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!
BI 121 Required Texts
http://uoduckstore.com/

Human Body Systems
Structure, Function, and Environment
SECOND EDITION 2013

Daniel D. Chiras

Introduction to Human Physiology
Department of Biology, BI 121
Laboratory Manual
University of Oregon
Eugene, OR 97403
Fall 2017

DC
New $32.00 Used $23.25

LM
Lab Notebook $ 9.90
BI 121 Optional Source @ Amazon.com or Smith Family Bookstore?

Publisher’s Price → Gold Nuggets?

Fundamentals of Human Physiology 4E
Lauralee Sherwood

LS 2012
New $253.95! Used $53.11 - $188.66 Rental $40.49 E-Book $20.99
Dr. Evonuk’s 6 Balances

- Metabolic
  - ANA-
  - CATA-

- $\text{H}_2\text{O}$
- $T_{\text{oC}}$

- $\text{O}_2/\text{CO}_2$

- Ion +/-
Mitochondria: Energy Organelles

Proteins of electron transport system

Inner mitochondrial membrane

Matrix

Intermembrane space

Outer mitochondrial membrane

Cristae
What does DNA look like? Double-helix!!
What are DNA’s major functions?
Heredity + Day-to-Day Cell Function
Dietary Analyses: SuperTracker + Diet Organizer!
Dietary Composition & Physical Endurance

High-fat diet (eg, Atkins!)
~ 1/3 endurance!

Normal mixed diet

High-carbohydrate diet

Maximum endurance time:
57 min
114 min
167 min
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

Systemic System
Atherosclerosis developing within vessel walls!
CABG ≡ Coronary Artery Bypass Graft
Cigarette Smoking: #1 Preventable Cause of Premature Death in the US
How much aerobic?

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

HAPOC?
With the right food choices, physical activity, and not smoking, we could prevent about ~90% of diabetes, 80% of heart disease & 70% of stroke!
(c) When blood pressure is 120/80:

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

- Cuff pressure is between 120 and 80 mm Hg.
- 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
Times of Plenty!!

NB: Diabetics have problems either here or here.

Fox 1987
ANP = Atrial Natriuretic Polypeptide
M. Supplementary motor area (on inner surface—not visible; programming of complex movements)

M. Premotor cortex (coordination of complex movements)

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

M. Broca’s area (speech formation)

S. Primary auditory cortex surrounded by higher-order auditory cortex (hearing)

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

M. Primary motor cortex (voluntary movement)

Central sulcus

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)

Key

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

Rest-and-digest: Parasympathetic activity dominates.

Fight-or-flight: Sympathetic activity dominates.
Homeostasis is essential for the survival of cells. Body systems maintain homeostasis, and cells make up body systems.
A sarcomere is the basic contractile unit of muscle fibers, characterized by the presence of Z lines and the H zone. In the relaxed state, the sarcomere has a relaxed configuration with the I band, A band, and H zone clearly visible. During contraction, the sarcomere shortens, and the I band contracts, leading to a reduction in the size of the H zone and the A band. The thick filaments slide within the thin filaments, resulting in a shorter sarcomere and muscle contraction. This process is essential for muscle function, allowing muscles to perform work and generate force.
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!
Nerve conducts

Muscle contracts

Connective connects!!

Epithelial covers
Epithelial tissue gives rise to glands: (a) exocrine & (b) endocrine

(a) Exocrine gland

(b) Endocrine gland

Surface epithelium
Duct cell
Secretory exocrine gland cell

Surface epithelium
Secretory endocrine gland cell
Blood vessel

LS fig 1-3 p 4
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
Which body systems?
Which body systems?
Why study human physiology?
KNOWLEDGE IS POWER!!!
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)
Homeostasis or Homeokinesis?

https://www.khanacademy.org/partner-content/mit-k12/chem-and-bio/v/homeostasis
Dr. Evonuk’s 6 Balances

Metabolic

ANAH-  CATAH-  H2O  ToC

O2/CO2  pH  Ion+/-

Carbon Dioxide  Electricity  Bicarbonate and pH Balance