Nutrition for Garden Teachers

What does food mean to you?

The Big Picture

* What are the most important food principles in today's world???

Michael Pollan

* Eat food, not too much, mostly plants

Eat from the Rainbow

* Whole Foods
* Taste
* Fresh

healthy plate

Food Quality

- How many ingredients?
- Where is the food from?
- Preparation?

Basic Needs

* Calories
* Protein, fat and carbohydrate
* Vitamins and minerals
* Fluid and fiber

Safari File Edit View History Bookmarks Window Help (Charged)

Tool: Calorie calculator - MayoClinic.com

www.mayoclinic.com/health/calorie-calculator/NU00598

Reader

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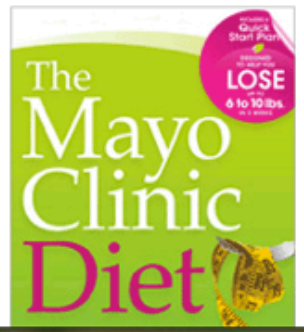

Calorie calculator

Your estimated daily calorie needs (rounded to the nearest 50 calories) are:

1850 calories

recalculate

See how your daily calorie needs change if you alter your activity level:

1550 calorie	1700 calorie	1850 calorie	2150 calorie
Inactive	Somewhat Active	Active	Very Active

People judge the intensity of their activities differently. And activity levels can change over time. So think of your calorie estimate as a starting point and adjust it up or down as you alter your activity level.

print results

Credits: Based on Harris Benedict Equation and Dietary Reference Intakes, Institute of Medicine (IOM), 2005. Adapted by Mayo Foundation for Medical Education and Research.

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Kids Caloric Needs

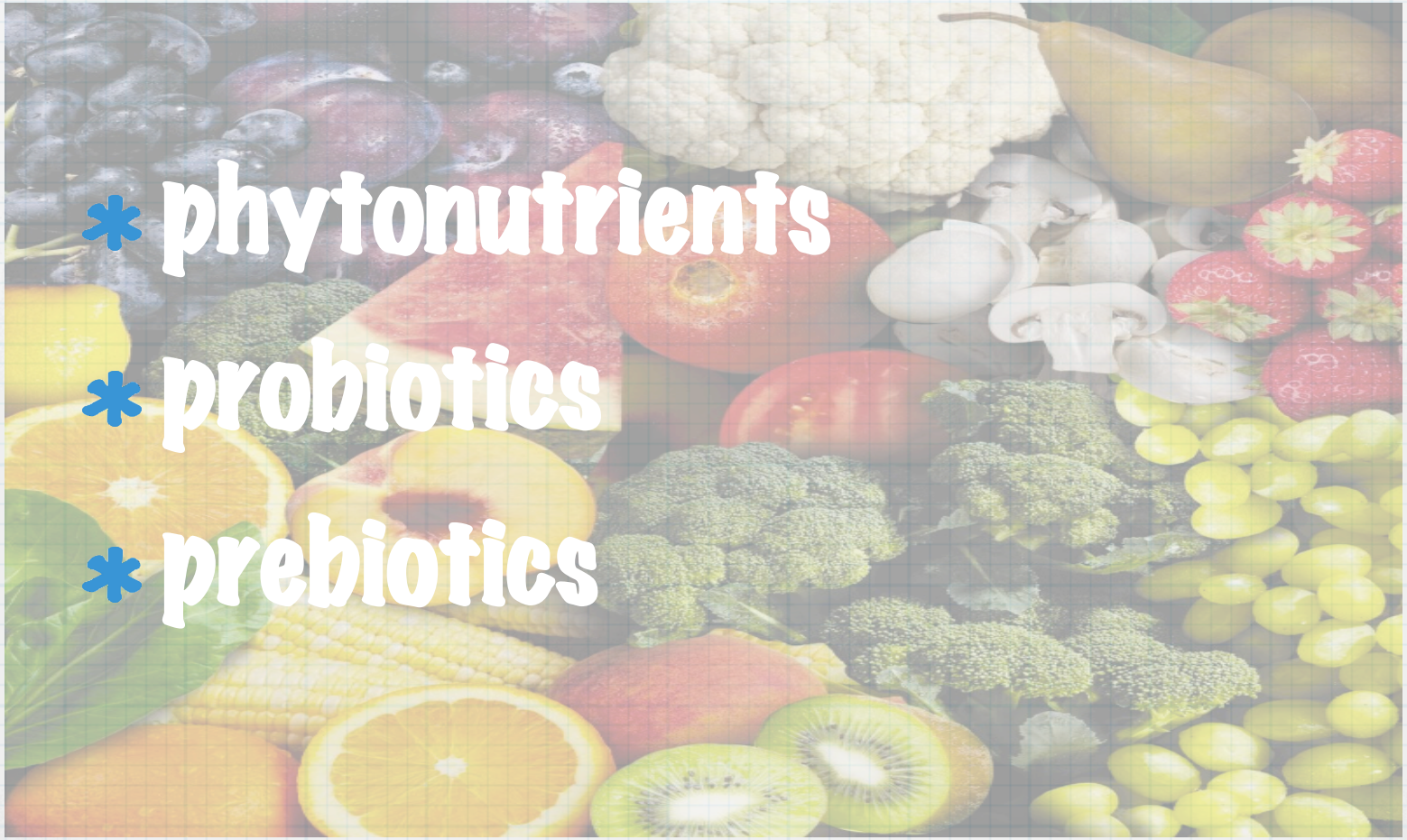
* Moderately active
* 9-13 yr old girl, 1600-2000 Kcal/ day
* 9-13 yr old boy 1800-2200
* 13-18 yr old boy 2400-2800

Nutrients

- The basic building blocks of food
- Structure and function
- Digestion and metabolism

- carbs (4 kcals per gm)
- protein (4 kcal per gm)
- fats (9 kcal per gm)
- fiber
- water
- vitamins and minerals

New Discoveries

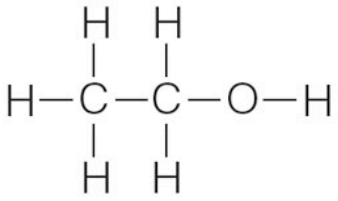


* phytonutrients
* probiotics
* prebiotics

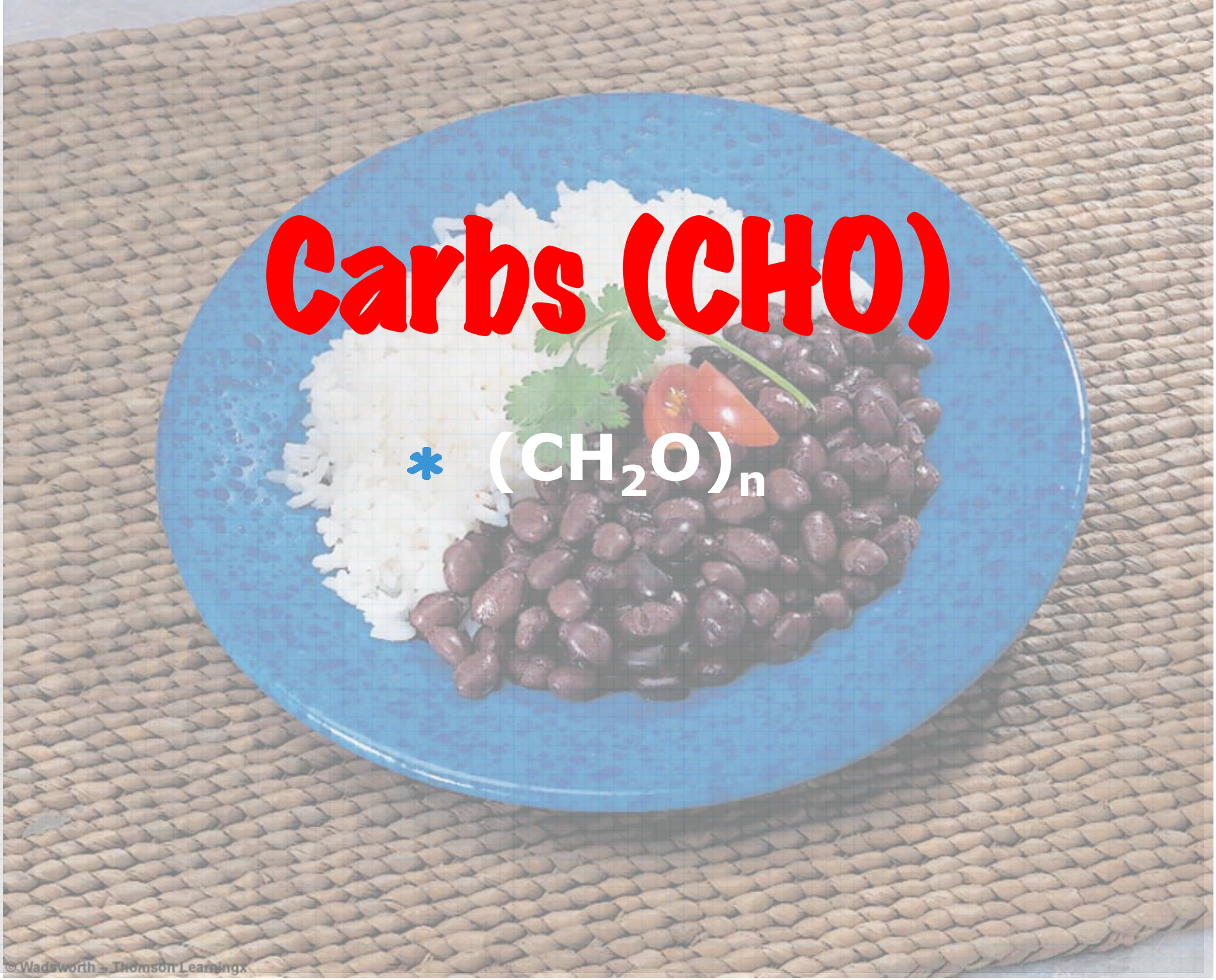
Nutrient Structure

The four main types of atoms found in nutrients are hydrogen (H), oxygen (O), nitrogen (N), and carbon (C).

Each atom has a characteristic number of bonds it can form with other atoms.



Notice that in this simple molecule of ethyl alcohol, each H has one bond, O has two, and each C has four.


Carbs (CHO)
* $(CH_2O)_n$
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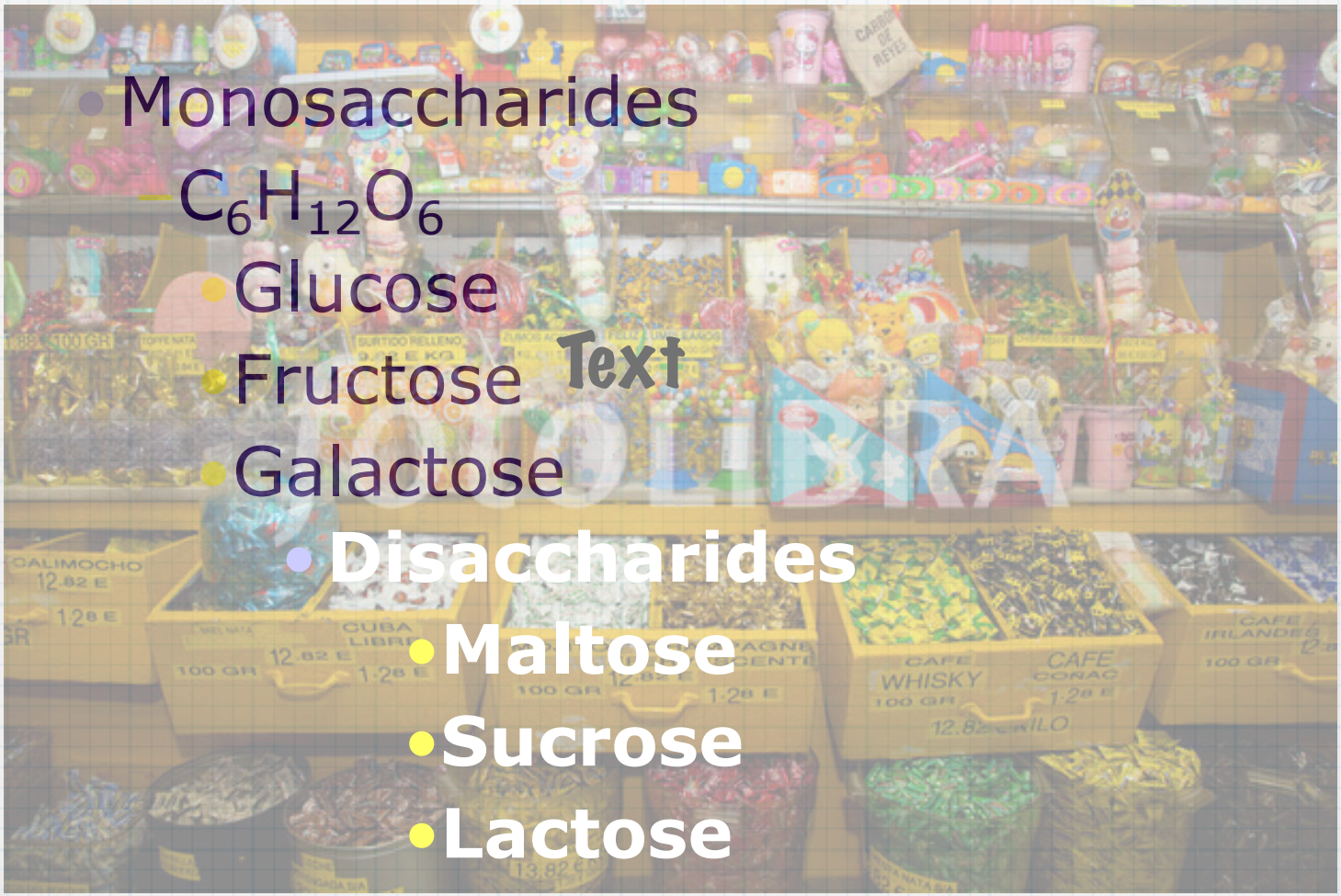
Simple Sugars

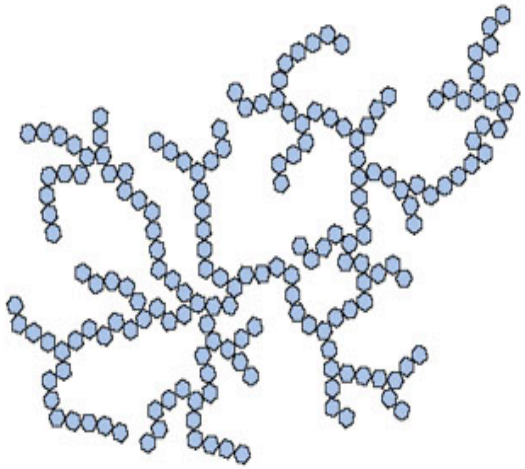


- Monosaccharides
  - $C_6H_{12}O_6$
    - Glucose
    - Fructose
    - Galactose
- **Disaccharides**
  - **Maltose**
  - **Sucrose**
  - **Lactose**

Complex Carbohydrates

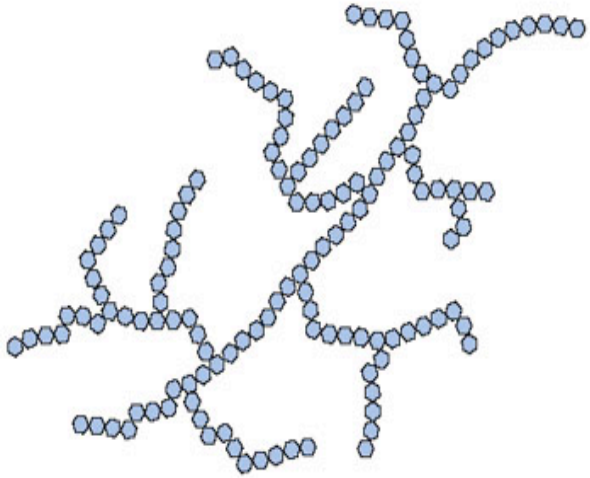
- **Polysaccharides**
  - **Glycogen**
  - **Starches**
  - **Fibers**

The Structure of Starches

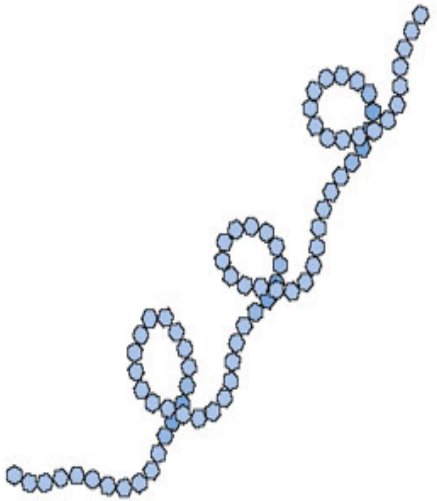


Glycogen

A glycogen molecule contains hundreds of glucose units in long, highly branched chains.



Starch (amylopectin)



Starch (amylose)

A starch molecule contains hundreds of glucose molecules in either occasionally branched chains (amylopectin) or unbranched chains (amylose).

Non digestible starches

- (these include the prebiotics)
- Fibers
  - Cellulose
  - Hemicelluloses
  - Pectins
  - Gums and mucilages
  - Lignin
  - Resistant starches

What is this?

Types of Fibers

- Soluble fibers
  - Viscous
  - Fermentable

Insoluble fibers

- Fibers
  - Insoluble fibers
    - Nonviscous
- (Phytic acid)

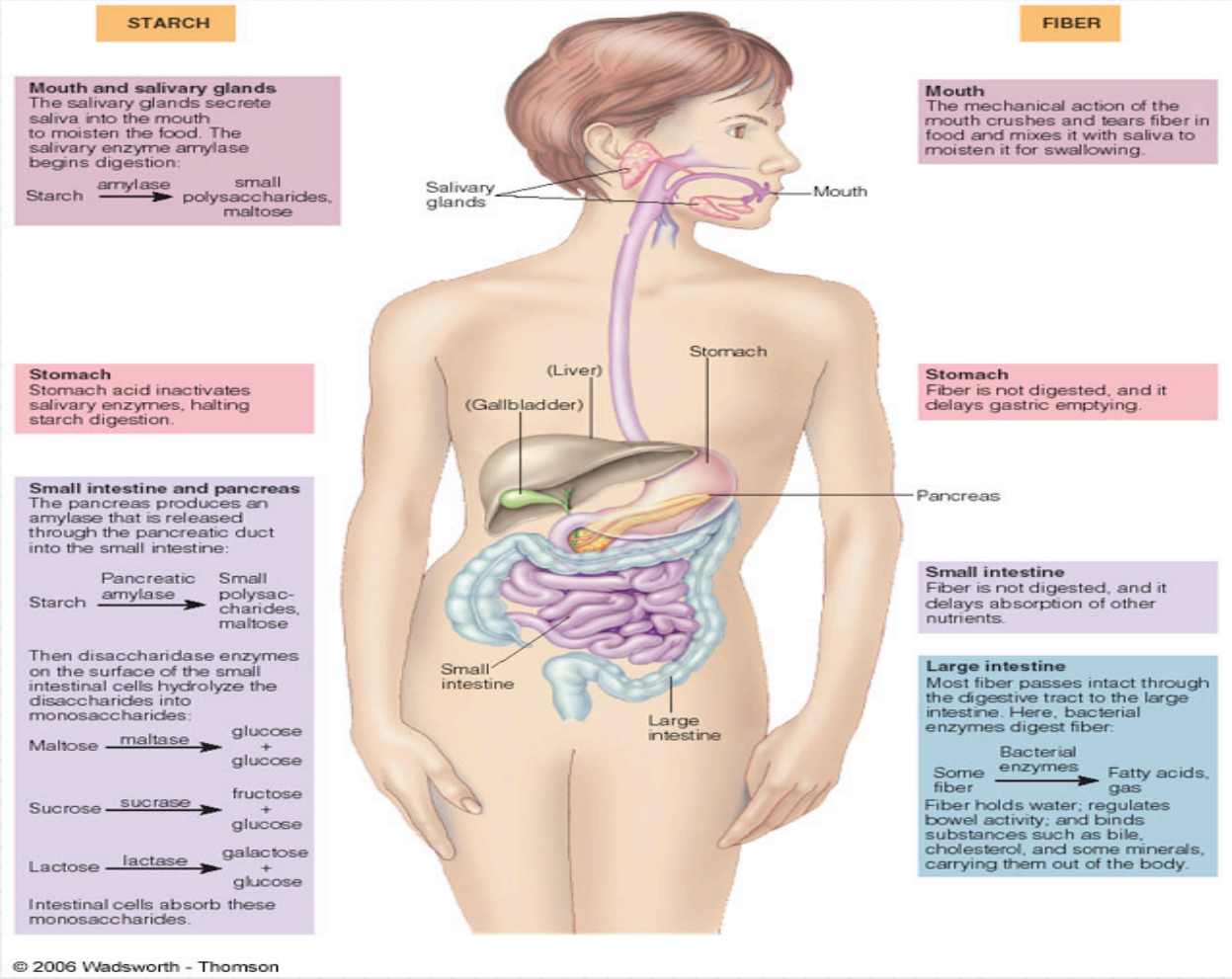
Digestion

- Mouth
  - Salivary amylase
- Stomach
  - Fibers and satiety

Digestion

- Small intestine
  - Maltase, sucrase, lactase
- Pancreas
  - Pancreatic amylase

Digestion


STARCH
Mouth and salivary glands
The salivary glands secrete saliva into the mouth to moisten the food. The salivary enzyme amylase begins digestion:
Starch —amylase→ small polysaccharides, maltose
Stomach
Stomach acid inactivates salivary enzymes, halting starch digestion.
Small intestine and pancreas
The pancreas produces an amylase that is released through the pancreatic duct into the small intestine:
Starch —Pancreatic amylase→ Small polysaccharides, maltose
Then disaccharidase enzymes on the surface of the small intestinal cells hydrolyze the disaccharides into monosaccharides:
Maltose —maltase→ glucose + glucose
Sucrose —sucrase→ fructose + glucose
Lactose —lactase→ galactose + glucose
Intestinal cells absorb these monosaccharides.
FIBER
Mouth
The mechanical action of the mouth crushes and tears fiber in food and mixes it with saliva to moisten it for swallowing.
Stomach
Fiber is not digested, and it delays gastric emptying.
Small intestine
Fiber is not digested, and it delays absorption of other nutrients.
Large intestine
Most fiber passes intact through the digestive tract to the large intestine. Here, bacterial enzymes digest fiber:
Some fiber —Bacterial enzymes→ Fatty acids, gas
Fiber holds water; regulates bowel activity; and binds substances such as bile, cholesterol, and some minerals, carrying them out of the body.
Salivary glands
Mouth
Stomach
(Liver)
(Gallbladder)
Pancreas
Small intestine
Large intestine
© 2006 Wadsworth - Thomson

Digestion

- Large intestine

Fermentation of viscous fibers

Water, gas, short-chain fatty acid production

Fiber digestion

FIBER

Mouth
The mechanical action of the mouth crushes and tears fiber in food and mixes it with saliva to moisten it for swallowing.

Stomach
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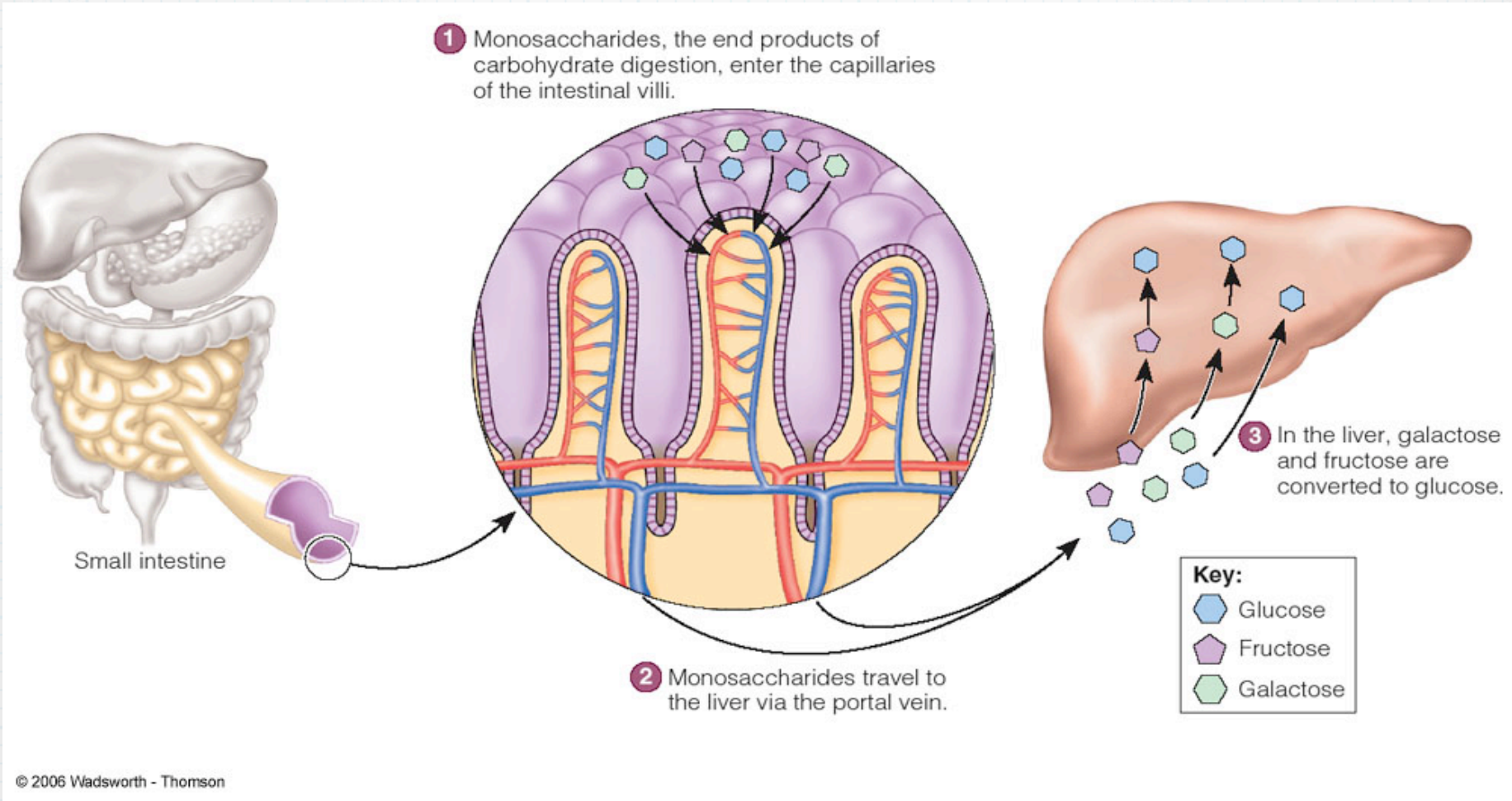
Some fiber —(Bacterial enzymes)→ Fatty acids, gas

Fiber holds water; regulates bowel activity; and binds substances such as bile, cholesterol, and some minerals, carrying them out of the body.

Absorption of CHO



Digestion Problems

* **Lactose Intolerance**
* **Leaky guts**

Energy in the Body

- Energy
- Glycoproteins
- Glycolipids

Using and storing energy

Other sources of energy

- Making glucose from protein
  - Gluconeogenesis
  - Protein-sparing action of carbohydrates

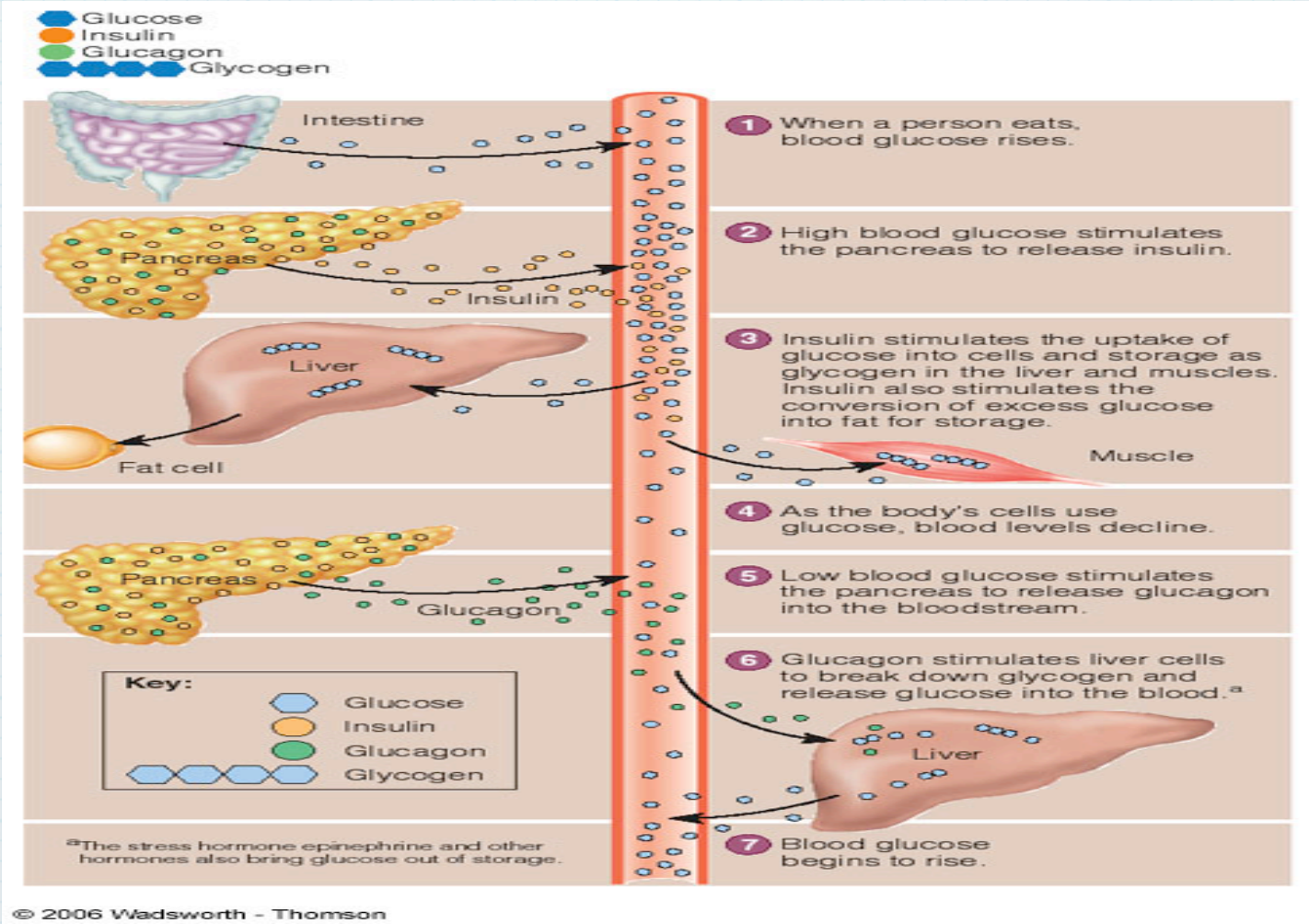
Fat turned into energy

- Making ketone bodies from fat fragments
- Ketone bodies
- Ketosis
- Acid-base balance

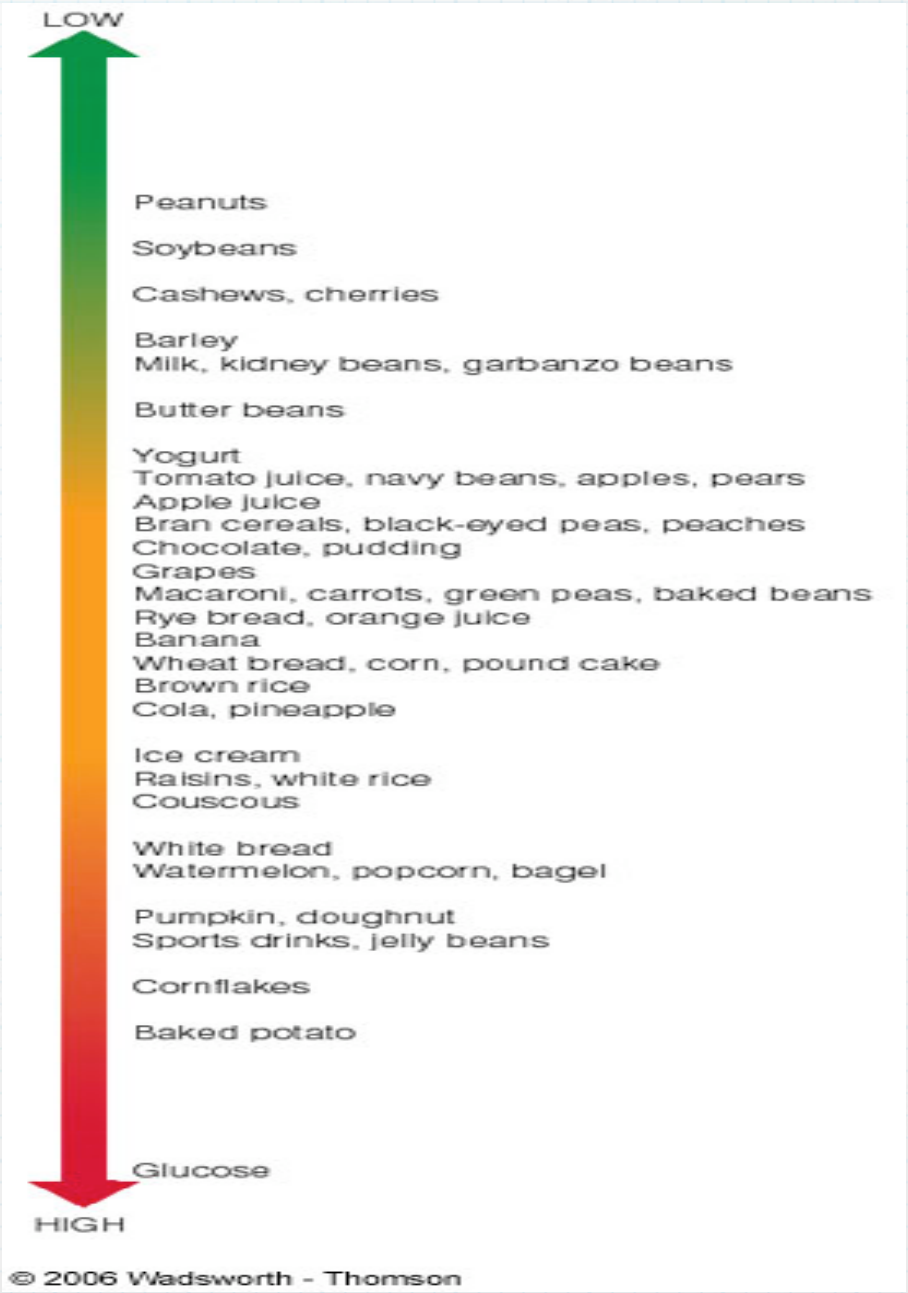
Keeping the blood sugar constant

- Regulating hormones
  - *Insulin
  - *Glucagon
  - *Epinephrine

How digestion works



Glycemic response to foods



Sugars in foods

TABLE 4-1 Sample Nutrients in Sugar and Other Foods

The indicated portion of any of these foods provides approximately 100 kcalories. Notice that for a similar number of kcalories and grams of carbohydrate, milk, legumes, fruits, grains, and vegetables offer more of the other nutrients than do the sugars.

	Size of 100 kcal Portion	Carbohydrate (g)	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin A (µg)	Vitamin C (mg)
Foods							
Milk, 1% low-fat	1 c	12	8	300	0.1	144	2
Kidney beans	½ c	20	7	30	1.6	0	2
Apricots	6	24	2	30	1.1	554	22
Bread, whole wheat	1½ slices	20	4	30	1.9	0	0
Broccoli, cooked	2 c	20	12	188	2.2	696	148
Sugars							
Sugar, white	2 tbs	24	0	trace	trace	0	0
Molasses, blackstrap	2½ tbs	28	0	343	12.6	0	0.1
Cola beverage	1 c	26	0	6	trace	0	0
Honey	1½ tbs	26	trace	2	0.2	0	trace

Message:

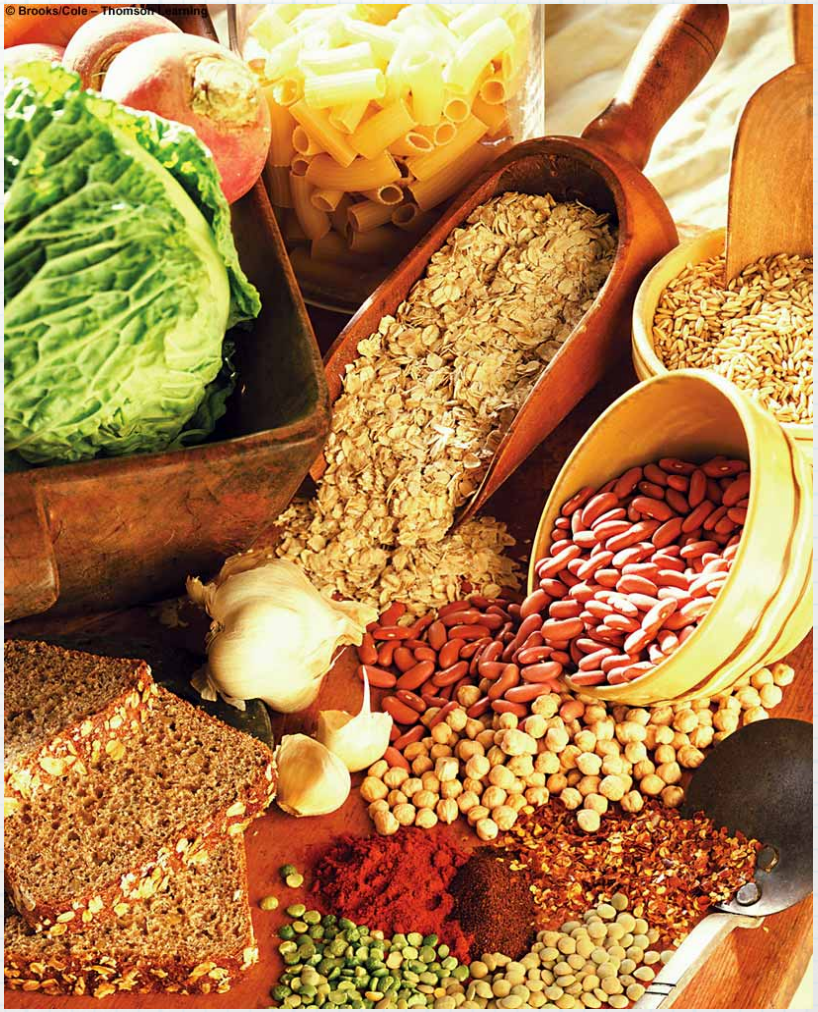
Eat Whole Foods

Recommended upper limit for sugar intake

- DRI
  - No more than 25% of total daily energy intake

Starch and Fiber

- Health benefits
- GI
- Heart
- Diabetes
- Cancer
- Weight management



Functions of Fiber

- Lower blood cholesterol
- Slow glucose absorption
- Slow transit of food through upper GI tract

More Fiber Functions:

- Holds moisture in stools, softening them
- Yield small fat molecules that the colon can use for energy

Fiber Sources

- Brown rice, fruits, legumes, seeds, vegetables, wheat bran, whole grains
- Extracted and used as food additives

Fn of Insoluble Fiber

- Increased fecal weight
- Speeds fecal passage through colon
- Provides bulk and feelings of fullness

Non viscous functions

- Alleviate constipation
- Lower risks of diverticulosis, hemorrhoids, appendicitis
- May help with weight management

Intake of starches and fiber

- RDA for carbohydrate
  - 130 g/day
  - 45% - 65% total daily energy intake
- Daily Value: 300 g/day
- 25gm/day of fiber
- (14gm/1000kcal)

Sugar Replacers

- Stevia - Non caloric
- Xylitol - 2/3 of the calories of sugar. Glycemic Index of 7 and good for dental health

Other Sugars

* Honey
* Agave
* Coconut sugars.....
* All in moderation

Sugar Substitutes

TABLE H4-1 Sweeteners

Sweeteners	Relative Sweetness[a]	Energy (kcal/g)	Acceptable Daily Intake	Average Amount to Replace 1 tsp Sugar	Approved Uses
Approved Sweeteners					
Saccharin	450	0	5 mg/kg body weight	12 mg	Tabletop sweeteners, wide range of foods, beverages, cosmetics, and pharmaceutical products
Aspartame	200	4[b]	50 mg/kg body weight[c] Warning to people with PKU: Contains phenylalanine	18 mg	General purpose sweetener in all foods and beverages
Acesulfame-K	200	0	15 mg/kg body weight[d]	25 mg	Tabletop sweeteners, puddings, gelatins, chewing gum, candies, baked goods, desserts, alcoholic beverages
Sucralose	600	0	5 mg/kg body weight	6 mg	Carbonated beverages, dairy products, baked goods, coffee and tea, fruit spreads, syrups, tabletop sweeteners, chewing gum, frozen desserts, salad dressing
Neotame	8000	0	18 mg/day	0.5µg	Baked goods, nonalcoholic beverages, chewing gum, candies, frostings, frozen desserts, gelatins, puddings, jams and jellies, syrups
Tagatose	0.8	1.5	7.5 g/day	1 tsp	Baked goods, beverages, cereals, chewing gum, confections, dairy products, dietary supplements, health bars, tabletop sweetener
Sweeteners with Approval Pending					**Proposed Uses**
Alitame	2000	4[e]	—		Beverages, baked goods, tabletop sweeteners, frozen desserts
Cyclamate	30	0	—		Tabletop sweeteners, baked goods

More...

TABLE H4-3 Sugar Replacers

Sugar Alcohols	Relative Sweetness[a]	Energy (kcal/g)	Approved Uses
Isomalt	0.5	2.0	Candies, chewing gum, ice cream, jams and jellies, frostings, beverages, baked goods
Lactitol	0.4	2.0	Candies, chewing gum, frozen dairy desserts, jams and jellies, frostings, baked goods
Maltitol	0.9	2.1	Particularly good for candy coating
Mannitol	0.7	1.6	Bulking agent, chewing gum
Sorbitol	0.5	2.6	Special dietary foods, candies, gums
Xylitol	1.0	2.4	Chewing gum, candies, pharmaceutical and oral health products

[a] Relative sweetness is determined by comparing the approximate sweetness of a sugar replacer with the sweetness of pure sucrose, which has been defined as 1.0. Chemical structure, temperature, acidity, and other flavors of the foods in which the substance occurs all influence relative sweetness.

Mindful eating break

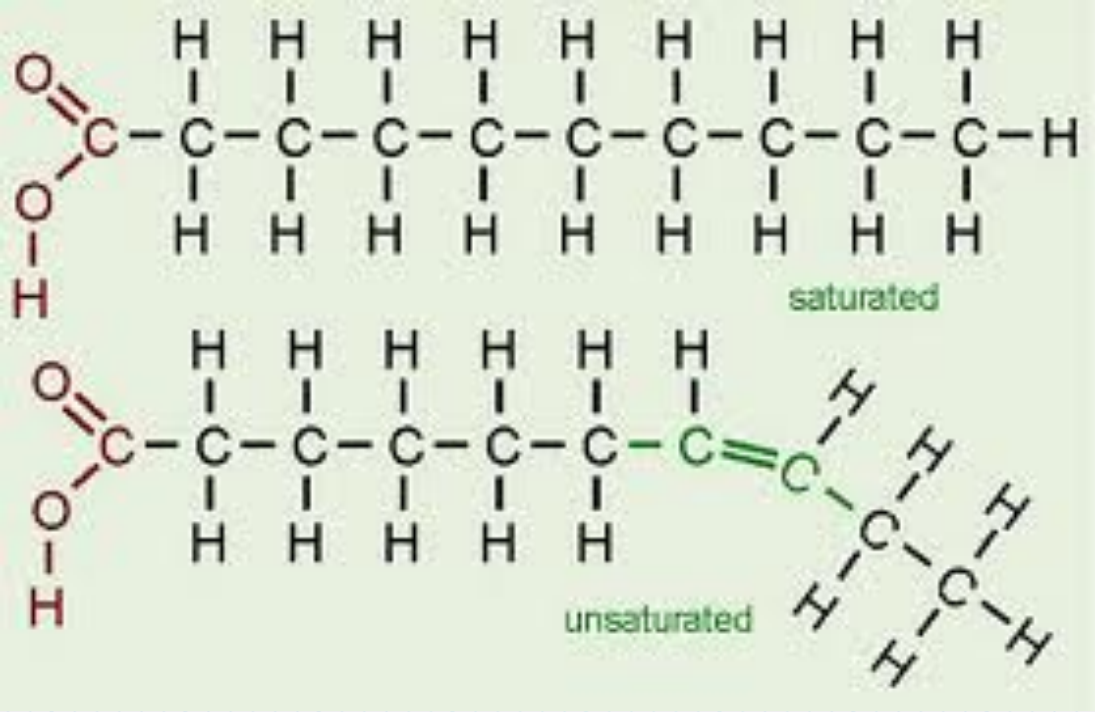
* Select 1 item to chew on- where does it come from, how many hands touched this?
* Place it in your mouth
* Feel the texture, taste
* Chew for 1 minute

FATS

- Triglycerides
- Fats and oils
- Phospholipids
- Sterols

Fatty acids

- Saturated vs. unsaturated



Point of saturation

- Point of saturation
- Degree of saturation
  - Saturated fatty acid
  - Monounsaturated fatty acid
  - Polyunsaturated fatty acid

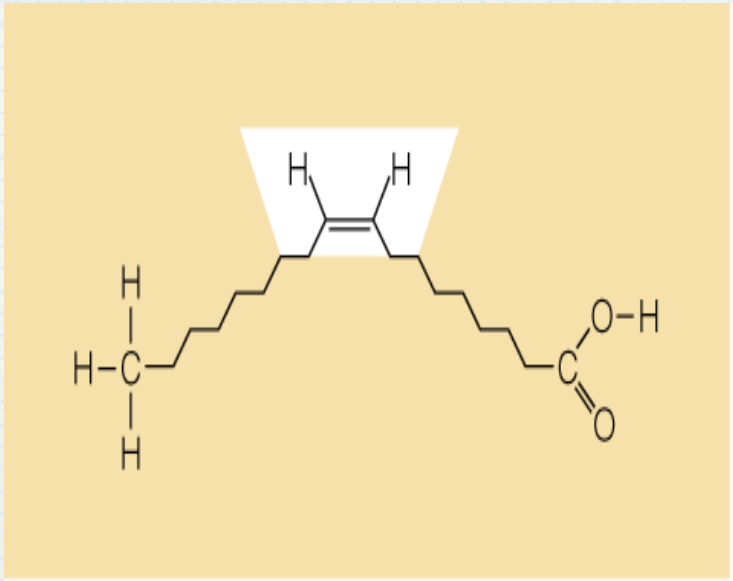
Location of double bonds

- Location of double bonds
  - Omega number
    - Omega-3 fatty acid
    - Omega-6 fatty acid

Degree of unsaturation

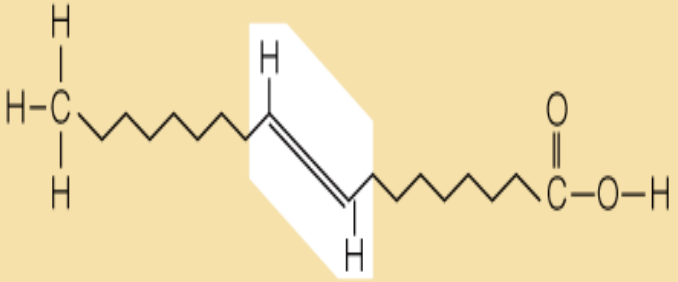
- Degree of unsaturation revisited
  - Firmness
  - Stability
    - Oxidation
      - Antioxidants

cis vs. trans



cis-fatty acid

A *cis*-fatty acid has its hydrogens on the same side of the double bond; *cis* molecules fold back into a U-like formation. Most naturally occuring unsaturated fatty acids in foods are *cis*.



trans-fatty acid

A *trans*-fatty acid has its hydrogens on the opposite sides of the double bond; *trans* molecules are more linear. The *trans* form typically occurs in partially hydrogenated foods when hydrogen atoms shift around some double bonds and change the configuration from *cis* to *trans*.

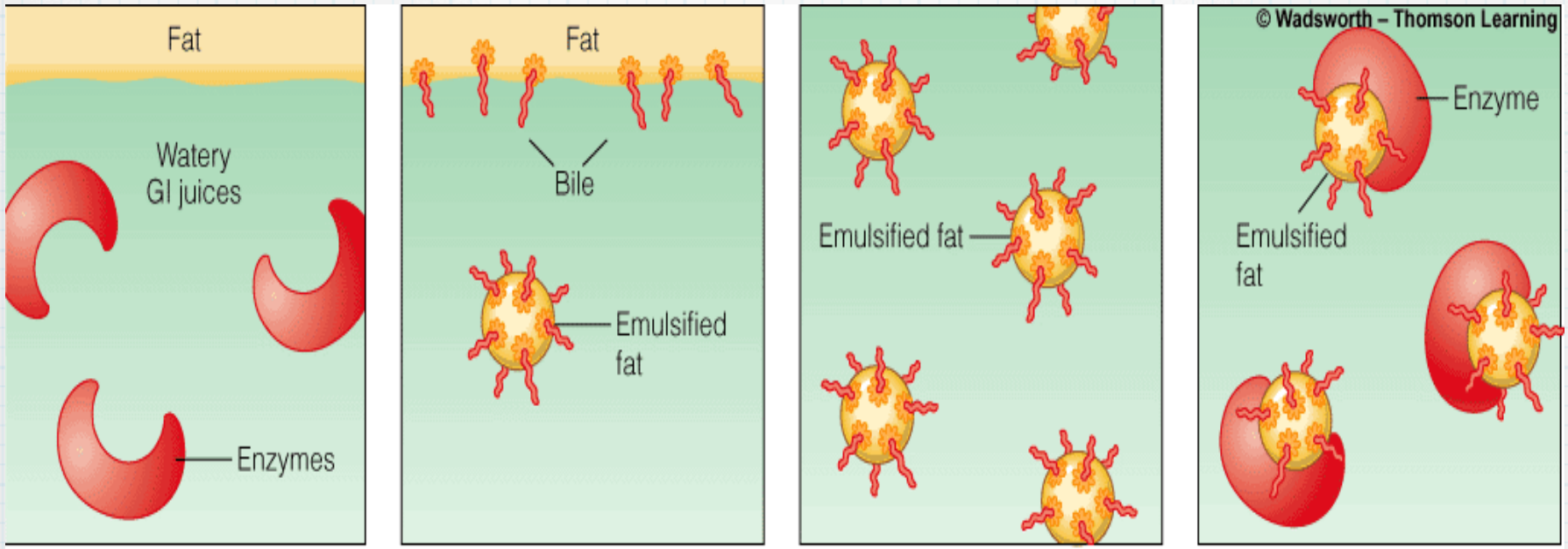
Roles of sterols

- Bile acids
- Sex hormones
- Adrenal hormones
- Vitamin D

Fat digestion

*Hydrolysis
*Triglycerides
*Monoglycerides
*Fatty acids
*Glycerol

Fat digestion



In the stomach, the fat and watery GI juices tend to separate. The enzymes in the GI juices can't get at the fat.

When fat enters the small intestine, the gallbladder secretes bile. Bile has an affinity for both fat and water, so it can bring the fat into the water.

Bile's emulsifying action converts large fat globules into small droplets that repel each other.

After emulsification, more fat is exposed to the enzymes, making fat digestion more efficient.

Fat digestion

- Small intestine
  - Pancreatic lipases
  - Intestinal lipases

Triglycerides

- Fat stores
  - Energy
  - Protection
  - insulation

Essential fatty acids

- Linoleic acid and the omega-6 family
  Arachidonic acid

Linolenic to EPA, DHA

- Linolenic acid and the omega-3 family
  - EPA =eicosapentaenoic acid
  - DHA = docosahexaenoic acid

Sources of omega 3's

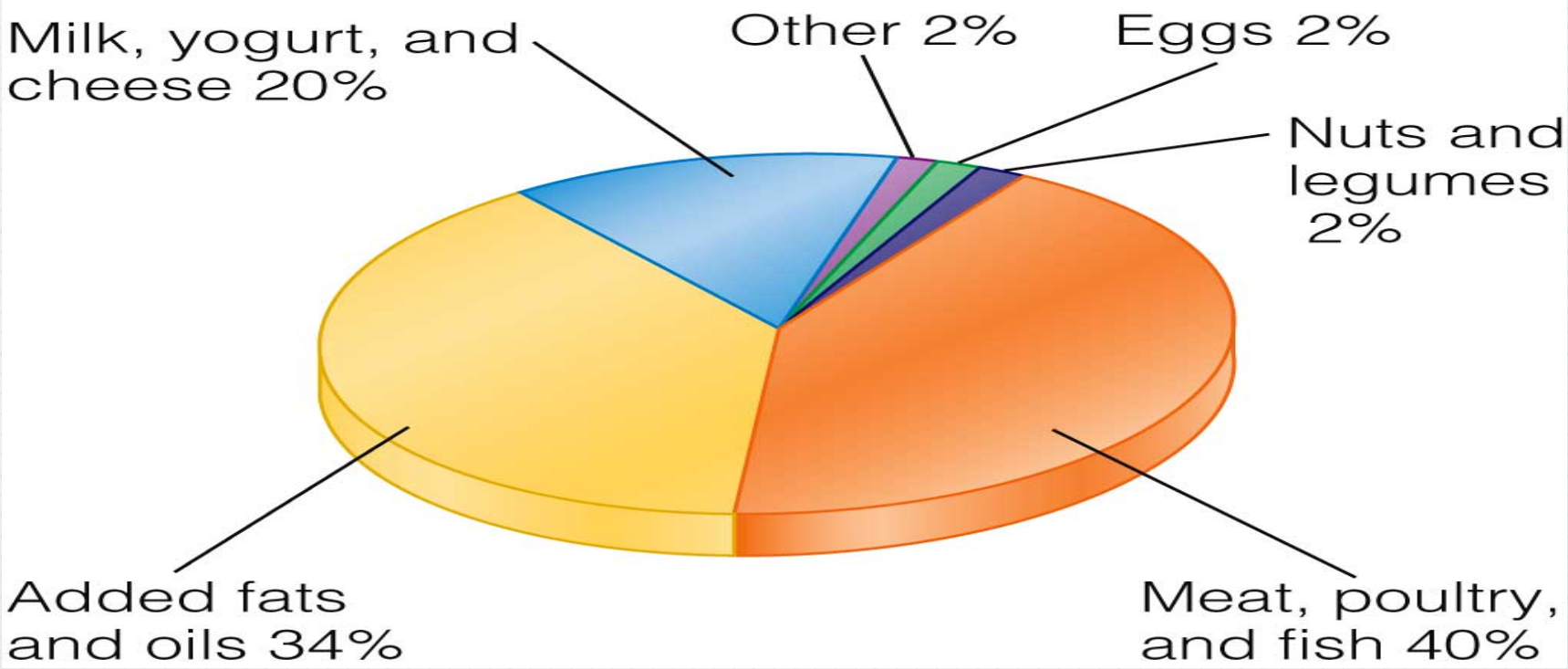
TABLE 5-2 Sources of Omega Fatty Acids

Omega-6	
Linoleic acid	Vegetable oils (corn, sunflower, safflower, soybean, cottonseed), poultry fat, nuts, seeds
Arachidonic acid	Meats, poultry, eggs (or can be made from linoleic acid)
Omega-3	
Linolenic acid	Oils (flaxseed, canola, walnut, wheat germ, soybean) Nuts and seeds (butternuts, flaxseeds, walnuts, soybean kernels) Vegetables (soybeans)
EPA and DHA	Human milk
	Pacific oysters and fish[a] (mackerel, salmon, bluefish, mullet, sablefish, menhaden, anchovy, herring, lake trout, sardines, tuna) (or can be made from linolenic acid)

[a]All fish contain some EPA and DHA; the amounts vary among species and within a species depending on such factors as diet, season, and environment. The fish listed here except tuna provide at least 1 gram of omega-3 fatty acids in 100 grams of fish (3.5 ounces). Tuna provides fewer omega-3 fatty acids, but because it is commonly consumed, its contribution can be significant.

Sources of Fats

Note that fruits, grains, and vegetables are insignificant sources, unless saturated fats are intentionally added to them during preparation.



25-35% from cals

* avoidance of saturated
* high fat meat and dairy
* trans fats in processed and deep fried

TABLE H5-1 Major Sources of Various Fatty Acids

Healthful Fatty Acids

Monounsaturated	Omega-6 Polyunsaturated
Avocado	Margarine (nonyhydrogenated)
Oils (canola, olive, peanut, sesame)	Oils (corn, cottonseed, safflower, soybean)
Nuts (almonds, cashews, filberts, hazelnuts, macadamia nuts, peanuts, pecans, pistachios)	Nuts (walnuts)
Olives	Mayonnaise
Peanut butter	Salad dressing
Seeds (sesame)	Seeds (pumpkin, sunflower)

Bad fats

Harmful Fatty Acids

Saturated	*Trans*
Bacon	Fried foods (hydrogenated shortening)
Butter	Margarine (hydrogenated or partially hydrogenated)
Chocolate	Nondairy creamers
Coconut	Many fast foods
Cream cheese	Shortening
Cream, half-and-half	Commercial baked goods (including doughnuts, cakes, cookies)
Lard	Many snack foods (including microwave popcorn, chips, crackers)
Meat	
Milk and milk products (whole)	
Oils (coconut, palm, palm kernel)	
Shortening	
Sour cream	

NOTE: Keep in mind that foods contain a mixture of fatty acids.

Fats subs

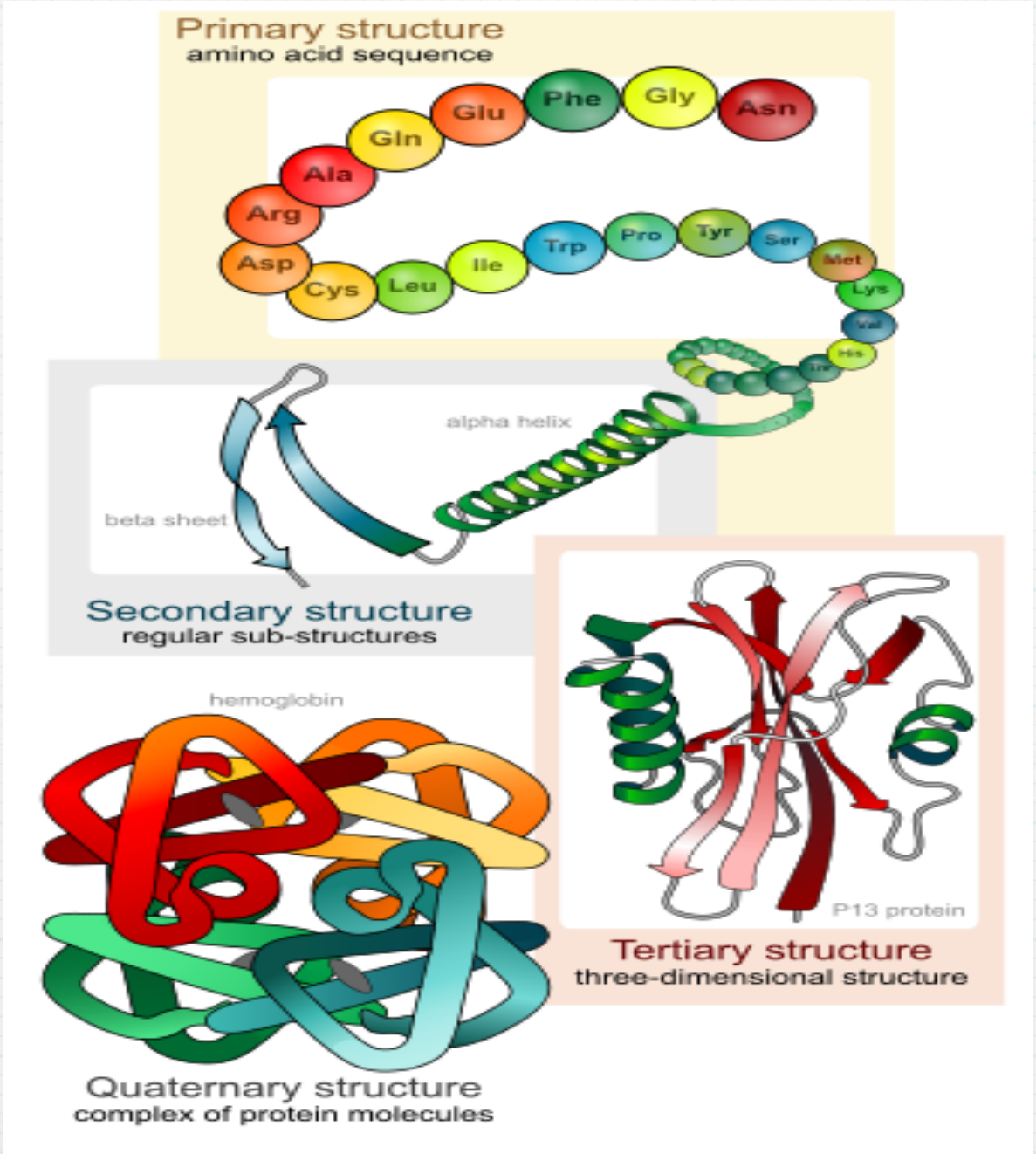
TABLE H5-2 Replacing Saturated Fat with Unsaturated Fat

Examples of ways to replace saturated fats with unsaturated fats include sautéing foods in olive oil instead of butter, garnishing salads with sunflower seeds instead of bacon, snacking on mixed nuts instead of potato chips, using avocado instead of cheese on a sandwich, and eating salmon instead of steak. Portion sizes have been adjusted so that each of these foods provides approximately 100 kcalories. Notice that for a similar number of kcalories and grams of fat, the first choices offer less saturated fat and more unsaturated fat.

	Total Fat (g)	Saturated Fat (g)	Unsaturated Fat (g)
Olive oil vs. butter	11 vs. 11	2 vs. 7	9 vs. 4
Sunflower seeds vs. bacon	8 vs. 9	1 vs. 3	7 vs. 6
Mixed nuts vs. potato chips	9 vs. 7	1 vs. 2	8 vs. 5
Avocado vs. cheese	10 vs. 8	2 vs. 4	8 vs. 4
Salmon vs. steak	4 vs. 5	1 vs. 2	3 vs. 3
Totals	**42 vs. 40**	**7 vs. 18**	**35 vs. 22**

Reducing fats

* In baking- try tofu, applesauce, pureed prunes.
* In sauces- non fat yogurt, tofu


Primary structure
amino acid sequence
Phe
Gly
Asn
Glu
Gln
Ala
Arg
Asp
Cys
Leu
Ile
Trp
Pro
Tyr
Ser
Met
Lys
alpha helix
beta sheet
Secondary structure
regular sub-structures
P13 protein
Tertiary structure
three-dimensional structure
hemoglobin
Quaternary structure
complex of protein molecules

Proteins

- Each have C, H and NH2(amino group)
- Made up of Amino acids chains- some essential(the body cannot make these)
- Antibodies, enzymes, hormones, structural (muscle), storage (albumin), transport (hemoglobin)

More protein functions:

- regulate pH balance (protein excess produced an acid residue)
- regulate fluids

Protein needs

* about .8-1 gm per kg of body weight
* average 150# needs 68 gms
* 9-13 yr olds need about 34 gm
* about 15-20% of calories

Types of protein

Complete and incomplete proteins

* egg and casein best absorbed
* soy most highly of vegetable protein

Animal vs. vegetable protein

* Choose lowest fat, unless fish
* vegetable protein has fiber!

Take home

- most Americans eat more protein than needed
- you don't need to combine incomplete proteins at a meal, but do eat a variety
- many cuisine combine foods to produce complete protein e.g. rice and beans

Vitamins and Minerals

* http://kidshealth.org/teen/misc/vitamin_chart.html
* http://kidshealth.org/teen/misc/mineral_chart.html

From A to Z

* Vitamins - water soluble and fat soluble
* Become active in the body playing many functions
* Minerals- structure and function

Phytonutrients

* Substances in plant foods that promote health

Different types

* Carotenoid

Common Food	Sources
alpha-carotene	carrots
beta-carotene	leafy green and yellow vegetables (eg. broccoli, sweet potato, pumpkin, carrots)
beta-cryptoxanthin	citrus, peaches, apricots
Lutein	leafy greens such as kale, spinach, turnip greens
Lycopene	tomato products, pink grapefruit, watermelon, guava
Zeaxanthin	green vegetables, eggs, citrus

Carotenoids
Flavonoids (Polyphenols), including
Isoflavones (Phytoestrogens)
Inositol Phosphates (Phytates)
Lignans (Phytoestrogens)
Isothiocyanates and Indoles
Phenols and Cyclic Compounds
Saponins
Sulfides and Thiols
Terpenes

Resource info:

* http://www.webmd.com/diet/phytonutrients-faq

Beneficial bacteria

* help with digestion
* help immune function
* may regulate caloric absorption and weight

Sources

* cultured foods- miso, kimchee, sauerkraut
* yogurts, femented milks
* supplements

Take Home

* Eat from the rainbow
* Eat some cultured foods

Putting into practice what is in our food

* Read labels
* evaluate recipes
* food as medicine- what we eat does affect us.
* how does culture affect food patterns
* Looking at disease states and nutrition

Mahalo!

* This is a very big topic and we just got a taste today. I hope you will be motivated to seek out more information .