BI 121 Lecture 1

I. **Announcements**: Please check & sign attendance roster. Not on list? See Pat during break/class. *Lab 1 Histology* Thursday, 10 am – 5 pm sections in 130 HUE. Much fun!!

II. **Introduction**: Staff, office hr, required sources, course overview, grading, expectations & success. Q?

III. **Human Physiology** LS ch 1, DC Module 1,
   A. What? cf: Anatomy LS p 1
   B. Where? Body Levels of Organization LS pp1-6, DC pp1-5
   C. How? Different Study Approaches LS p 1

IV. **Homeostasis** LS ch 1, DC Module 1
   A. What? Maintenance of ECF LS p 8
   B. Where? ECF = Plasma + Interstitium LS fig 1-4 p 8
   C. How? Simplified Homeostatic Model cf: LS fig 1-7 p 14 Balances LS p 9, DC pp 5-6
   D. Why? Cell survival! LS fig 1-5 p 9, DC p 5

...Welcome to Human Physiology – what makes us tick!
Human Body Systems
Structure, Function, and Environment
SECOND EDITION

Daniel D. Chiras

Introduction to Human Physiology
Department of Biology, BI 121
Laboratory Manual
University of Oregon
Eugene, OR 97403
Fall 2015

DC
New (2013 ed) $28.25 Used $19.50

LM
Lab Notebook $9.75

http://uoduckstore.com/
Publisher’s Price → Gold Nuggets?

Fundamentals of Human Physiology 4E
Lauralee Sherwood

BI 121 Optional Source @ ValoreBooks.com, Smith Family Bookstore, Google.com or Amazon.com

$234.55 New; $134.93 Used; $63.49 Rental; Valore Books $11.23!
Dr. Evonuk’s 6 Balances

- Metabolic
- $H_2O$
- $ToC$
- $O_2/CO_2$
- Ion$^{+/-}$
- pH
Mitochondria: Energy Organelles

Proteins of electron transport system

Inner mitochondrial membrane

Matrix

Outer mitochondrial membrane

Cristae

Intermembrane space

Cristae
What does DNA look like? Double-helix!!

LS fig C-2
What are DNA’s major functions?
Heredity + Day-to-Day Cell Function
Dietary Analyses Thanks to Michelle Obama!
Dietary Composition & Physical Endurance

~ 1/3 endurance!

- High-fat diet
- Normal mixed diet
- High-carbohydrate diet

Maximum endurance time:
- 57 min
- 114 min
- 167 min

eg, Atkins!
Digestion Steps

1. Ingestion
2. Mechanical Digestion
3. Chemical Digestion
4. Peristalsis
5. Absorption
6. Storage
7. Defecation

Cardiovascular System
Figure-8 Loop

Pulmonary System

8

Systemic System

Capillary beds of lungs where gas exchange occurs
Pulmonary circuit
Pulmonary arteries
Pulmonary veins
Vena cavae
Aorta and branches
Right ventricle
Left ventricle
Systemic circuit
Arterioles
Capillary beds of all body tissues where gas exchange occurs
Venules
Oxygen-poor, CO2-rich blood
Oxygen-rich, CO2-poor blood

DC 2003
Atherosclerosis developing within vessel walls!
CABG ≡
Coronary Artery Bypass Graft
Cigarette Smoking: #1 Preventable Cause of Premature Death in the US

Cardiovascular Mortality (average annual incidence per 1,000)

- None: 7
- Less than 20: 8.4
- 20: 10.2
- More than 20: 12.4
- Quit One Year: 7

Cigarettes smoked per day
How much aerobic?

Continuous exercise

- > 50% muscle mass
- > Conversational pace
- 20-60 min/session
- 3-5 days/wk
Healthy Oils to Minimize Atherosclerosis

HAPOC?
(c) When blood pressure is 120/80:

- Cuff pressure is greater than 120 mm Hg.
- No blood flows through vessel.
- No sound is heard.

Blood flow through vessel is turbulent whenever blood pressure exceeds cuff pressure.

Intermittent sounds are heard as blood pressure fluctuates throughout cardiac cycle.

- Cuff pressure is less than 80 mm Hg.
- Blood flows through vessel in smooth, laminar fashion.
- No sound is heard.
What's in Blood? Plasma & Blood Cells

Plasma (55% of whole blood)

- Buffy coat: platelets and leukocytes (<1% of whole blood)
- Erythrocytes (45% of whole blood)

- Platelets
- Leukocytes (white blood cells)
- Erythrocytes (red blood cells)
A & B Antigens
(Agglutinogens)
Glucose: Sugar in Blood

Normal: 70-99
Pre-Diabetes: 100-125
Diabetes: ≥ 126 mg/dL
NB: Diabetics have problems either here or here.

Cellular uptake and utilization of glucose

Times of Plenty!!

Blood

Glucose

Islets

A cells

Glucagon

B cells

Insulin

Fox 1987

Store!
ANP = Atrial Natriuretic Polypeptide
Motor

M. Supplementary motor area (on inner surface—not visible; programming of complex movements)

M. Premotor cortex (coordination of complex movements)

M. Primary motor cortex (voluntary movement)

Central sulcus

Sensory

S. Primary sensory cortex (sensation)

A. Posterior parietal cortex (integration of somatosensory and visual input; important for complex movements)

A. Wernicke’s area (speech understanding)

A. Parietal-temporal-occipital association cortex (integration of all sensory input; important in language)

S. Primary visual cortex surrounded by higher-order visual cortex (sight)

A. Limbic association cortex (mostly on inner and bottom surface of temporal lobe; motivation and emotion; memory)

A. Prefrontal association cortex (planning for voluntary activity; decision making; personality traits)

M. Broca’s area (speech formation)

Key

M. Motor cortex
A. Association cortex
S. Sensory cortex
Homeostasis is a **dynamic balance** between the autonomic branches.

- **Parasympathetic**
  - Rest-and-digest: Parasympathetic activity dominates.

- **Sympathetic**
  - Fight-or-flight: Sympathetic activity dominates.

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Axon of motor neuron
Myelin sheath
Action potential propagation in motor neuron
Axon terminal
Terminal button
Vesicle of acetylcholine
Calcium channel
Action potential propagation in muscle fiber
Plasma membrane of muscle fiber
Acetylcholine receptor site
Cation channel
Acetylcholinesterase
Motor end plate
Contractile elements within muscle fiber
Local current flow between depolarized end plate and adjacent membrane
Muscular System

Body systems maintain homeostasis

Homeostasis is essential for survival of cells

Cells make up body systems

Cells

LS ch 8 p 202
LS 2012 fig 8-7
Atrophy

decrease in size & strength

Hypertrophy

increase in size & strength
NB: In vivo, Cupola or peak of each lung goes into neck > clavicle line!
Not only the Brain, but the Heart & 100s of Other Tissues and Organs are Adversely Affected!
I ❤️ U of O!

Students who succeed are usually those who:

1. **Attend** class regularly
2. **Ask** questions
3. **Come** to office hours & problem-solving sessions
4. **Study** outside class both alone & in study groups
5. **Seek** to understand methods & overarching principles/concepts rather than specific answers
6. **Teach** or tutor others &
7. **Discuss** concepts informally with fellow students.

ANATOMY vs PHYSIOLOGY
STRUCTURE vs FUNCTION
WHAT? vs HOW?
WHERE? vs WHY?
Structure begets function!
Structure gives rise to function!
Structure & function are inseparable!
Knee Structure-Function?
Preoperative Diagnoses: R Knee
Degenerative Joint Disease (DJD) = arthritis
Varus malalignment = bow-leg

Procedures:
Arthroscopy & microfracture
High Tibial Osteotomy (HTO)
Packing bone graft substitute

Blocks/Medications:
Femoral n. block
General anesthesia
IV Morphine, Oral Oxycontin + Oxycodone,
Tylenol, Injectable Lovenox (enoxaparin Na)
R knee medial meniscus cleavage & tear
R knee lateral compartment in good shape!
1. Arthroscopy clean-up
2. Debridement complete
3. Microfracture with awl
4. Punctuate bleeding
Further bleeding to create superclot!
High-Tibial Osteotomy (HTO) to Realign the Joint

1. Oscillating saw cut
2. R plate/scaffolding insert
3. Align, stabilize w/screws & pack defect
Post-Operative Reality: 10 d injectable anti-coagulant, 3 wk oral anti-coagulant, 4 wk CPM machine, non-wt bearing 8 wk, 12 wk PT, 3-5 d/wk,...

CPM ≡ Torture Device
Break for discussion/questions!
Body Levels of Organization

1. Molecular
2. Cellular
3. Tissue
4. Organ
5. System

Entire Organism, like you & me!
Epithelial tissue gives rise to glands: (a) exocrine & (b) endocrine

(a) Exocrine gland

(b) Endocrine gland
Epithelial tissue in frog skin developing into an exocrine gland!
Organs are made up ≥ 2 tissue types

Organ:
Body structure that integrates different tissues and carries out a specific function

- **Epithelial tissue**: protection, secretion, absorption
- **Connective tissue**: structural support
- **Muscle tissue**: movement
- **Nervous tissue**: communication, coordination, control

LS fig 1-2 p 4
Which body systems?
Which body systems?
Why study human physiology?
KNOWLEDGE IS POWER!!!

Thomas Hobbes of Malmesbury
English Philosopher, 1658
Homeostasis is essential for cell survival!
Maintenance of a relative constancy in the Internal environment = ECF = fluid outside of cells

milieu interieur?

100 trillion cells working intimately

Claude Bernard

Walter B. Cannon
Where is extracellular fluid?
Where is extracellular fluid?

As long as between/outside cells, ECF everywhere?

G&H 2011
ICF = Intracellular

ECF = Extracellular

Plasma (within CV System)

Interstitium (eg, between muscle cells)
HOMEOKINESIS?
Dr. Evonuk’s 6 Balances

- Metabolic
  - ANA-
  - CATA-
- H₂O
- Ion⁺⁻
- O₂/CO₂
- pH
- ToC

Carbon Dioxide

Electricity

Salt

Bicarbonate and pH Balance