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 pp 1-6, DC pp 1-5
   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
ANATOMY vs PHYSIOLOGY
STRUCTURE vs FUNCTION
WHAT? vs HOW?
WHERE? vs WHY?
Structure begets function!
Structure gives rise to function!
Structure & function are inseparable!
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)
1. Arthroscopy clean-up
2. Debridement complete
3. Microfracture with awl
4. Punctuate bleeding
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,...
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
Which body systems?
I. **Announcements** Lab 1 Histology today!
   130 HUE. Fun! Readings: DC, LS, LM? **NB:** Course website UO Biology vs. Blackboard [http://blogs.uoregon.edu/bi121/fall-2014/]

II. **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. **Homeostatic Balances?** LS p 9, DC pp 5-6
   D. **Why?** Cell survival! LS fig 1-5 p 9, DC p 5
   E. **Physiology in the News** H₂O? Are we like watermelons?
   F. **How** are balances maintained? Simplified Homeostatic Model *cf:* LS fig 1-7 p 14; T°C + BP balance e.g. + vs. - FB

III. **Cell Anatomy, Physiology & Compartmentalization** LS ch 2
   B. Basic survival skills LS ch 1 p 3
   C. Organelles ≡ Intracellular specialty shops
      Endoplasmic Reticulum (ER), Golgi, Lysosomes, Peroxisomes & Mitochondria, LS fig 2-1, 2-2, 2-3 pp 20-3
Maintenance of a relative constancy in the Internal environment = ECF = fluid outside of cells
Where is extracellular fluid?

As long as between/outside cells, ECF everywhere?
ICF = Intracellular

ECF = Extracellular

Plasma (within CV System)

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

Metabolic

ANA-  CATA-

H₂O

T₀C

O₂/CO₂

Ion+/-

pH
Drink about 1 L per 1000 calories energy expenditure!!

Human ~ 2/3 H₂O
~ 60 – 70 %

= ~40 – 48 kg H₂O

NB: So 2000 kcal →
drink 2000 mL
≡ 67.63 fl oz
≡ ~ 8 cups!

150 lb /68 kg
Invariably, Invariably, Negative Feedback

Feedback loop

Invariably, Negative Feedback
**NB:** Though most often negative feedback, there are exceptions:

Selected +FB eg:

LH Surge + Ovulation
Oxytocin + Uterine Contraction
Blood Clotting Cascade
cAMP Cascade
Na+ influx during AP
INPUT:
- Dietary Drink: 1200 mL
- Dietary Eat: 400 mL
- Oxidation: 400 mL

Total = 2000 mL

OUTPUT:
- Urine: 1000 mL
- Sweat + Insensible: 900 mL
- Feces: 100 mL

Total = 2000 mL

\[ \text{ICF} = 35 \text{L} \]
\[ \text{ECF} = 14 \text{L} \]
\[ \text{Interstitium} = 11 \text{L} \]
\[ \text{Plasma} = 3 \text{L} \]

\[ 70\% \text{ H}_2\text{O} \Rightarrow 49 \text{L} \]

\[ 70 \text{ kg} \Rightarrow \]

\[ \text{H}_2\text{O} \Rightarrow \text{BALANCE!} \]
Venous Pooling

Seated to Standing

BP

I

R

Baroreceptors/Pressure Receptors eg, in Carotids & Aorta

NB: Corrective Change Opposes Original Input

E

Ef

CV Control Center Brain Stem

O

Electrochemical Signal eg, Symp Accel N

BP

HR

VC

+ +
BI 121 Lecture 3  Anatomy & Physiology Lab Thurs! Fun again...

I. **Announcements**  Sign roster? OSA Voting. Q? Office hr?
II. **Cell Anatomy, Physiology & Compartmentalization**  LS ch 2
   B. Basic survival skills ch 1 p 3
   C. Organelles ≡ Membranous, cytoplasmic specialty shops!
      1. Endoplasmic Reticulum (ER) 2. Golgi 3. Lysosomes
      fig 2-1, 2-2, 2-3, 2-4, 2-5, 2-6, 2-7, 2-8 pp 20-7 tab 2-1 p 36
   D. What about vaults? LS 2006, p 32
   E. **Physiol News**  Moms eggs execute Dad’s mitochondria?
III. **Anaerobic vs Aerobic Metabolism Overview**  Many sources! Mathews & Fox 1976...LS 2012 pp 26-33, fig 2-15 p 33
IV. **Introduction to Genetics**  LS 2012 ch 2 p 20-1 + Appendix C
   A. What’s a gene? Where? p A-18, fig C-2, C-3
   B. Why are genes important? p A-18
   C. What’s DNA & what does it look like? pp A-18 thru A-20
   D. How does information flow in the cell? fig C-6
   E. How does DNA differ from RNA? pp A-20 thru A-22
   G. How are proteins made? fig C-7, C-9
Cytoplasm = Cell - Nucleus

[Extract nucleus; includes organelles]

Cytosol = Cytoplasm - Organelles

[Extract organelles; complex gel-liquid]
Why Compartments? Advantage?

_Incompatible_ reactions can take place _Simultaneously!!_
Basic Cell Survival Skills?

1. Get food
2. Use food
3. Rid wastes
4. Move
5. Reproduce

How to live?

Nucleus or nose?
1 e.g. Cell of 100 Trillion!
Rough & Smooth Endoplasmic Reticulum (ER): Protein & Lipid Synthesizing Factories

Smooth ER:
1. packages new proteins in transport vesicles
2. stores calcium in muscles

fig 2-2 LS 2012
Secretion of Proteins Produced by ER
Lysosomes vs. Peroxisomes
L. Nilsson, Nat Geog 1986

http://www.hopkinsmedicine.org/cellbio/devreotes/videos.htm


Film: Neutrophil engulfing bacterium
Catalase Enzyme Reaction in Peroxisomes
Neutralize Toxin at Production Site!

$$2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$$
Mitochondria: Energy Organelles

- Intermembrane space
- Cristae
- Proteins of electron transport system
- Inner mitochondrial membrane
- Matrix
- Outer mitochondrial membrane

Cristae

fig 2-8 LS 2012
I. **Announcements**  
Anatomy & Physiology Lab today!  
Be sure to complete p 3-7 dietary record in LM < lab next wk!  
Help with estimating serving sizes for Nutrition Lab 3. Q?

II. **Physiology in the News + Connections**  
Mom’s eggs execute dad’s mitochondria? What’s a vault? Science News

III. **Anaerobic vs Aerobic Metabolism Summary**  
LS ch 2 pp 26-33  
A. Take-home points + key differences fig 2-15 + vpl  
B. Few details: Glycolysis, CAC, ETC fig 2-9, 2-10, 2-11, 2-12

IV. **Cytoskeleton**  
LS 2012 fig 2-17, 2-18 + LS 2006 fig 2-20

V. **Introduction to Genetics**  
LS pp 20-1 + Appendix C  
A. What’s a gene? Where? p A-18, fig C-2, C-3  
B. Why are genes important? p A-18  
C. What’s DNA & what does it look like? pp A-18 thru A-20  
D. How does information flow in the cell? fig C-6  
E. How does DNA differ from RNA? pp A-20 thru A-22  
G. How are proteins made? Class skit! fig C-7, C-9

Structure-function = fun!
4 oz → 3 oz

Deck of Cards

http://blogs.uoregon.edu/bi121/fall-2014/

raw → cooked

1/4 c

1/3 c

1 c

1 oz

1.5 oz
Inside a fertilized egg, with its two sets of chromosomes (blue), the protein ubiquitin (red) tags sperm mitochondria (yellow).

An organelle?

Vaults Hold Cell Mystery
AEROBIC
w/O₂
= MITOCHONDRION

ANAEROBIC
without O₂
= CYTOSOL

1. Immediate/ATP-PC
2. Glycolysis
ATP Supplied

Performance Time

Power Output

ATP-PC/Immediate

15 - 30 s

Cytosol

Mitochondria

Oxygen System

≥ 3 – 5 m

Anaerobic

Glycolysis

1.5 – 3 m

Aerobic

Modified after Mathews & Fox
Cleave One High Energy Phosphate Bond To Do Work!!

7 – 10 KiloCalories/KCal

1 Synthesis of Macromolecules
Make big things from little things!

2 Membrane Transport
Move things! Microscopic!

3 Mechanical Work
Move things! Macroscopic!

Adenosine

Pi

Anaerobic vs. Aerobic Metabolism

Anaerobic Glycolysis
"sugar dissolving" without O₂. Net of 2 ATP per molecule of glucose

Aerobic Metabolism
+mitochondrial processing of glucose with O₂. Net of 32 ATP per molecule of glucose

fig 2-15 LS 2012
AEROBIC w/O₂

ANAEROBIC

Glycolysis

Mitochondria

Cytosol

Immediate/ATP-PC
Goals of Aerobic Metabolism

AEROBIC = MITOCHONDRION
w/O₂

CITRIC ACID CYCLE
harvest electrons

ELECTRON TRANSPORT CHAIN
"cash in"

for ATP Energy!!
What are DNA’s major functions?
Heredity + Day-to-Day Cell Function
I. **Announcements** Nutrition Analysis Lab this Thursday! Please record diet on p 3-7 LM & begin analysis using [https://www.supertracker.usda.gov/](https://www.supertracker.usda.gov/) Q?

II. **Introduction to Genetics** LS 2012 ch 2 p 20-1 + Appendix C
- A. What’s a gene? Where located? Why important? p A-18, fig C-2, C-3
- B. How does information flow in the cell? fig C-6
- C. How does DNA differ from RNA? pp A-20 thru A-22
- E. How & where are proteins made? fig C-7, C-9
- F. Class skit: Making proteins @ ribosomes!

III. **Nutrition Primer** Sizer & Whitney (S&W) Sci Lib
- A. Essential Nutrients: H₂O, 1⁰ Carbohydrates, 2⁰ Fats, 3⁰ Proteins, Vitamins, Minerals; Macro- vs Micro-?
- B. Dietary Guidelines: USDA, AICR, Eat Like the Rainbow!
- D. Beware of Nutrition Quackery S. Kleiner & Monaco 1990!
What does DNA look like? Double-helix!!
Gene = Stretch of DNA that codes for a protein

cf: LS fig C-3
What does DNA do, day-to-day?

DNA → Replication

RNA → Transcription

Protein → Translation @ ribosomes

Nucleus → Cytoplasm

cf: LS fig C-6
DNA vs RNA?

1. Double-stranded
2. Deoxyribose (without oxygen)
3. A, T, C, G
   Thymine
4. Self-replicative (can copy itself)
5. Nucleus (+mitochondria)

1. Single-stranded
2. Ribose (with oxygen)
3. A, U, C, G
   Uracil
4. Needs DNA as template
5. 1⁰ Cytoplasm (but Nucleus origin)
6. mRNA, rRNA, tRNA
**Triplets of bases code for amino acids, the building blocks of proteins**

<table>
<thead>
<tr>
<th>DNA code word</th>
<th>mRNA codon</th>
<th>tRNA anti-codon</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAT</td>
<td>AUA</td>
<td>UAU</td>
</tr>
<tr>
<td>ACG</td>
<td>UGC</td>
<td>ACG</td>
</tr>
<tr>
<td>TTT</td>
<td>AAA</td>
<td>UUU</td>
</tr>
<tr>
<td>TAC</td>
<td>AUG</td>
<td>UAC</td>
</tr>
</tbody>
</table>
Translation? Ribosomes Make Proteins

LS 2012 fig C-7
Macronutrients & Micronutrients
Essential for Life

**Macronutrients**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Sample Food Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water (H₂O)</td>
<td>Water, other drinks, fruits &amp; vegetables</td>
</tr>
<tr>
<td>1° Carbohydrates</td>
<td>Grains, vegetables, fruits, dairy products</td>
</tr>
<tr>
<td>2° Fats/Lipids</td>
<td>Meats, full-fat dairy products, oils</td>
</tr>
<tr>
<td>3° Proteins</td>
<td>Meats, legumes, dairy vegetables</td>
</tr>
</tbody>
</table>

**Micronutrients**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Sample Food Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamins (A, D, E, K; C + B)</td>
<td>Vegetables, vegetable oils, fruits, citrus, grains, dairy</td>
</tr>
<tr>
<td>Minerals (K⁺, Na⁺, Ca²⁺, Mg²⁺, Fe²⁺, Zn²⁺,…)</td>
<td>Fruits, vegetables, grains, nuts, dairy, meats, processed foods</td>
</tr>
</tbody>
</table>

*NB: Need only minute quantities!*

**Energy nutrients = yield ATP**
2. Focus on fruits. Whole fruit preferable to juice, but any fruit counts! Fill ½ your plate with fruits & vegetables!

3. Make at least ½ of your grains whole grains!

4. Go lean with protein. Keep protein to < ¼ plate! Nuts, beans, peas, seeds, poultry, lean meat, seafood,…

5. Get your calcium-rich foods. Buy skim or 1% milk. Go easy on cheese!

MyPlate launched June 2, 2011!
Diet & Health Guidelines for Cancer Prevention

1. Choose a diet rich in variety of plant-based foods.
2. Eat plenty of vegetables & fruits.
3. Maintain a healthy weight & be physically active.
4. Drink alcohol only in moderation, if at all.
5. Select foods low in fat & salt.
   
   And always, remember...

   Do not smoke or use tobacco in any form.

American Institute for Cancer Research (AICR)
Your plate should be the size of a Frisbee, not a manhole cover.

When it comes to colorful foods, Fruit Loops don’t count.

A surprising number of people get 1/5 of their calories from sodas or other liquids.

If you look at the label & need a chemistry degree to read it, put the item back on the shelf!

BI 121 Lecture 6  Nutrition Lab 3 today! More fun about me...

**I. Announcements** Nutrition Lab Today! Got Data? Q?
If you want notebook to study for Exam I on Oct 28th, turn in prior lecture next Tuesday, Oct 21st. Sample Exam Q.

**II. Nutrition Connections**  Sizer & Whitney (S&W) Sci Lib + DC
A. Diet or exercise? Diet composition & endurance? Fasting?
   Zuti & Golding 1976; Sacks *AHA NPAM Council* 2009;
   AMDR? Adjusted Macronutrient Distribution Range!
B. Beware of Nutrition Quackery S. Kleiner & Monaco 1990!

**III. Gastrointestinal Physiology** DC Module 3 pp 17-23, LS ch 15+
A. Steps of digestion, hydrolysis central theme LS pp 437-9
B. What’s missing? LS fig 15-1 p 438
D. How is the gut controlled?
E. Organ-by-organ review A&P LS tab 15-1 pp 440-1 +...
F. Zymogen? = Inactive precursor LS fig 15-9 p 452...
   [http://www.cdc.gov/ulcer](http://www.cdc.gov/ulcer) Beyond the Basics LS p 456
I. Large intestine? LS fig 15-24 pp 472-4

NB: Each group 500 kcal deficit/day, 16 weeks
Exercise is better than dieting in lowering body fat & preserving muscles!
Dietary Composition & Physical Endurance

- **High-fat diet:** eg, Atkins!
- **Normal mixed diet:** ~ 1/3 endurance!
- **High-carbohydrate diet:** Maximum endurance time:
  - 57 min
  - 114 min
  - 167 min
Negative Effects of Low Carbohydrate

1. ↑ fatigue/exhaustion central & peripheral!
2. ↓ glucose – brain+spinal cord, rbcs thrive upon.
3. ↓ variety which reduces intake of phytochemicals, vitamins, minerals & fiber.
4. ↑ risk of respiratory infections. + gall stones, ↓ thermoregulation...
We’re better at storing fat vs carbohydrate!

Dietary Fat → 3 % Kcal → Body Fat → 23 % Kcal

Dietary Carbohydrate
To Help Lower Body Wt & %Fat
EXERCISE!! +Minimize These!!

- FAT 9 Kcal/g
- ETOH 7 Kcal/g
- CARB 4 Kcal/g
- PRO 4 Kcal/g

NB: Minimize not Eliminate!
Moderation not Abstinence!!
60-day Fast???

Lost 60 lb!! Wow!!

Yet

{ > \frac{3}{4} \\
26 \text{ lb Water} \\
20 \text{ lb Lean Body Mass} \\
14 \text{ lb Fat} \\

Fat < \frac{1}{4} \text{ total wt loss!}
**Dr. Sacks’ Conclusions:**

We conclude that healthful diets with varying emphases on carbohydrate, fat & protein levels can all achieve clinically meaningful weight loss & maintenance of weight loss over a 2-yr period. The results give people who need to lose weight the flexibility to choose a diet that they can stick with, as long as it’s heart healthy. Such diets can also be tailored for individuals based on their personal & cultural preferences & in this regard may have the best chance for long-term success.
### US Dietary Recommended Intakes (DRI) Committee Acceptable Macronutrient Distribution Ranges (AMDR)

<table>
<thead>
<tr>
<th>Energy Nutrient</th>
<th>% Total Calories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td>45-65%</td>
</tr>
<tr>
<td>Fat</td>
<td>20-35%</td>
</tr>
<tr>
<td>Protein</td>
<td>10-35%</td>
</tr>
</tbody>
</table>
Kleiner's & Monaco's Top 10 Hit List for Nutrition Quackery

1. Treatment based on **unproven theory** calling for non-toxic, painless therapy.

2. Author's/purveyor's **credentials aren't recognized** in scientific community.

3. **No reports in scientific, peer-reviewed literature** but rather mass media used for marketing.

4. Purveyors claim **medical establishment is against them & play on public's paranoia about phantom greed of medical establishment.**

5. Treatments, potions, drugs manufactured according to **secret formula.**

6. **Excessive claims promising miraculous cures**, disease prevention or life extension.

7. **Emotional images** rather than facts used to support claims.

8. Treatments **require special nutritional support** including health food products, vitamins and/or minerals.

9. Clients are cautioned about discussing program to avoid negative.

10. Programs based on **drugs or treatments not labeled** for such use.
AHA + DASH + MAYO CLINIC

Trade Books

Peer-Reviewed = Texts → Research

Not Peer-Reviewed = Trade Books

Lower Carbohydrate

Lower Fat

Eliminate Calories or Food Groups

Encourage Fasting

Adequacy

Balance

Consistency & Moderation

Choose MyPlate.gov
5 times per wk? $\equiv 106,600$ calories/yr $\equiv \pm 30.5$ lb fat/yr

Better choices!
Digestion Steps

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

Hi gang!!
You need me for digestion!!

H₂O + Enzyme

Hydrolysis of Energy Nutrients
**Polymer to Monomer (Many to One)**

- Carbohydrate
  - Glucose
- Protein + Fat
  - Amino Acids
    - Fatty Acids + Glycerol
GI-DONUT ANALOGY

GI LUMEN

BODY
BI 121 Lecture 7  Exam I one week from today! I’ll be ready!...

I. Announcements Lab Notebooks? Q? from last time?

II. GI Physiology Connections DC Module 3 pp 17-23, LS ch 15+
   A. How is the gut controlled? Common control mechanisms
   B. Gut layers LS fig 15-2 pp 439-43 DC p 23
   D. Organ-by-organ review A&P LS tab 15-1 pp 440-1 +...
   E. Zymogen? = Inactive precursor LS fig 15-9 p 452...
      http://www.cdc.gov/ulcer Beyond the Basics LS p 456
   H. Large intestine? LS fig 15-24 pp 472-4

III. Cardiovascular System DC Mod 4, LS ch 9, Torstar, G&H+…
   A. Circulatory vs. Cardiovascular (CV)? CV vs. Lymphatic
      CV Pulmonary & Systemic circuits DC pp23-31+LS p229+
      DC fig 4-1 p 24, LS fig 9-2b p 231
   B. Arteries, capillaries, veins, varicosities? G&H, Torstar, DC
   C. layers, box, chambers, valves, inlets, outlets
      LS fig 9-4 p 233, fig 9-2a p 231; DC pp 23-6
   D. Normal vs. abnormal blood flow thru & CVS LS, Fox+…
Common Control Mechanisms

1. Local (autoregulation)
2. Nervous (rapidly-acting)
3. Hormonal (slower-acting/reinforcing)
## Gut Secretions

<table>
<thead>
<tr>
<th>Secretion</th>
<th>Release Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mucus</td>
<td>into GI Lumen</td>
</tr>
<tr>
<td>2. Enzymes</td>
<td>into GI Lumen</td>
</tr>
<tr>
<td>3. $\text{H}_2\text{O}$, acids, bases+</td>
<td>into GI Lumen</td>
</tr>
<tr>
<td>4. Hormones</td>
<td>into Blood</td>
</tr>
</tbody>
</table>
1. **Mouth**

   *Ingestion* entry way
   salivary gland secretion
   mucus + enzymes
   enzymatic digestion: carbohydrate
   mastication = chewing
   deglutition = swallowing

2. **Esophagus**

   Rapid transit
   peristalsis
   secretion mucus

3. **Stomach**

   Mixing peristalsis
   secretion mucus + HCl
   + enzymes
   enzymatic digestion:
   protein + butter fat!

4. **Liver-Gall Bladder**

   Emulsification =
   detergent action of bile
   + secretion

5. **Pancreas**

   Secretion mucus +
   NaHCO₃ + enzymes
   enzymatic digestion:
   carbohydrate, fat, protein

6. **Small Intestine**

   Absorption
   Secretion mucus
   + enzymes
   enzymatic digestion:
   carbohydrate, fat, protein
   Peristalsis

7. **Large Intestine**

   Dehydration
   secretion + absorption
   storage + peristalsis
Zymogen = an inactive precursor
Endocrine + Exocrine functions; Makes enzymes for digesting all 3 energy nutrients!
Ulcer Facts

• Most ulcers are caused by an infection, not spicy food, acid or stress.
• The most common ulcer symptom is burning pain in the stomach.
• Your doctor can test you for *H. pylori* infection.
• Antibiotics are the new cure for ulcers.
• Eliminating *H. pylori* infections with antibiotics means that your ulcer can be cured for good.
Large Intestine Structure & Function

- Transverse colon
- Hastra
- Descending colon
- Ascending colon
- Ileocecal valve
- Cecum
- Appendix
- Rectum
- Sigmoid colon
- Internal anal sphincter (smooth muscle)
- External anal sphincter (skeletal muscle)
- Anal canal

LS 2012 fig 15-24 p 472
Cardiovascular (CV) = Heart + Vessels + Blood!
**NB:** Figure-8 loop

**Pulmonary**

8

**Systemic**

D Chiras 2013 fig 4-1b
Dual Pump Action & Parallel Circulation
I. **Announcements** Exam I next session; 12 n lab section go directly to 129 Huestis (HUE). All others here (100 WIL)! Review: Sunday, 6 pm here (100 WIL)! Lab notebooks. Q?

II. **Cardiovascular Connections** LS 2012 ch 9, Torstar Books+

III. **CV Physiology in News** AHA + NHLBI websites. Nic? ACSM, AHA, DHHS Healthy people exercise guidelines!

IV. **CV Pathophysiology & Risk Reduction** LS ch 9, 10 +…
   A. AMI, CVA, CVD, PVD, TIA, HTN? + surgical treatments
   B. Atherosclerosis? LS fig 9-27, 9-25, 9-26 pp 266-8
   C. How to minimize risk of CVDs? Treatment triad: Exercise, Diet, Drugs+Surgery
   D. Food choices make a difference?
      What’s HAPOC?
Lymphatic System

1. Lymph Nodes
2. Vessels
3. Lymph

No pump!
Lymphatic System Blockage in Elephantiasis from Mosquito-borne Parasitic Filaria Worm
Human $\heartsuit = 4$-chambered box? 2 separate pumps?

Upper = Atria

Lower = Ventricles

RA $\rightarrow$ RV $\rightarrow$ LV

LA $\rightarrow$ Pulmonary Systemic

Primer Pumps

Power Pumps
Human ❤️ = 4 unique valves? 2 valve sets?

Semilunar = Half-moon shaped
1. Pulmonic/Pulmonary
2. Aortic

AV = Atrioventricular
3. R AV = Tricuspid
4. L AV = Mitral/Bicuspid
Cardiac Cycle

**Systole**
- Contract
- & Empty

**Diastole**
- Relax
- & Fill

Diagram showing the cycle between systole and diastole.
Veins ➔ Atria ➔ Ventricles ➔ Arteries

http://www.nhlbi.nih.gov/health/health-topics/topics/hhw/contraction.html

LS2007
Guidelines: Healthy Adults < 65 yr

Do moderately intense aerobic exercise
30 min/d, 5 d/wk

OR

Do vigorously intense aerobic exercise
20 min/d, 3 d/wk

AND

Do 8-10 strength-training exercises
8-12 repetitions/each exercise, 2 d/wk
FIGURE 9-35
Extent of myocardial damage as a function of the size of the occluded vessel

L Sherwood 2004 p 336
Treatment Triad

NB: Last blasted resort!!

Drugs/Surgery

Exercise

Dietary Modification
300/200

KA-BOOM!

Hg
An LDL to HDL ratio **greater than** 5 to 1 in men or 4.5 to 1 in women.

**Increased risk of heart disease**
HEALTH-RELATED FITNESS

Cardiorespiratory Endurance

Muscular Strength/Endurance

Flexibility

Neuromuscular Relaxation
Pick an abundance of whole grains, legumes, nuts, vegetables & fruits!
Fish Oil Intakes & Cardiovascular Death Rates
Healthy Oils to Minimize Atherosclerosis

HAPOC?