
- Scrotum
- Testes
- Epididymus
- Spermatic Cord
- Inguinal Canal
- Seminal vesicles
- Ejaculatory duct
- Prostate Gland
- Bulbourethral (Cowper’s) glands

Penis
- Corpora cavernosa
- Corpus spongiosum
- Erection
- Glans Penis
- Prepuce (foreskin)
- Corona
The Female Reproductive System

Ovaries
Uterine (fallopian) tubes
Infundibulum
Ampulla
Isthmus
Uterus
Fundus
Body
Isthmus
Cervix

Histological layers of the uterus-
  Perimetrium
  Myometrium
  Endometrium
    Stratum basalis
    Stratum functionalis

Vagina
  Fornix
  Rugae
  Vaginal orifice
  Hymen

External Genitals (vulva)
  Mons pubis
  Labia majora
  Labia minora
  Clitoris
  Vaginal vestibule
    Skene’s glands
    Bartholin’s glands
  Perineum

The Female Reproductive Cycle

Phases of the Cycle
  Menstrual phase- menses
  Preovulatory phase
  Ovulation
  Postovulatory Phase
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<td>Chapter 1 - Introduction, Basic themes in anatomy and physiology, homeostasis and feedback control mechanisms - Anatomical terminology and body design</td>
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<td>Chapter 4 - Basic histology</td>
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<td>16 Thurs</td>
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<td>Chapter 6 - Introduction to the skeletal system</td>
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<td>21 Tues</td>
<td>Chapter 7 - Muscle tissue and ultrastructure</td>
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<td>Chapter 8 Synaptic conduction and neurotransmitters</td>
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<td>6 Thurs</td>
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