ANNOUNCEMENTS Quiz 2 on Tuesday covers Lectures 4 & 5, GI Physiology & Nutrition. Please review slides 78-89 from last t! Lifetime information! Nutrition reports by e-mail to Conor or Emile by 5 pm next Tuesday. Update on outlines. Q?

II. Nutrition Connections Q in lab on coconut vs. other oils.

III. Blood + Body Resistance to Infection I

G&H ch 32, 33, LS, Stuart Fox, Daniel Chiras (DC), Basiro Davey

A. Blood: cell + fragments vs liquid (plasma vs serum) LS
B. Red blood cells, white blood cells, platelets, Demo? LS, DC
C. Red blood cell production, hemoglobin G&H pp 413-9 G&H fig 32-1 thru 32-6 +..., Fox
D. Pathogen? Microbe that causes disease, Davey pp 5-6
E. Barriers to infection Davey fig 2.1 p 12, fig 2.2 p 13
F. National Geographic, The Wars Within, Lennart Nilsson
G. WBC effectors: Innate & adaptive immunity G&H pp 433-7 G&H fig 34-1 + Davey fig 2.2 p 13, fig 3.4 p 24, fig 3.12 p 36
H. Medical Physiology News Handwashing to prevent infection! US Centers for Disease Control
Animal fats and the tropical oils of coconut and palm contain mostly saturated fatty acids.

<table>
<thead>
<tr>
<th>Fat Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coconut oil</td>
</tr>
<tr>
<td>Butter</td>
</tr>
<tr>
<td>Beef tallow (beef fat)</td>
</tr>
<tr>
<td>Palm oil</td>
</tr>
<tr>
<td>Lard (pork fat)</td>
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<tr>
<td>Chicken fat</td>
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</tbody>
</table>

Some vegetable oils, such as olive and canola, are rich in monounsaturated fatty acids.

<table>
<thead>
<tr>
<th>Oil Type</th>
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</thead>
<tbody>
<tr>
<td>Olive oil</td>
</tr>
<tr>
<td>Canola oil</td>
</tr>
<tr>
<td>Peanut oil</td>
</tr>
</tbody>
</table>

Many vegetable oils are rich in omega-6 polyunsaturated fatty acids.

<table>
<thead>
<tr>
<th>Oil Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safflower oil(^b)</td>
</tr>
<tr>
<td>Sunflower oil</td>
</tr>
<tr>
<td>Corn oil</td>
</tr>
<tr>
<td>Soybean oil</td>
</tr>
<tr>
<td>Walnut oil</td>
</tr>
<tr>
<td>Cottonseed oil</td>
</tr>
</tbody>
</table>

Only a few oils provide significant omega-3 polyunsaturated fatty acids.

<table>
<thead>
<tr>
<th>Oil Type</th>
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</thead>
<tbody>
<tr>
<td>Flaxseed oil</td>
</tr>
<tr>
<td>Fish oil(^c)</td>
</tr>
</tbody>
</table>

\(^a\)These families of polyunsaturated fatty acids are explained in a later section.

\(^b\)Salad or cooking type over 70% linoleic acid.

\(^c\)Fish oil average values derived from USDA data for salmon, sardine, and herring oils.
The Amazing BENEFITS of Coconut Oil

Nutritional Content in Coconut Oil:

- **Anti-oxidants**
- **MCT Medium-Chain Triglycerides**
- **Lauric Acid**
- **Caprylic Acid**
- **Capric Acid**

The Health & Healing Benefits of Coconut Oil:

**Skin Care**
The MCT in Coconut oil act as a natural skin conditioner. Deeply penetrating & moisturizing, they protect against environmental & free radical damage, it also helps with anti-aging, eczema & even provides some sun protection.

**Weight Loss**
The Fatty Acids in coconut oil destroy candida (yeast overgrowth) which triggers weight gain, carbohydrate cravings & fatigue. They’re easily digested & converted into energy, which helps to speed up metabolism & help burn stored fat.

**Hair Care**
Coconut oil is one of the best ways to provide nutrients to your hair. The fatty acids condition deeply from the inside of the strands out, Providing protein, eliminating dandruff & aiding in re-growth. Many people use it as a conditioner!

**Immunity**
The unique saturated fats of coconut oil contain antibacterial, antiviral, anti-fungal, and anti-parasitic properties that help strengthen the immune system. Consuming coconut oil regularly will reduce incidences of sickness.

**Diabetes**
Coconut oil may improve insulin sensitivity & glucose tolerance over time. It helps regulate blood sugar levels & protects against insulin resistance. It can even help prevent Type II Diabetes.

**Stress Relief**
Coconut oil is very soothing. The natural aroma of coconut is also very soothing. You can apply the oil to your head & gently massage to help remove mental fatigue.

**Infections**
Lauric Acid (found only in breast milk & coconut oil) is converted into monolaurin in the body. This may destroy bacterial & viral infections like measles, influenza, hepatitis C & even HIV. Monolaurin may also eliminate Athlete’s foot.

**Heart Health**
The fat in coconut oil does not have a negative effect on cholesterol. In fact, it helps improve your cholesterol profile. It helps prevent heart attack & stroke and may even cure heart disease.

**Digestion**
MCT molecules in coconut oil are small so they are easily digested with less strain on the pancreas & digestive system. Some are suffering from diabetes, obesity, gallbladder disease, or Crohn’s disease may benefit greatly from coconut oil.

**TIP:** Buy Organic, Unrefined, Cold-Pressed, Extra-Virgin Coconut Oil!!

**SOURCES:**
http://www.coconutresearchcenter.org
http://www.naturalnews.com
www.NaturalHealthyConcepts.com
Many claims with little scientific, peer-reviewed research support

Coconut Oil
Health Benefits

- Improves or Reverses Alzheimer’s Disease
- Improves Type 2 AND Type 1 Diabetes
- Improves or Heals Many Skin Diseases
  - Fungal Infections
  - Acne
  - Eczema
  - Keratosis Polaris
  - Psoriasis
  - Rosacea
- Provides Peak Performance Energy
  - Drug-free Energy
  - Longer Endurance
- Kills Candida Fungus
- Helps with Hypothyroidism
  - Increases Metabolism
  - Raises Body Temperature
- Conditions and Strengthens Hair
  - Penetrates Roots
  - Kills Lice
  - Improves Dandruff
- Kills many Bacteria AND Viruses
- Promotes Weight Loss
  - Preserves Muscle Mass
  - Promotes Ketosis

Find all the research at: CoconutOil.com

http://www.doctoroz.com/videos/surprising-health-benefits-coconut-oil
Coconut Oil
Nutritional Wonder?

Claims?
http://coconutoil.com/about-us/

Review articles, last 5 yr (1) on health benefits?

Other articles?

The bottom line?
http://www.cspinet.org/nah/articles/coconut-oil.html
http://health.clevelandclinic.org/2012/05/heart-healthy-cooking-oils-101/
http://en.wikipedia.org/wiki/Smoke_point
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)
Dermal bone production of red blood cells

![Graph showing the percentage of cellularity for different bones and shafts over age.](image)

G&H 2011 fig 32-1 p 414
Pluripotent Hematopoietic Stem Cell Lines

- PHSC (Pluripotent hematopoietic stem cell)
- CFU-S (Colony-forming unit–spleen)
- CFU-GM (Colony-forming unit–granulocytes, monocytes)
- CFU-B (Colony-forming unit–blast)
- CFU-E (Colony-forming unit–erythrocytes)

Erythrocytes

Granulocytes (Neutrophils) (Eosinophils) (Basophils)

Monocytes

Macrophages

Megakaryocytes

Platelets

T lymphocytes

B lymphocytes
Red Blood Cell Genesis

Proerythroblast

Basophil erythroblast

Polychromatophil erythroblast

Orthochromatric erythroblast

Reticulocyte

Erythrocytes

Microcytic, hypochromic anemia

Sickle cell anemia

Megaloblastic anemia

Erythroblastosis fetalis

G&H 2011 fig 32-3 p 415
Erythropoietin Regulates RBC Production

Hematopoietic Stem Cells

Proerythroblasts

Red Blood Cells

Tissue Oxygenation

Factors that decrease oxygenation
1. Low blood volume
2. Anemia
3. Low hemoglobin
4. Poor blood flow
5. Pulmonary disease

Decreases

Kidney

Erythropoietin

Decreases

G&H 2011 fig 32-4 p 416
Hemoglobin Formation

Citric Acid Cycle

I. 2 succinyl-CoA + 2 glycine

II. 4 pyrrole → protoporphyrin IX

III. protoporphyrin IX + Fe^{2+} → heme

IV. heme + polypeptide → hemoglobin chain (α or β)

V. 2 α chains + 2 β chains → hemoglobin A

G&H 2011 fig 32-5 p 417
Heme Structure

G&H 2011 fig 32-6 p 418
Hemoglobin Structure

L Sherwood 2011 fig 11-2
What a difference one amino acid can make!

Amino acid sequence of normal hemoglobin:
Val → His → Leu → Thr → Pro → Glu → Glu

Amino acid sequence of sickle-cell hemoglobin:
Val → His → Leu → Thr → Pro → Val → Glu

S&W 2011 fig 6-5 p 194
Megakaryocyte

Platelets/Thrombocytes

Immune Response

1. Detect invader or ID toxic product.
2. Communicate to network.
3. Recruit coordinated, multi-pronged attack.
4. Amplify & if yes to success, then –
5. Suppress

Davey 1990 p 6
Pathogen?
Microbes that cause disease!

- Bacteria
- Viruses
- Fungi
- Protozoa
- + Multicellular Parasites, e.g., ticks & lice

Davey 1990 p 5
Pathogens & Parasites Cause:

1. **70-80% of deaths in less developed countries**
2. **Tens of millions of deaths due to infectious diseases**
3. **> 20 million childhood deaths per year in Asia, Africa & Latin America due to diarrheal infections alone**
4. Yet **< 2% deaths in modern, industrialized countries!**

*World Health Organization 2011 Statistics + [Link](http://www.who.int/bulletin/volumes/86/9/07-050054.pdf)*

Davey 1990 p 5
Why such striking differences across the world?

1. Poor sanitation
2. Contaminated water supply
3. Contaminated food supply
4. Malnutrition
5. Existing infections
6. Patchy, inadequately-funded vaccinations
7. AIDS superimposed on top of 1-6!

Davey 1990 p 5
FIGURE 2.1 Summary of the main physical, chemical and mechanical barriers to infection entering the human body.

Davey 1990 p 12
Good phagocytes!

Davey 1990 p 13
Figure 33-2 Movement of neutrophils by *diapedesis* through capillary pores and by *chemotaxis* toward an area of tissue damage.  G&H 2011
Hand-washing

The right way to wash your hands:
Thoroughly wash with soap and warm running water — rubbing your hands together for at least 10 seconds.

Hand-washing is the single most effective thing you can do to reduce the spread of colds and other infectious disease.

It's not necessary to use anti-bacterial soaps when washing up. Regular soap and water do the job just fine.

Also, using germicidal soaps too often may produce antibiotic-resistant bacteria.

*Source: Hospital Infections Program, U.S. Centers for Disease Control and Prevention*

NB: Happy Birthday Song 20-30 sec!!!