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
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)

William Sterett, MD  
Ben Hogan, PAC  
Vail Summit Orthopedics
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
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?
I. **Announcements** Lab today 12 n & 1 pm. Q last time?

II. **Connections** Extracellular fluid (ECF) & Homeostasis
   A. ECF: Plasma vs. Interstitium?
   B. Dr Evonuk Balances LS pp 5 - 15
   C. **Physiology in the News** Are we like watermelons?
   D. Simplified Model DO Norris cf: fig 1- 8 LS
   E. Negative feedback? Positive feedback? LS pp 14 - 15
   F. Balances & e.g. H₂O, T°C, BP Dr Evonuk + LS pp 8 - 10

III. **Cell Anatomy, Physiology & Compartmentalization** ch 2 (LS)
   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. **Physiol News** Moms eggs execute Dad’s mitochondria?
   E. What about vaults? LS 2006, p 32 + *Science News*
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)
Dr. Evonuk’s 6 Balances

- Metabolic
  - ANA-
  - CATA-

- Water ($H_2O$)

- pH

- Ion $^{+/-}$

- $O_2/CO_2$

- $T_oC$

- ToC
Drink about 1 L per 1000 calories energy expenditure!!

Human ~ 2/3 $\text{H}_2\text{O}$
~ 60 – 70 %

$\text{NB}$: So 2000 kcal →
drink 2000 mL
≡ 67.63 fl oz
≡ ~ 8 cups!

= ~40 – 48 kg $\text{H}_2\text{O}$
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
70% H₂O = 49L

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

BALANCE!

ECF = 14L
- Interstitium = 11L
- Plasma = 3L

70 kg

eg
Controller = Hypothalamus with Set Point

True Diurnal Variation

- 42°C Protein Denaturation
- 37°C (98.6°F) Set Point
- 35°C Mild Hypothermia
- 33°C Profound Hypothermia
- < 30°C Lethal

Time of Day:
- 0600
- 1400

ToC
Venous Pooling

Electrochemical Signal

CV Control Center

Brain Stem

Baroreceptors/Pressure Receptors

eg, in Carotids & Aorta

NB: Corrective Change

Opposes Original Input

Seated to Standing

Electrochemical Signal

eg, Symp Accel N

BP

I

R

C

E

Ef

+ HR

+ VC

↑ BP

Seated to Standing

↑ BP

Seated to Standing

↑ BP
Cytoplasm = Cell - Nucleus

[Extract nucleus; includes organelles]

Cytosol = Cytoplasm - Organelles

[Extract organelles; complex gel-liquid]
I. Announcements
Q from lecture or lab?

II. Cell Physiology Connections LS ch 2
A. Exocytosis vs. Endocytosis fig 2-5 a & b, p 25
B. Organelles ≡ ICF specialty shops (continued) ...
C. Physiol News Moms eggs execute Dad’s mitochondria?

III. Anaerobic vs Aerobic Metabolism Summary LS ch 2 pp 26-33
A. Key differences fig 2-15 + vpl
B. Selected details: Glycolysis, CAC, ETC, fig 2-9 thru 2-12

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
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

Nucleus or nose?

How to live?
Rough & Smooth Endoplasmic Reticulum (ER): Protein & Lipid Synthesizing Factories

- **Rough ER**
  - Ribosomes
  - Sacs

- **Smooth ER**
  - Lumen
  - Tubules

**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

Instructions for building proteins leave the nucleus and enter the cytoplasm.

Proteins (colored strands) are assembled on ribosomes attached to the ER or free in the cytoplasm.

Ribosomes

Rough ER

Smooth ER

Transport vesicles

Golgi complex

Secretory vesicles

Lysosome

Secretion (exocytosis)

fig 2-3 LS 2012
Lysosomes vs. Peroxisomes
Catalase Enzyme Reaction in Peroxisomes
Neutralize Toxin at Production Site!

\[ 2\text{H}_2\text{O}_2 \xrightarrow{\text{Catalase}} 2\text{H}_2\text{O} + \text{O}_2 \]
Mitochondria: Energy Organelles

![Diagram of mitochondria with labeled parts:](image)

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

fig 2-8 LS 2012
Mom's eggs execute Dad's mitochondria

In "Hamlet," Rosencrantz and Guildenstern deliver a letter to the rulers of England that carries the ill-fated duo's own death sentence. Perhaps Shakespeare knew a bit about reproductive biology.

Scientists have now found that during a sperm’s creation, its mitochondria—energy-producing units that power all cells—acquire molecular tags that mark them for destruction once the sperm fertilizes an egg. This death sentence, a protein called ubiquitin, may explain why mammals inherit the DNA within mitochondria only from their mothers, a bi-species mitochondrial inheritance. Sperm mitochondria sometimes avoid destruction when two different species of mice mate, and Schatten’s team has shown this also holds true in cattle. It’s hard to understand how an egg distinguishes between paternal mitochondria of closely related species, says Schon.

When paternal mitochondria escape destruction in normal mating, the resulting embryo may suffer. Schatten notes that a colleague has found sperm mitochondria in some defective embryos from infertility clinics.

AEROBIC
w/O₂

MITOCHONDRION

ANAEROBIC
without O₂

= CYTOSOL

1. Immediate/ATP-PC
2. Glycolysis
BI 121 Lecture 4

I. **Announcements** Nutrition Analysis Lab next Tuesday! Please record your diet on p 3-7 LM & begin analysis using [https://www.supertracker.usda.gov/](https://www.supertracker.usda.gov/) Estimating quantities. Q?

II. **Introduction to Genetics** LS 2012 ch 2 p 20-1 + Appendix C
   A. How does information flow in the cell? fig C-6
   B. How does DNA differ from RNA? pp A-20 thru A-22
   C. Genetic code? pp A-22, A-23
   D. How & where are proteins made? fig C-7, C-9
   E. Class skit: Making proteins @ ribosomes!

III. **Nutrition Primer** DC Module 2, 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. *Nutrition Quackery, Balanced Approach* Kleiner, Monaco+
4 oz $\rightarrow$ 3 oz

Deck of Cards

or

$\equiv$ 1 c

raw $\rightarrow$ cooked

$\equiv$ 1/3 c

$\equiv$ 1 oz

$\equiv$ 1/4 c

$\equiv$ 1.5 oz
ATP Supplied

Cytosol

ATP-PC/
Immediate
15 - 30 s

Mitochondria

Oxygen
System
> 3 – 5 m

% ATP Supplied

Anaerobic

Glycolysis

1.5 – 3 m

Aerobic

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

7 – 10 KiloCalories/KCal

Adenosine

1 Synthesis of Macromolecules
Make big things from little things!

2 Membrane Transport
Move things! Microscopic!

3 Mechanical Work
Move things! Macroscopic!
Anaerobic vs. Aerobic Metabolism

Anaerobic Glycolysis
"sugar dissolving" without $O_2$. Net of 2 ATP per molecule of glucose

Aerobic Metabolism
+ mitochondrial processing of glucose with $O_2$. Net of 32 ATP per molecule of glucose
Stages of Cellular Metabolism/Respiration

**Anaerobic**
- Glycolysis
  - Cytosol
  - Glucose and other fuel molecules
  - Pyruvate
  - 2 ATP

**Aerobic**
- Metabolism
  - Mitochondria
  - Matrix
  - Citric acid cycle
    - Acetyl-CoA
    - Electrons carried by NADH and FADH$_2$
    - 2 ATP
  - Oxidative phosphorylation
    - Mitochondrial inner membrane
    - (electron transport system and chemiosmosis)
    - 28 ATP
Goals of Aerobic Metabolism

AEROBIC
w/O₂

MITOCHONDRION

CITRIC ACID CYCLE
harvest electrons

“cash in”

ELECTRON TRANSPORT CHAIN
for ATP Energy!!

II. **Nutritional Physiology in the News**

- *UCB Wellness Letter*, June 2011, Salt–beyond hypertension
- *UCB Wellness Letter*, November 2014, Coconuts are on a roll?

III. **Nutrition Primer** (continued) DC Module 2, Sizer & Whitney (S&W) Science Library

A. What’s the best path to losing weight? What about fasting? Zuti & Golding 1976; Sacks *AHA NPAM Council* 2009; AMDR? Adjusted Macronutrient Distribution Range!

B. Nutrition Quackery, Balanced Approach, Kleiner, Monaco+

IV. **Digestion** LS 2012 ch 15, pp 437-9, DC Module 3 pp 17-23

A. Steps of digestion Dr. Evonuk + LS pp 437- 9; DC p 23
B. Hydrolysis: the central linking theme! LS p 438, Fox 2009
C. What’s missing? LS fig 15-1 p 438
D. GI-Donut analogy? Dr. Lorraine Brilla WWU
F. Organ-by-organ review LS tab 15-1 pp 440-1 + DC fig 3-1
More Reasons to Shake the Salt Habit

Stop me!

1. Blood vessel vasodilation w/in 30 min by ingesting 1500 mg Na+!
2. Ca\(^{2+}\) excretion \(\uparrow\) bone loss, risk of osteoporosis & fractures.
3. May directly impair kidney function & \(\uparrow\) risk of kidney stones.
4. GI cancer risk, inflammation?

UCB Wellness Letter Jun 2011 p 5
5 times per wk? $\equiv 106,600$ calories/yr $\equiv \pm 30.5$ lb fat/yr

Better choices!

Starbucks Cinnamon Dolce Latte, whipped cream (Venti, 20 oz.) $\equiv 410$ calories

Jogging $\equiv 50$ min.
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 Hypothroidism
  - 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
Coconuts are on a roll?

1. **Blood Cholesterol & ♠️ **Health?** Lauric acid, 1\(^{0}\) saturated fat may ↑ HDL good > LDL bad cholesterol, but depends on fat replaced. Neutral effect? Still don’t really know!

2. **Weight Loss?** Medium change fatty acids metabolized uniquely. Few human studies on body weight have had inconsistent results. Like all edible oils, high in kcal (120/Tbsp) so counterproductive.
### Macronutrients & Micronutrients Essential for Life

#### Macronutrients

- **H₂O/Water**
- **1️⃣ Carbohydrates**
- **2️⃣ Fats/Triglycerides/Lipids**
- **3️⃣ Proteins**

#### Micronutrients

- **Vitamins (A, D, E, K; C + B)**
- **Minerals (K⁺, Na⁺, Ca²⁺, Mg²⁺, Fe²⁺, Zn²⁺,...)**

#### Sample Food Sources

- **Water, other drinks, fruits & vegetables**
- **Grains, vegetables, fruits, dairy products**
- **Meats, full-fat dairy products, oils**
- **Meats, legumes, dairy vegetables**
- **Vegetables, vegetable oils, fruits, citrus, grains, dairy**
- **Fruits, vegetables, grains, nuts, dairy, meats, processed foods**

**NB: Need only minute quantities!**

**✓ Energy nutrients = yield ATP**
US Modifications to 1992 Food Pyramid 2005

- Regular Physical Activity: Exercise! Exercise!!
- “good” fats!
- saturated & trans fats!
- 3 or more!
- 5 or more!
- eg, fish, nuts
- 4 or more!
- ½ whole grain

Fats, oils, and sweets
Use sparingly

Milk, yogurt, and cheese group
2–3 servings

Vegetable group
3–5 servings

Meat, poultry, fish, dry beans, eggs, and nuts group
2–3 servings

Fruit group
2–4 servings

Bread, rice, and pasta group
6–11 servings

KEY
- Fat (naturally occurring and added)
- Sugars (added)
1. **Vary your veggies.** Fill ½ your plate with fruits & vegetables!

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)

NB: Each group 500 kcal deficit/day, 16 weeks
Dietary Composition & Physical Endurance

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

eg, Atkins!

~ 1/3 endurance!

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

Dietary Carbohydrate

23 % Kcal
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

- 26 lb Water
- 20 lb Lean Body Mass
- 14 lb Fat

Fat < ¼ 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.
LOWER CARBOHYDRATE
ELIMINATE CALORIES or FOOD GROUPS
ENCOURAGE FASTING

PEER-REVIEWED = TEXTS → RESEARCH

NOT PEER-REVIEWED = TRADE BOOKS

AHA + DASH + MAYO CLINIC

LOWER FAT

ADEQUACY
BALANCE
CONSISTENCY
& MODERATION

ChooseMyPlate.gov
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!!

$\text{H}_2\text{O} + \text{Enzyme} \rightarrow \text{Hydrolysis of Energy Nutrients}$
Polymer to Monomer (Many to One)

Carbohydrate

Protein + Fat

Fat

Protein + Carbohydrate

Fat

Glucose

Amino Acids

Fatty Acids + Glycerol

Amino Acid Structure
GI-DONUT ANALOGY

GI LUMEN

BODY
<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

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

2. **Esophagus**

   *Rapid transit*

   - peristalsis

   - secretion mucus

3. **Stomach**

   *Mixing*

   - peristalsis

   - secretion mucus + HCl
   + enzymes
   - enzymatic digestion:
     - protein + butter fat!
Common Control Mechanisms

1. Local (autoregulation)
2. Nervous (rapidly-acting)
3. Hormonal (slower-acting/reinforcing)
BI 121 Lecture 6 + Q + ½ Midterm Review

I. **Announcements** Next session Q? ~½ review, then Midterm. Fun Lab 3 Nutrition today! Sample Suisse Calculation? Q?

II. **Nutrition in the News** Be a whiz at healthy grilling! American Institute for Cancer Research, Grilling Quiz!

III. **Digestion Connections** LS ch 15, DC Module pp 17-23
   A. Histology of the gut LS fig 15-2, 15-3 p 442-3
   B. Stomach protein digestion + zymogens? LS fig 15-7, 15-9
   C. Accessory organs: Pancreas & Liver + Recycling!
      LS pp 457-63
   E. Summary of chemical digestion LS tab 15-5 p 466
   F. Large intestine? LS fig 15-24 pp 472-4

IV. **Midterm Review** Discussion + Q?
How Do I Calculate the % of Total Calories from Carbohydrate, Fat & Protein?

**Carbohydrate**  
46 g x 4 kcal/g = 184 kcal  
% Carbohydrate = 184/567 = 0.326 ≡ ~33%

**Fat**  
39 g x 9 kcal/g = 351 kcal  
% Fat = 351/567 = 0.619 ≡ ~62%

**Protein**  
8 g x 4 kcal/g = 32 kcal  
% Protein = 32/567 = 0.056 ≡ ~6%

\[ \sum = 567 \text{ kcal} \]
American Institute for Cancer Research (AICR) Healthy Grilling Quiz Summary

1. **Marinade, marinade, marinade!** By doing so, you can decrease carcinogens formed during grilling by < 96%!

2. **Cover the grill with aluminum foil,** turn gas down or wait for low-burning embers, cook to the side.

3. **Best choices for grilling include vegetables and fruits** (no HCAs + enzymes to inactivate HCAs!), and lean meats (e.g., fish & skinless chicken ↓ PAHs).

4. **Flip meat every minute** to reduce charring & remove charred portions prior to eating.

5. **To limit cancer risk, eat no more than 3 oz grilled red meat.** Cook small portions/kebabs.
Myenteric motor plexus!

Meissner’s sensory & secretory plexus!

LOCAL

H Howard 1990
Zymogen = an inactive precursor
Endocrine + Exocrine functions; Makes enzymes for digesting all 3 energy nutrients!

Duct cells secrete aqueous NaHCO₃ solution
Acinar cells secrete digestive enzymes

Endocrine portion of pancreas (Islets of Langerhans)

Blood

Hormones (insulin, glucagon)

LS 2012 fig 15-11 p 457

Exocrine portion of pancreas (Acinar and duct cells)

The glandular portions of the pancreas are grossly exaggerated.
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
- Haustra
- 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
Lab 3: Nutritional Analyses via 2 Programs

Choose MyPlate.gov

https://www.supertracker.usda.gov/