I. **Announcements**: Please check & sign attendance roster. Not on list? See Pat during a break or after class. *Lab 1 Histology* tomorrow in 130 HUE: 12 n & 1 pm sections.

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

Human Body Systems
Structure, Function, and Environment
SECOND EDITION

Daniel D. Chiras

DC
New (2013 ed) $28.25 Used $19.50

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

LM
Lab Notebook $9.75
BL 121 Optional Source @ Amazon.com or Smith Family Bookstore?

Publisher's Price. Gold nuggets?

List price $298.95! Valore Books $18.48 to Cengage Brain $59.49
Dr. Evonuk’s 6 Balances

- Metabolic
  - ANA-
  - CATA-

- H$_2$O
- ToC

- O$_2$/CO$_2$

- Ion$^+/$-

- pH
Mitochondria: Energy Organelles

Proteins of electron transport system

Inner mitochondrial membrane

Matrix

Intermembrane space

Cristae

Outer mitochondrial membrane

Cristae
<table>
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<tr>
<th>PRIMARY FUEL</th>
<th>ACTIVITY</th>
<th>% AEROBIC (Oxidative Energy System)</th>
<th>% ANAEROBIC (Immediate &amp; Non-Oxidative Energy Systems)</th>
<th>TIME (Min:Sec)</th>
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<td>(Small Amounts)</td>
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<tr>
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<td>1-Mile Run</td>
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<td>Soccer Lacrosse</td>
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<tr>
<td>&amp; Creatine</td>
<td>Tennis</td>
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<tr>
<td>&amp; Creatine</td>
<td>Volleyball</td>
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**AEROBIC w/O₂**

**ANAEROBIC Immediate/ATP-PC**

**MITOCHONDRIA**

**CYTOSOL**

**Glycolysis**
What does DNA look like? Double-helix!!
What are DNA’s major functions?
Heredity + Day-to-Day Cell Function
Dietary Analyses Thanks to Michelle Obama!
Dietary Composition & Physical Endurance

eg, Atkins!

High-fat diet

Normal mixed diet

High-carbohydrate diet

~ 1/3 endurance!

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

8

Systemic System

Capillary beds of lungs where gas exchange occurs

Pulmonary circuit

Pulmonary arteries

Vena cavae

Right ventricle

Pulmonary veins

Aorta and branches

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!

- Smooth muscle cells
- Tunica media
- Lumen of vessel
- Fat
- Ulceration
- Endothelium
- Cholesterol crystals

SI Fox 1987 p 370
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
- More than 20: 10.2
- Quit One Year: 12.4
- Quit: 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?
(a)

(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)

Packed cell volume, or hematocrit

© National Cancer Institute/Photo Researchers, Inc.
A & B Antigens
(Agglutinogens)
Glucose: Sugar in Blood

- **Normal:** 70-99 mg/dL
- **Pre-Diabetes:** 100-125 mg/dL
- **Diabetes:** ≥ 126 mg/dL
Times of Plenty!!

NB: Diabetics have problems either here or here.

Cellular uptake and utilization of glucose

Fox 1987
ANP = Atrial Natriuretic Polypeptide

- Pineal
- Hypothalamus
- Pituitary
- Parathyroid
- Thyroid
- Thymus
- Heart
- Stomach
- Adrenal gland
- Pancreas
- Duodenum
- Kidney
- Skin
- Ovaries in female
- Placenta in pregnant female

Legend:
- Red: Solely endocrine function
- Green: Mixed function
- Blue: Complete function uncertain

Testes in male
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)

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 sensory cortex (sensation)

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

A. Wernicke’s area (speech understanding)

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

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

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 survival of cells.

Body systems maintain homeostasis.

Cells make up body systems.
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!
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!

![Diagram of protein structures](image-url)
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,...
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
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
- $\text{H}_2\text{O}$
- $\text{pH}$
- Ion$^{+/-}$
- $\text{O}_2/\text{CO}_2$
- ToC

- ANA-
- CATA-