Human Nutrition

Evolutionary Background
Digestive System
Macronutrient
Micronutrients
Vitamins and Minerals
Dietary Guidelines




Chimpanzees – our closest relatives

- Have a diverse diet
- Eat fruits (mostly), leaves, nuts, seeds, blossoms, mushrooms, many kinds of insects
- Occasionally catch and eat medium-sized mammals.
- Meat makes up less than two percent of their overall diet.
- Chimps deliberately eat medicinal plants (e.g. Aspilla leaves) and minerals to relieve stomach pains or reduce internal parasites

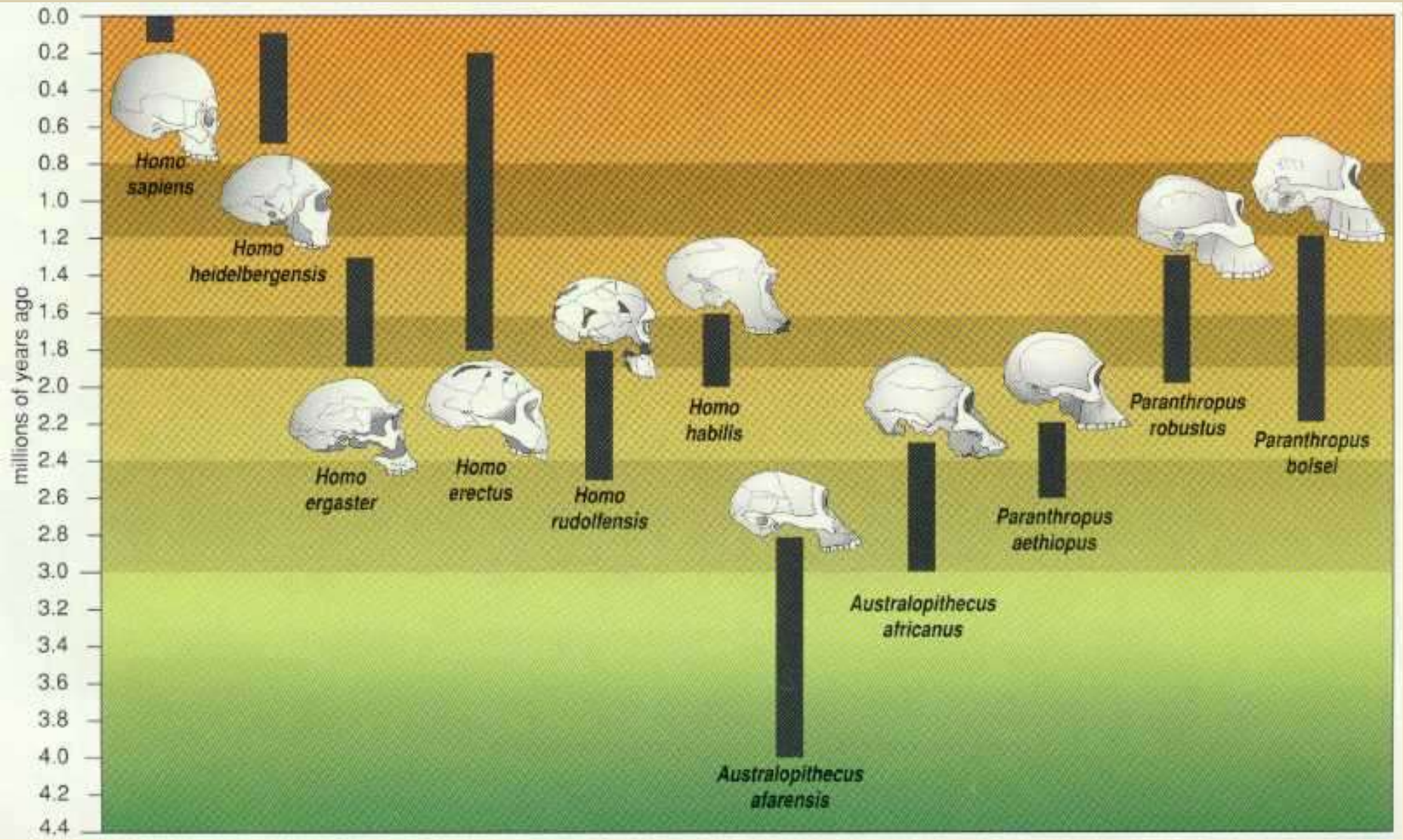
Gorillas

- Omnivorous
- Mainly vegetarian diet, feeding on stems, bamboo shoots and fruits, bitter leaves
- Also have an appetite for termites and ants

What did early humans eat?

Homo habilis *Australopithecus africanus* *Paranthropus robustus*

Evidence:
Archeological remains
Skull shape and muscle attachments
Teeth size, structure, and markings


millions of years ago
0.0
0.2
0.4
0.6
0.8
1.0
1.2
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1.6
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2.0
2.2
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3.4
3.6
3.8
4.0
4.2
4.4
Homo sapiens
Homo heidelbergensis
Homo ergaster
Homo erectus
Homo rudolfensis
Homo habilis
Australopithecus afarensis
Australopithecus africanus
Paranthropus aethiopus
Paranthropus robustus
Paranthropus boisei

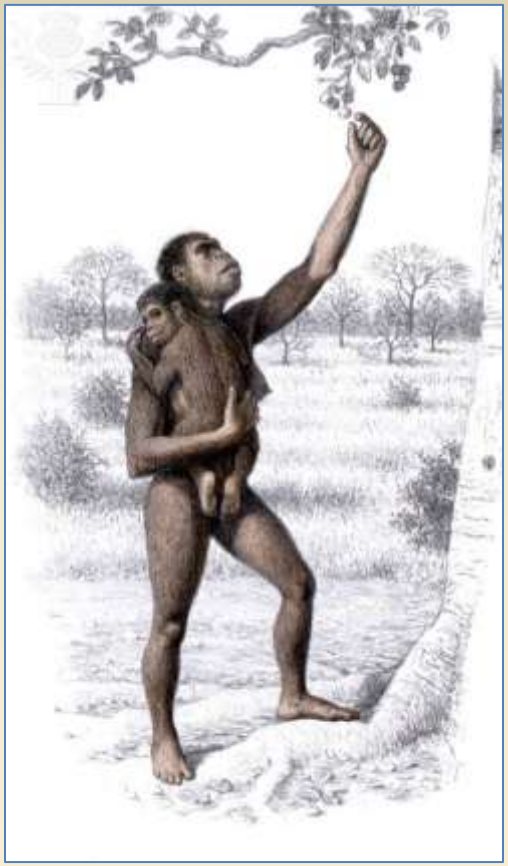
Australopithecus – *walked upright, short, small brains*

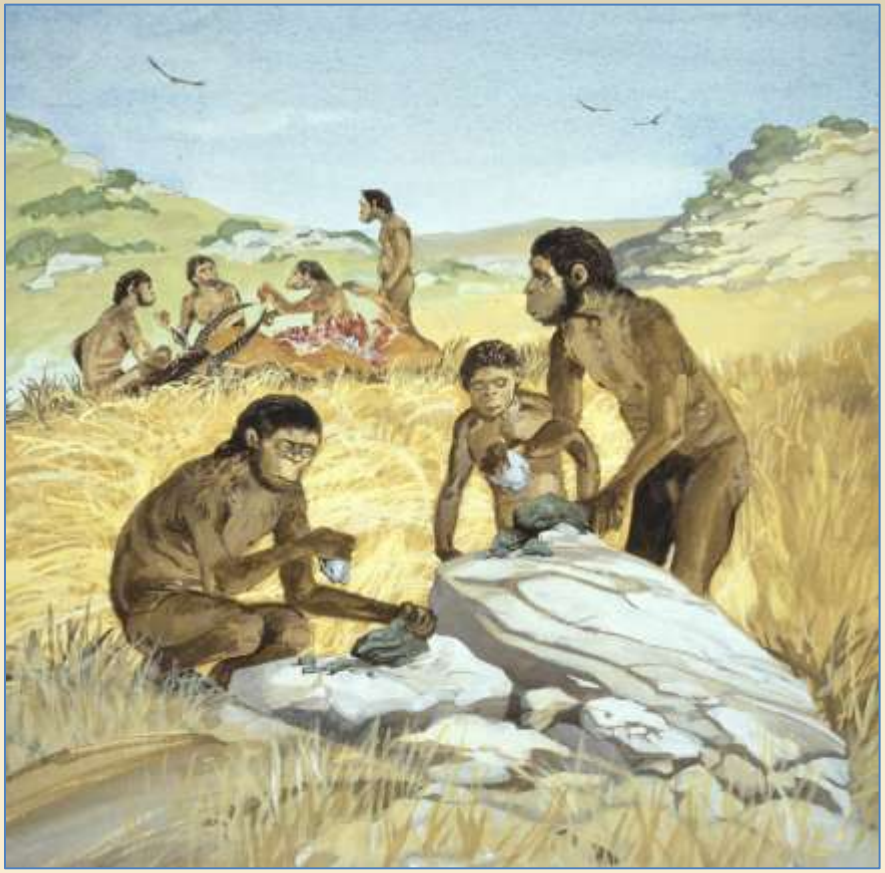
- Diet analyzed from chemical make up of teeth, carbon isotopes .
- Explored a wide variety of habitats and foods
- Early species ate leaves, fruit, bark, wood ,and other forest vegetation
- Later species switched to savannah plants – more roots, grasses, sedges, and possibly animals that ate such plants

Paranthropus boisei - the "Nutcracker Man"

- Lived between 2.3 and 1.2 million years ago.
- Teeth, cranium and mandible built for chewing and crunching.
- Back molar teeth large, twice as large as in modern humans.
- Ate larger quantities of plant matter than any other hominin studied to date.
- Perhaps too specialized, died out when climate changed

Homo habilis – Tool-using Humans

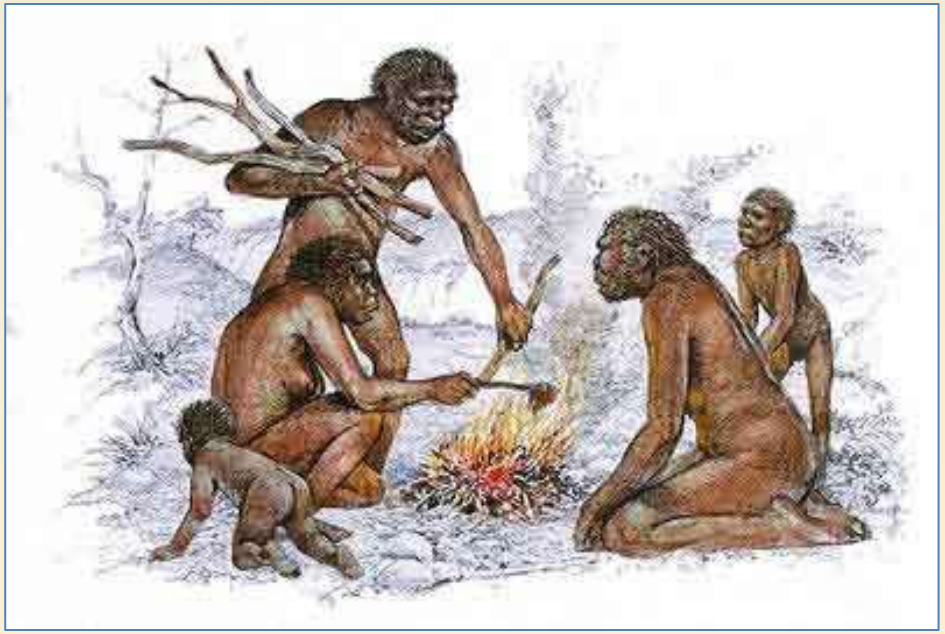




- Larger brains, made tools
- *Homo* scavenged roots, nuts, fruits, but included more meat
- Hunting and eating meat may have contributed to larger brain size

Homo erectus

- Resembled modern humans, same height, brains smaller
- First humans to master the art of cooking 1.9 million years ago
- Probably ate a lot of meat
- Preparing food with tools and fire meant more calories could be consumed and less time needed to be spent foraging and eating.
- Molar sizes shrunk while body mass increased



Homo erectus Scavenging Kills?

Domestication of cereals – 12,000 years ago

- More stable and predictable food source
- Allows people to stay in one place, e.g. villages, cities
- More carbohydrate in diet, less meat
- Health effects? Debated

YouTube Videos

Zeresenay Alemseged: The search for humanity's roots
https://www.youtube.com/watch?v=aTQx2VhwkK4

Walking With Lucy | California Academy of Sciences
https://www.youtube.com/watch?v=xT8Np0gI1dI&list=PLw_X3TN_pwALZxUPYiQxfLrmNQMja2Lwk&index=1

Mountain gorilla eating bamboo
https://www.youtube.com/watch?v=6OnOrp4gcwQ&noredirect=1

Chimpanzees Hunting for Meat
https://www.youtube.com/watch?v=YMXk5Z6-IHY

World's Deadliest - Killers Like Us: Chimpanzees
https://www.youtube.com/watch?v=RQq93Q2txrs

Australopithecus Boisei
https://www.youtube.com/watch?v=wgRBzAN3_jQ

Homo Heidelbergensis
https://www.youtube.com/watch?v=2g799e3SNX4

- **The GI tract** (gastrointestinal tract)

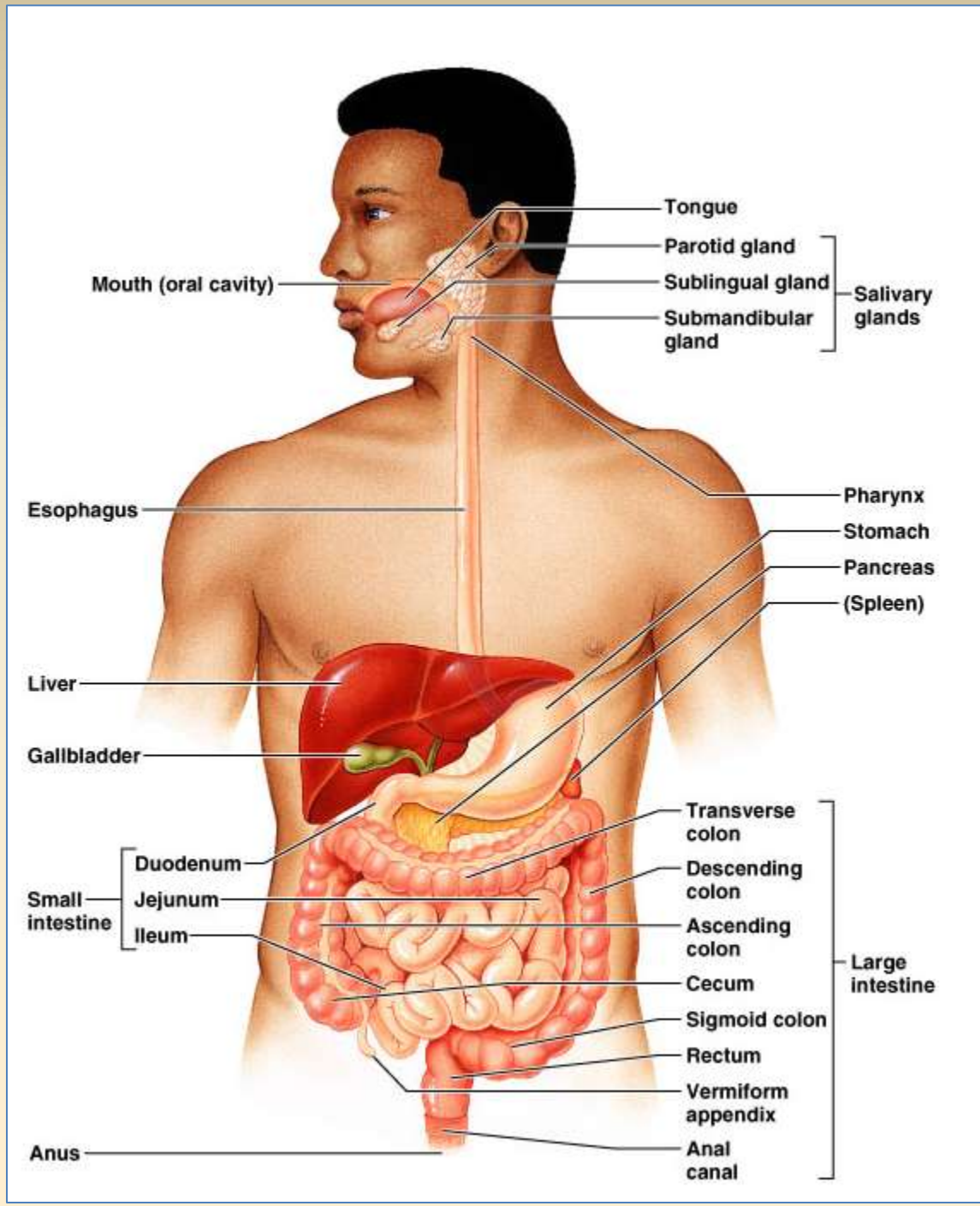
The muscular alimentary canal

  - Mouth
  - Pharynx
  - Esophagus
  - Stomach
  - Small intestine
  - Large intestine
  - Anus

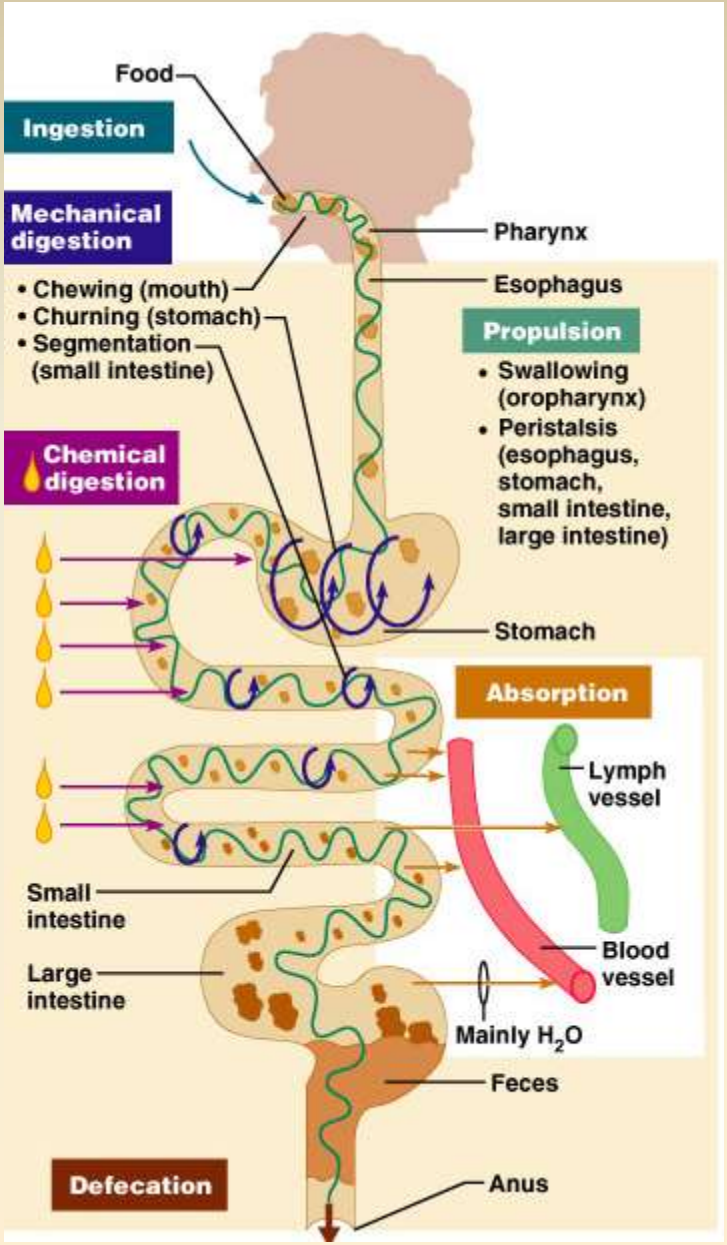
- **The accessory digestive organs**

Supply secretions contributing to the breakdown of food

  - Teeth & tongue
  - Salivary glands
  - Gallbladder
  - Liver
  - Pancreas



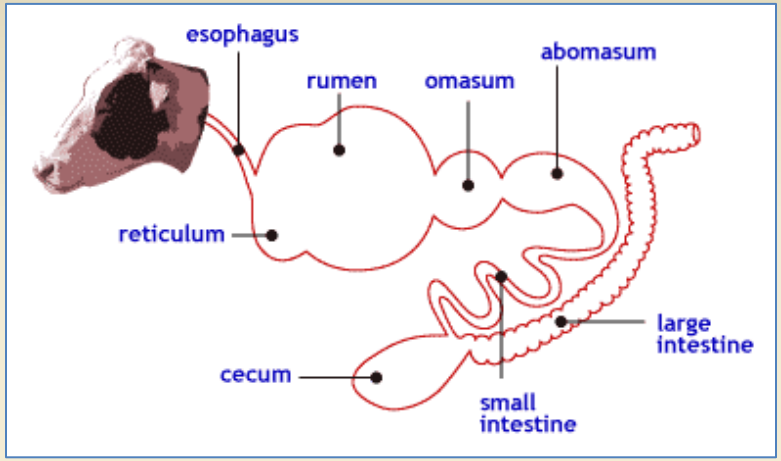
The Digestive Process



- Ingestion
  - Taking in food through the mouth
- Propulsion (movement of food)
  - Swallowing
  - Peristalsis – propulsion by alternate contraction &relaxation
- Mechanical digestion
  - Chewing
  - Churning in stomach
  - Mixing by segmentation
- Chemical digestion
  - By secreted enzymes: see later
- Absorption
  - Transport of digested end products into blood and lymph in wall of canal
- Defecation
  - Elimination of indigestible substances from body as feces

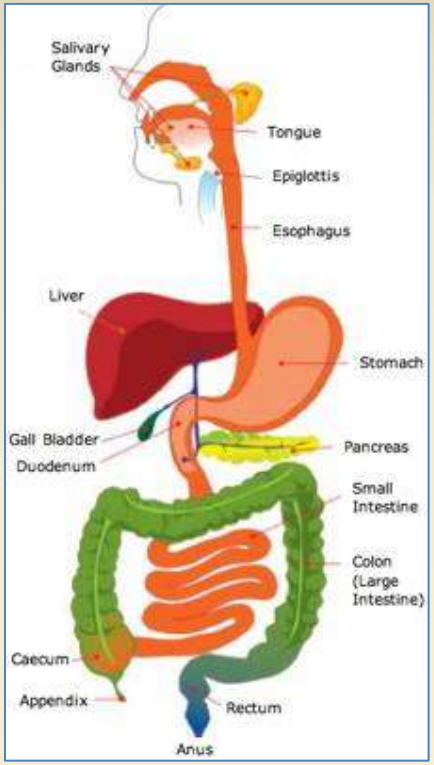
Length of Digestive Tract

Cow – 30 m

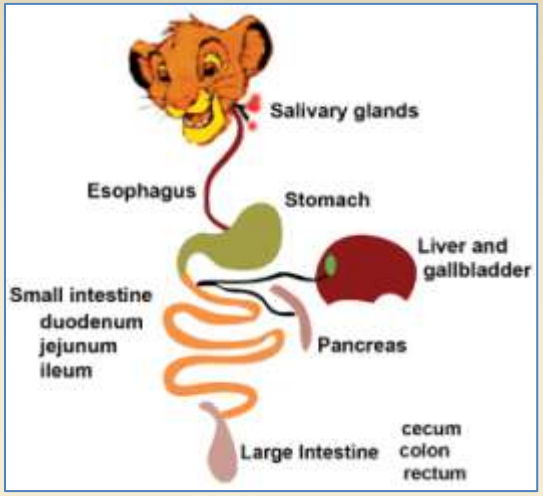


Herbivores have long digestive tract; foregut organs such as rumens or hindgut chambers for fermenting carbohydrates

Human – 9 m



Tiger – 7 m



Carnivores have shorter digestive tracts because digesting meat is easier

- Humans more intermediate, probably omnivores
- Humans have "large" intestines, while chimps and orangs have "large" colons

Energy - Calories

Calorie (with a capitol C = kcal) - the amount of energy needed to raise the **temperature of one kilogram of water by 1° C**.

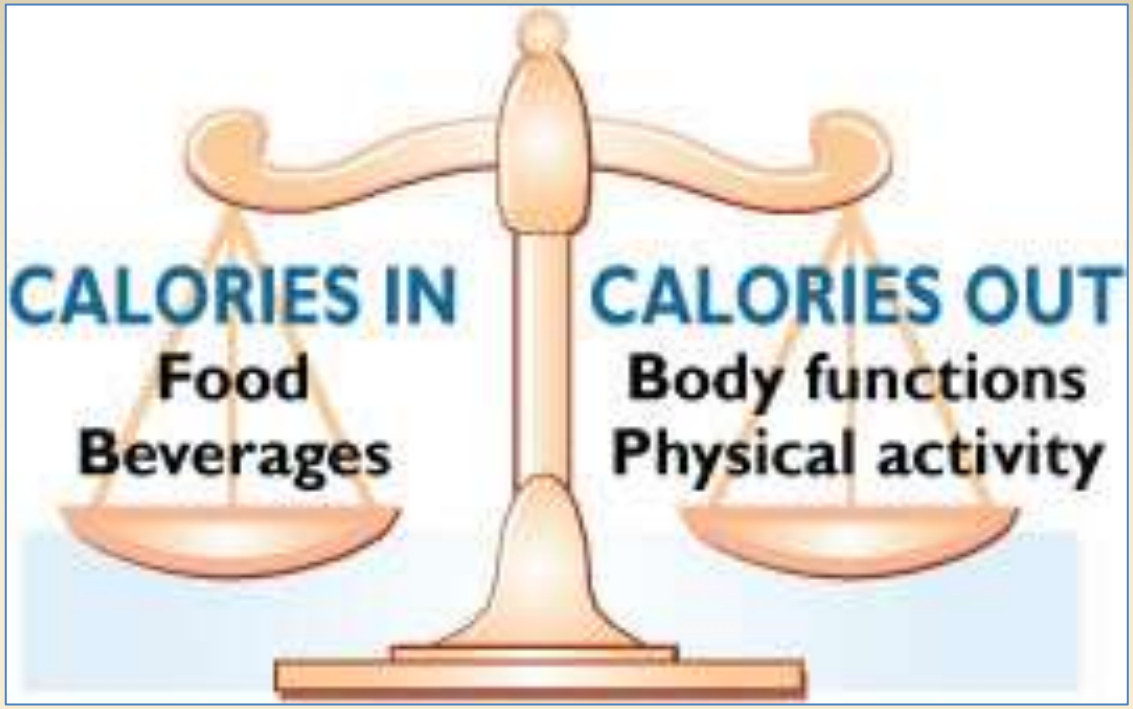
Energy requirements vary with age, sex, and activity level of the individual

Daily Requirements - Varies from 1,200 to 3,200 kilocaleries per day

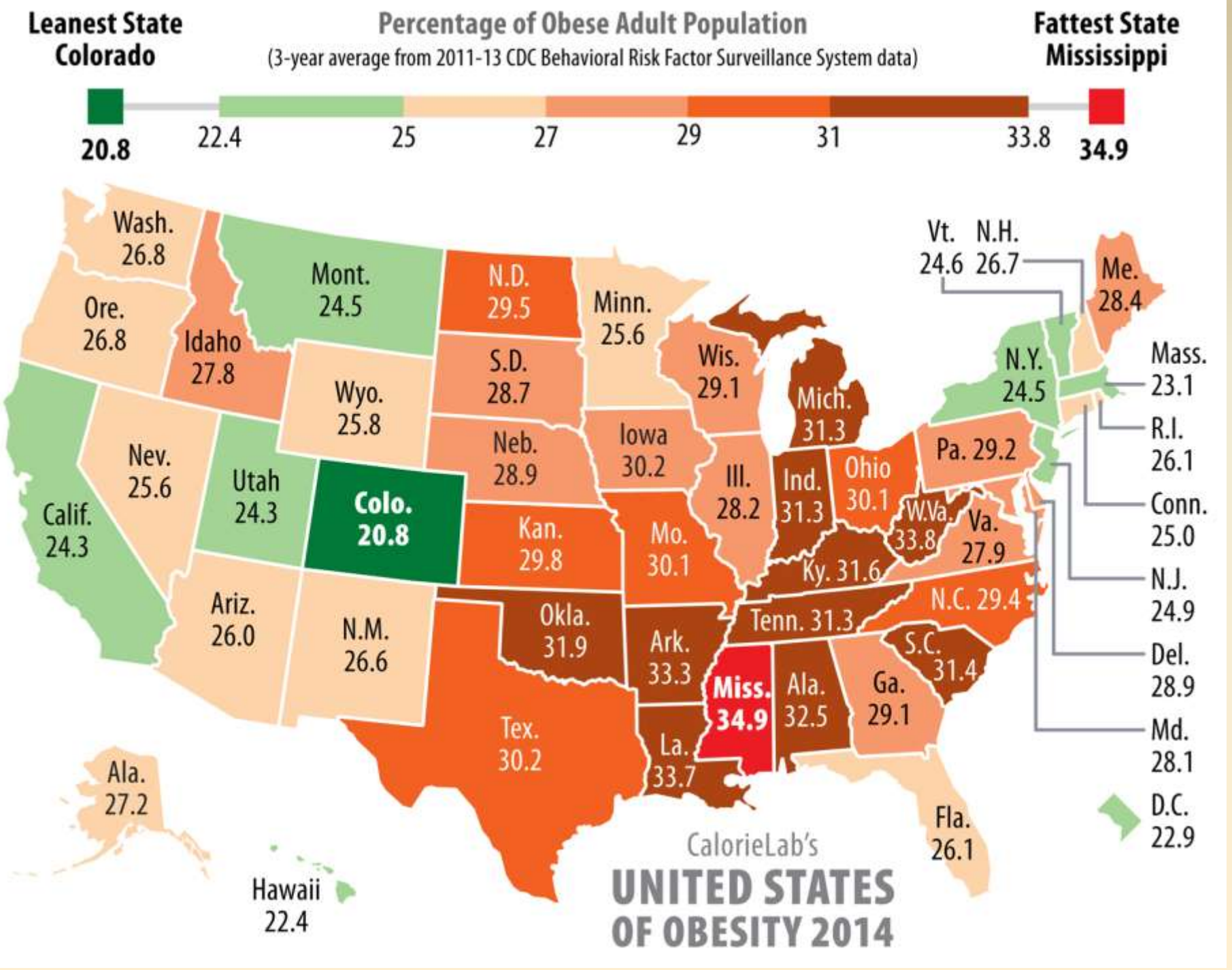
- 1,600 for women
- 2,200 for men

Sitting at a desk all day consumes about **2,000 Calories**

The Law



- If calories taken in exceed calories lost you will gain weight
- If you want to lose weight you must lose more than you take in. No shortcuts (except liposuction)


Leanest State
Colorado
Percentage of Obese Adult Population
(3-year average from 2011-13 CDC Behavioral Risk Factor Surveillance System data)
Fattest State
Mississippi
20.8
22.4
25
27
29
31
33.8
34.9
Wash. 26.8
Ore. 26.8
Calif. 24.3
Idaho 27.8
Nev. 25.6
Mont. 24.5
Wyo. 25.8
Utah 24.3
Colo. 20.8
Ariz. 26.0
N.M. 26.6
N.D. 29.5
S.D. 28.7
Neb. 28.9
Kan. 29.8
Okla. 31.9
Tex. 30.2
Minn. 25.6
Iowa 30.2
Mo. 30.1
Ark. 33.3
La. 33.7
Wis. 29.1
Ill. 28.2
Mich. 31.3
Ind. 31.3
Ohio 30.1
Ky. 31.6
Tenn. 31.3
Miss. 34.9
Ala. 32.5
Vt. 24.6
N.H. 26.7
Me. 28.4
N.Y. 24.5
Pa. 29.2
W.Va. 33.8
Va. 27.9
N.C. 29.4
S.C. 31.4
Ga. 29.1
Fla. 26.1
Mass. 23.1
R.I. 26.1
Conn. 25.0
N.J. 24.9
Del. 28.9
Md. 28.1
D.C. 22.9
Ala. 27.2
Hawaii 22.4
CalorieLab's
UNITED STATES
OF OBESITY 2014

Calorie Counters

HOW MANY CALORIES SHOULD I EAT EACH DAY?

American Cancer Society Calorie Counter
http://www.cancer.org/healthy/toolsandcalculators/calculators/app/calorie-counter-calculator

Mayo Clinic Calorie
http://www.mayoclinic.org/calorie-calculator/itt-20084939

HOW MANY CALORIES ARE IN YOUR FOOD?

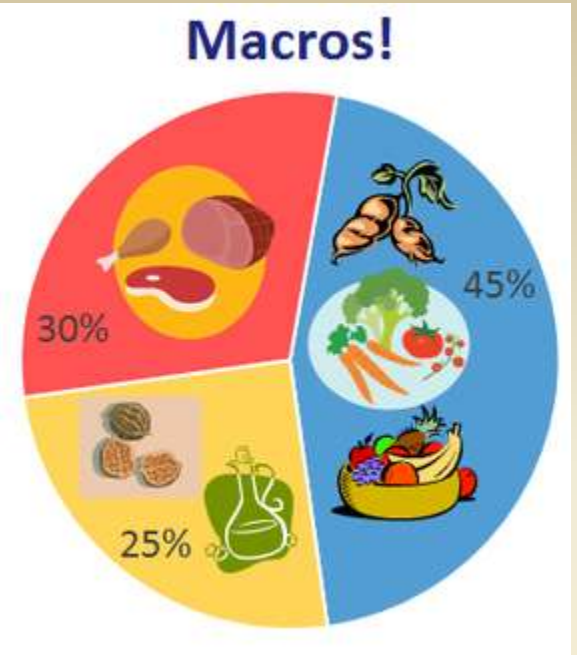
Online Calorie Counter
https://www.fitwatch.com/caloriecounter

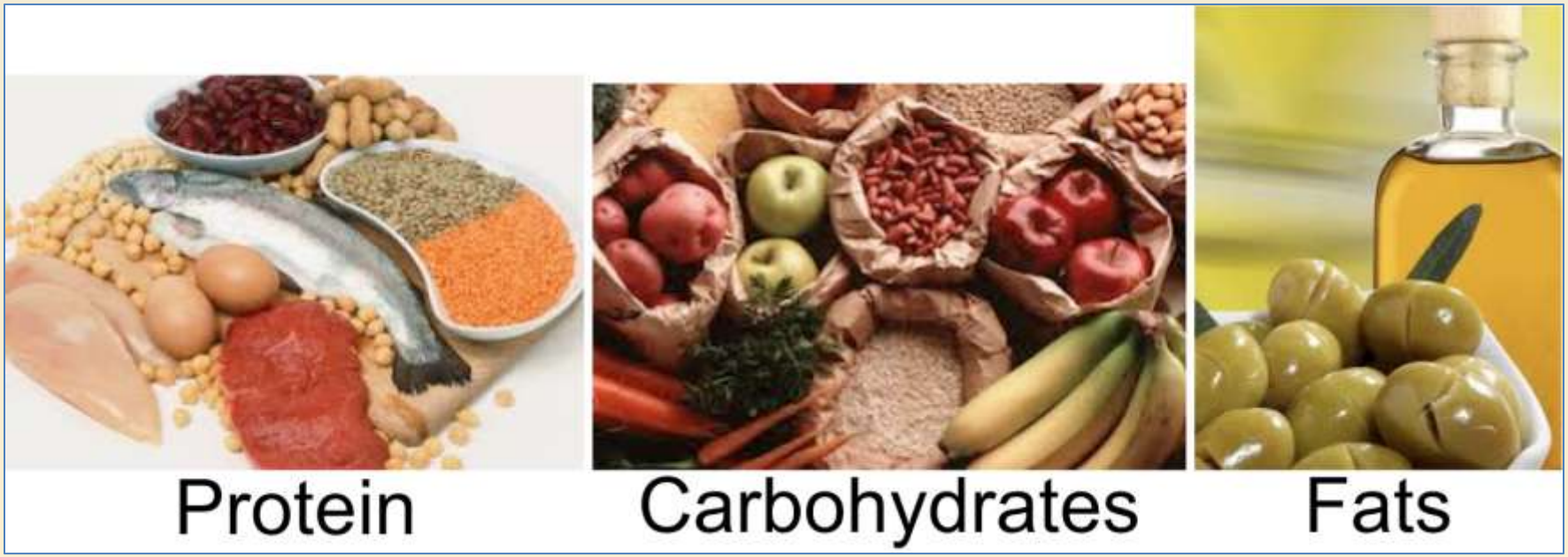
Food-o-Meter Calorie Calculator
http://www.webmd.com/diet/healthtool-food-calorie-counter

CalorieLab
http://calorielab.com/index.html

Macronutrients

- Carbohydrates
- Lipids
- Proteins



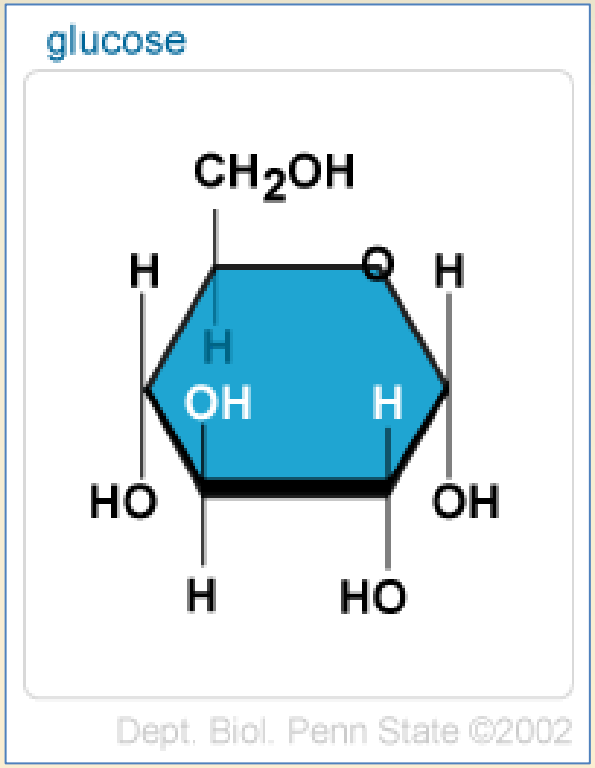


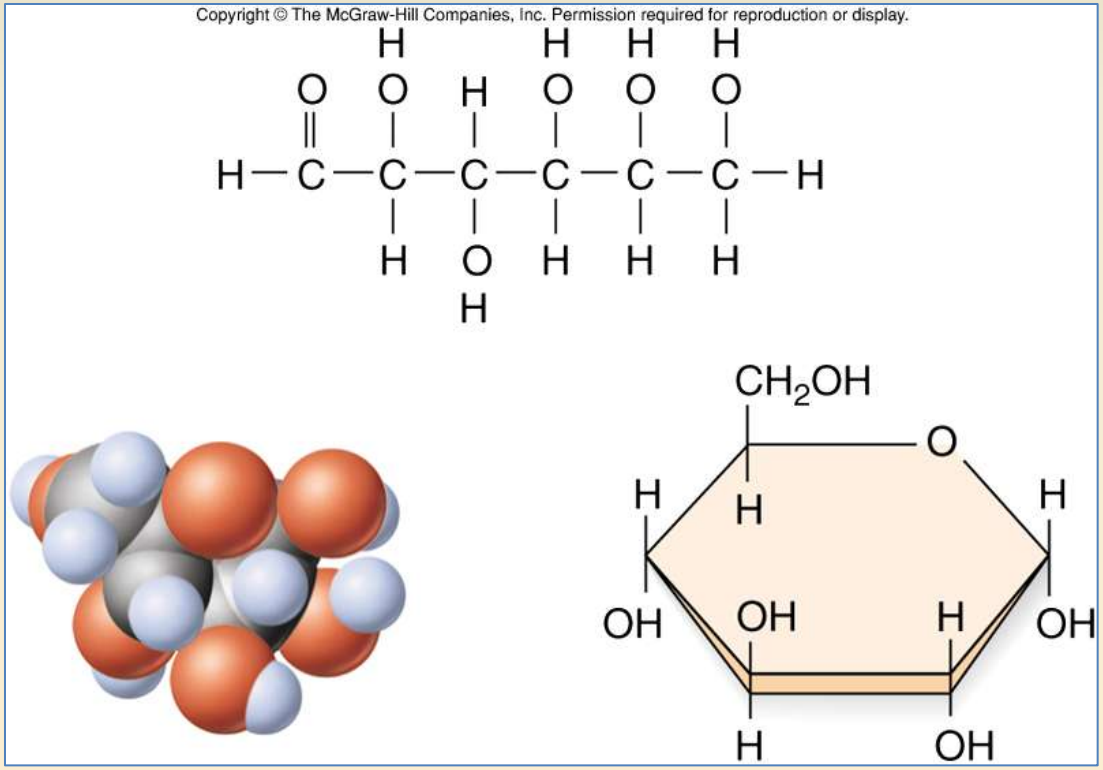
Sugars and Complex Carbohydrates

Monosaccharides - Glucose

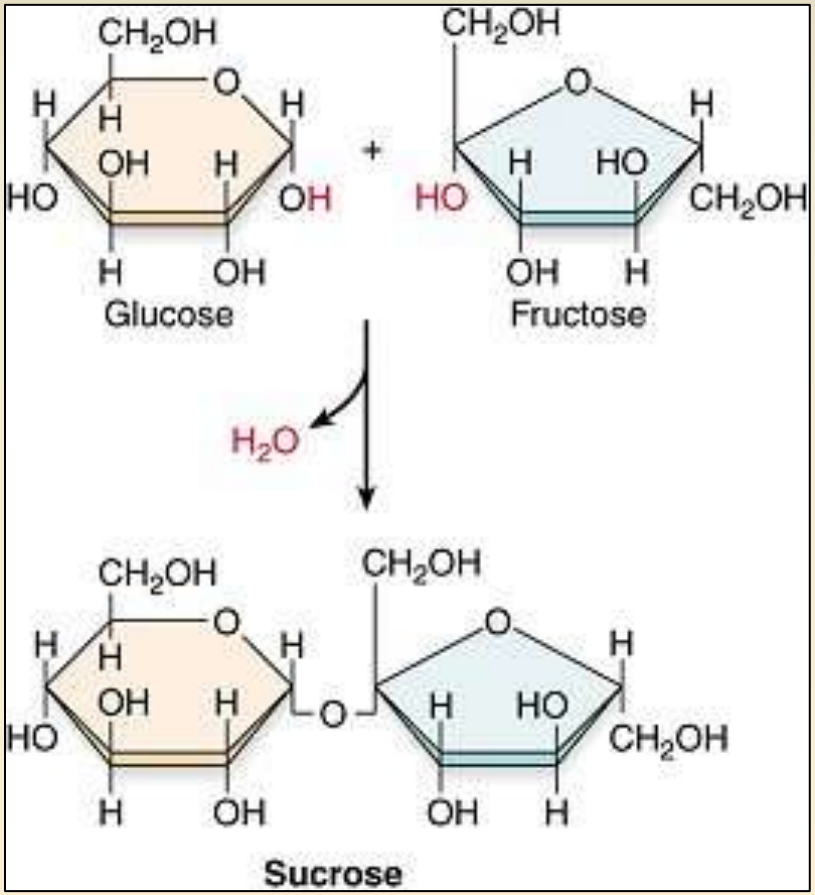
Carbs are source of glucose

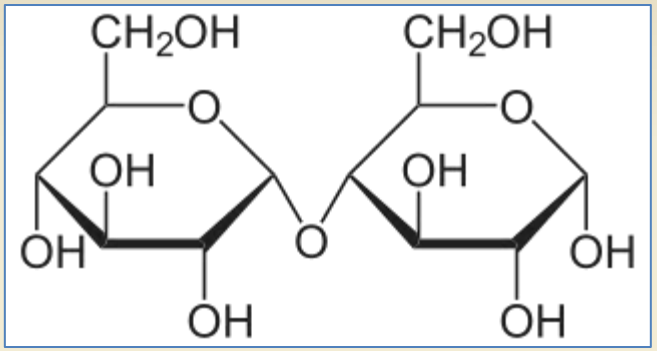
Formula C6H12O6





Disaccharides - two carbohydrates linked together; i.e. sucrose, maltose

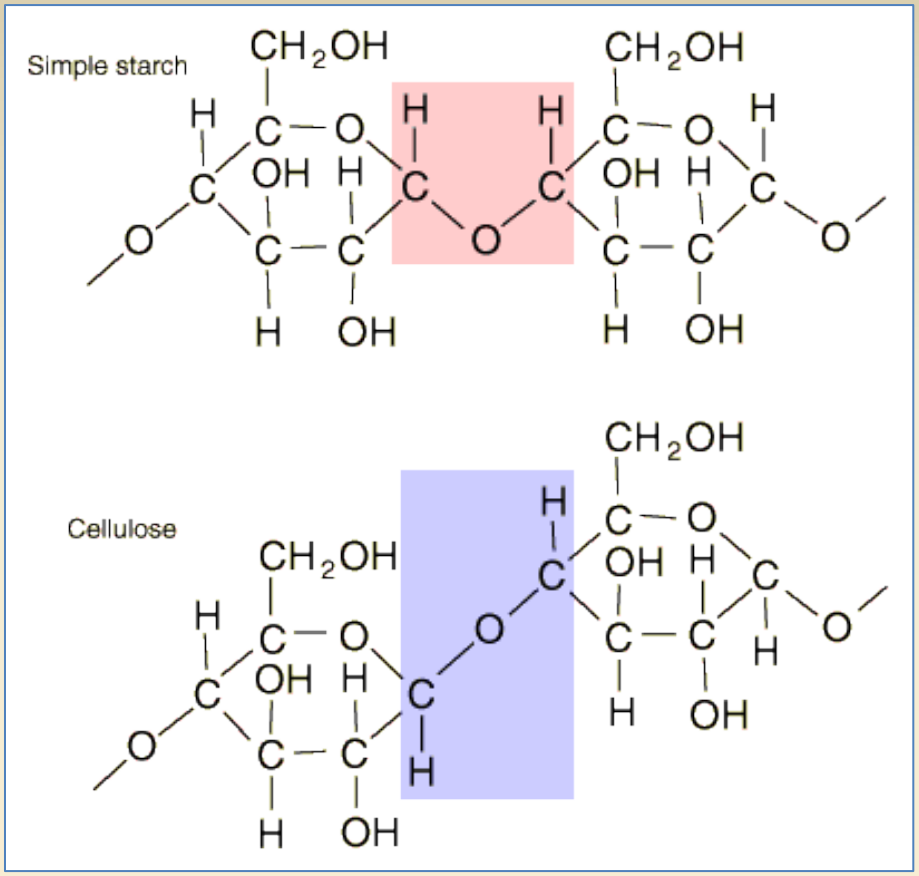




Maltose

Beer is brewed from malted barley

Polysaccharides - Starch and Cellulose



- differ in how the carbohydrates are linked together, two slightly different types of bonds are used.
- makes them different enough that one you can easily digest while the other is not digested at all by humans.

How much carbohydrate should I eat each day?

The optimal carb range varies between individuals, depending on activity levels, current metabolic health and a bunch of other factors

Adults should probably try to get between 45–65% of dietary energy from carbohydrates, although this is debated

USDA guidelines call for six one-ounce servings of grain foods each day, at least half from whole grain sources .

100-150 Grams Per Day - a moderate carbohydrate intake, appropriate for people who are lean, active and simply trying to stay healthy and maintain their weight.

- All the vegetables you can imagine.
- Several pieces of fruit per day.
- Some amount (not a lot) of healthy starches like potatoes, sweet potatoes and healthy grains like rice and oats.

50-100 Grams Per Day - if you want to lose weight while allowing for a bit of carbs in the diet.

- Plenty of vegetables.
- Maybe 2-3 pieces of fruit per day.
- Minimal amounts of starchy carbohydrates.

Fiber

Two Main Kinds

1. Insoluble
2. Soluble

How Much Dietary Fiber Do You Need Per Day?

25 g for adult women

38 g for adult men

The average American diet barely consumes half of this amount with an intake of 10-15 grams daily

Insoluble fiber

- Does not dissolve in water and does not get broken down by bacteria in the intestine. Instead, it essentially absorbs water to help to increase bulk and to soften stool.
- The net effect of insoluble fiber is that it promotes regular bowel movements. Additionally, insoluble fiber helps us to feel full which may reduce obesity. It also may reduce our risk of developing hemorrhoids.

Food Sources of Insoluble Fiber:

1. Whole-wheat products (bread, flour, bran)
2. Corn bran
3. Brown rice
4. Certain vegetables (Carrots, cauliflower, celery, tomatoes)
5. Nuts, beans

Soluble Fiber

- Dissolves in water and additionally is broken down by bacteria in the intestine.
- Helps prevent cholesterol from being absorbed by the intestines and is thought to help minimize the rise in blood sugar following a meal.

Dietary Sources of Soluble Fiber:

1. Oatmeal
2. Beans
3. Fruits such as apples, plums, kiwi, pears, blackberries, strawberries, raspberries, peaches, citrus fruits, dried apricots, prunes, and figs.
4. Some vegetables (dried peas, beans, and lentils)

Potential Health Benefits of Dietary Fiber:

1. Helps prevent constipation
2. May reduce risk of colon cancer
3. May reduces LDL cholesterol and cardiovascular risk
4. May reduce the risk of developing type 2 diabetes
5. Helps to increase satiety and reduce caloric intake. A high-fiber diet tends to make a meal feel larger and linger longer, so you stay full for a greater amount of time

Foods High in Fiber

1 medium-sized apple with its skin: 5g
1 cup of blueberries: 4.2g
1 cup of raspberries: 6.4g
1 medium banana: 3g
1 ounce of almonds: 4g
1 ounce of flaxseed: 8g
1 cup of cooked black beans: 13.9g
1 cup of rolled dry oats: 12g
1 medium avocado: 11.8g
1 cup of cooked kales: 7.2g
1 cup of cooked spinach: 4.3g

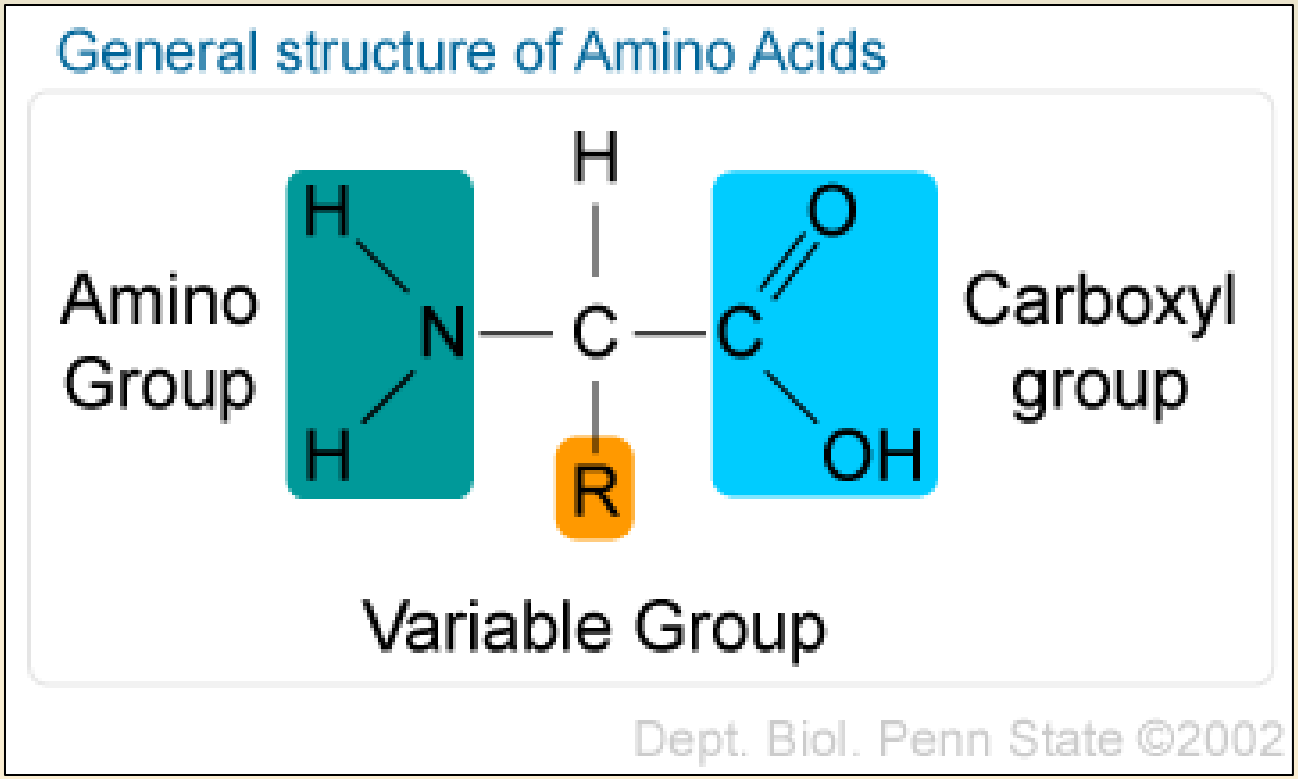
Proteins and Essential Amino Acids

Functions of Proteins

Type of Protein	Function	Examples
Structural	Support	Collagen, keratin
Enzymes	Catalysts	Digestive enzymes
Hormones	Regulation	Insulin
Transport	Transport substance	Hemoglobin
Storage	Storage of amino acids	Ovalbumin in egg white, casein in milk
Contractile	Movement	Actin and myosin in muscles
Defensive	Protection	Antibodies (immunoglobins)

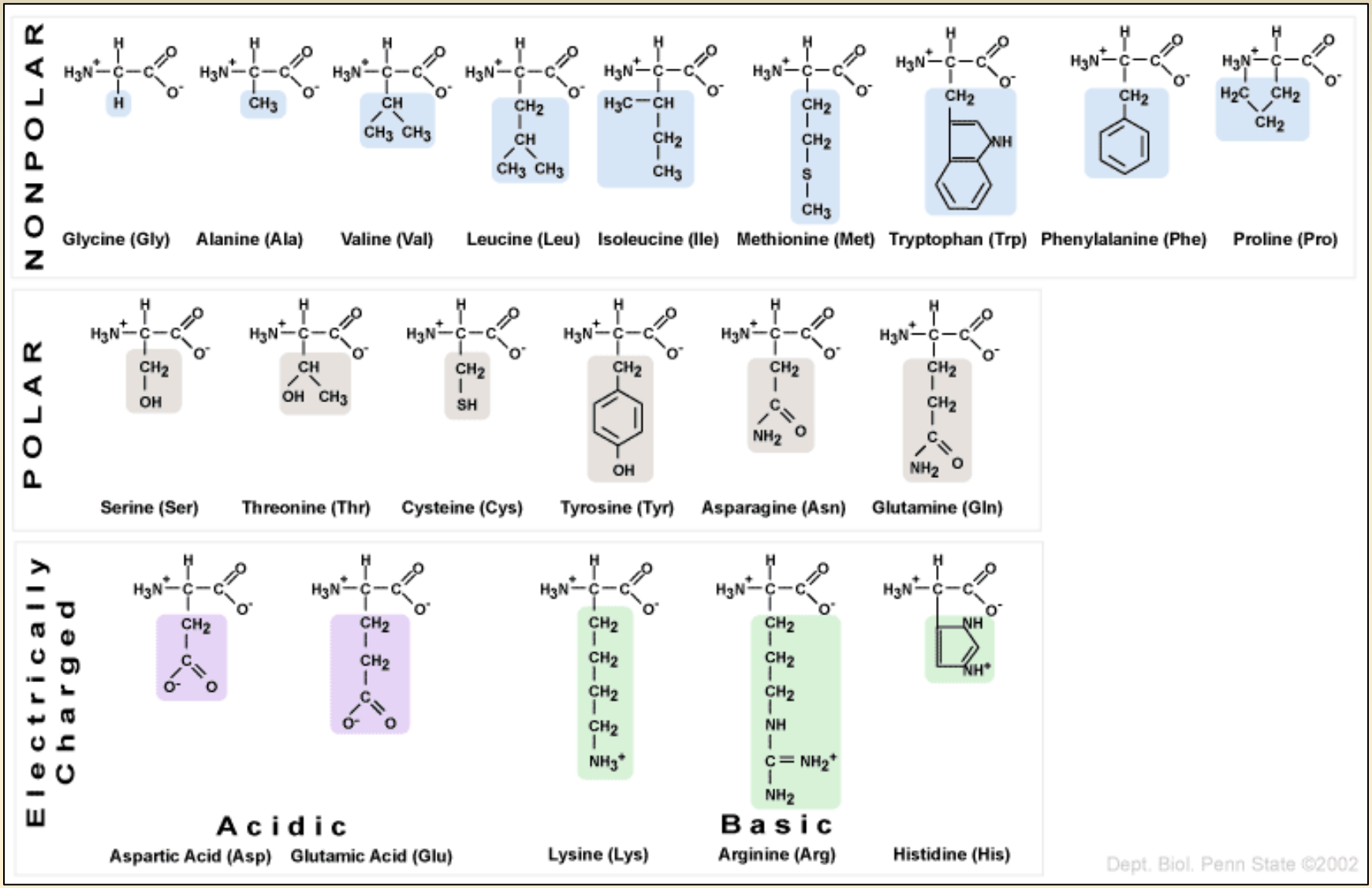
Proteins

Proteins are made by building long chains of **amino acids**.
The Amino acid structure looks like this:



Joined together in Polypeptides

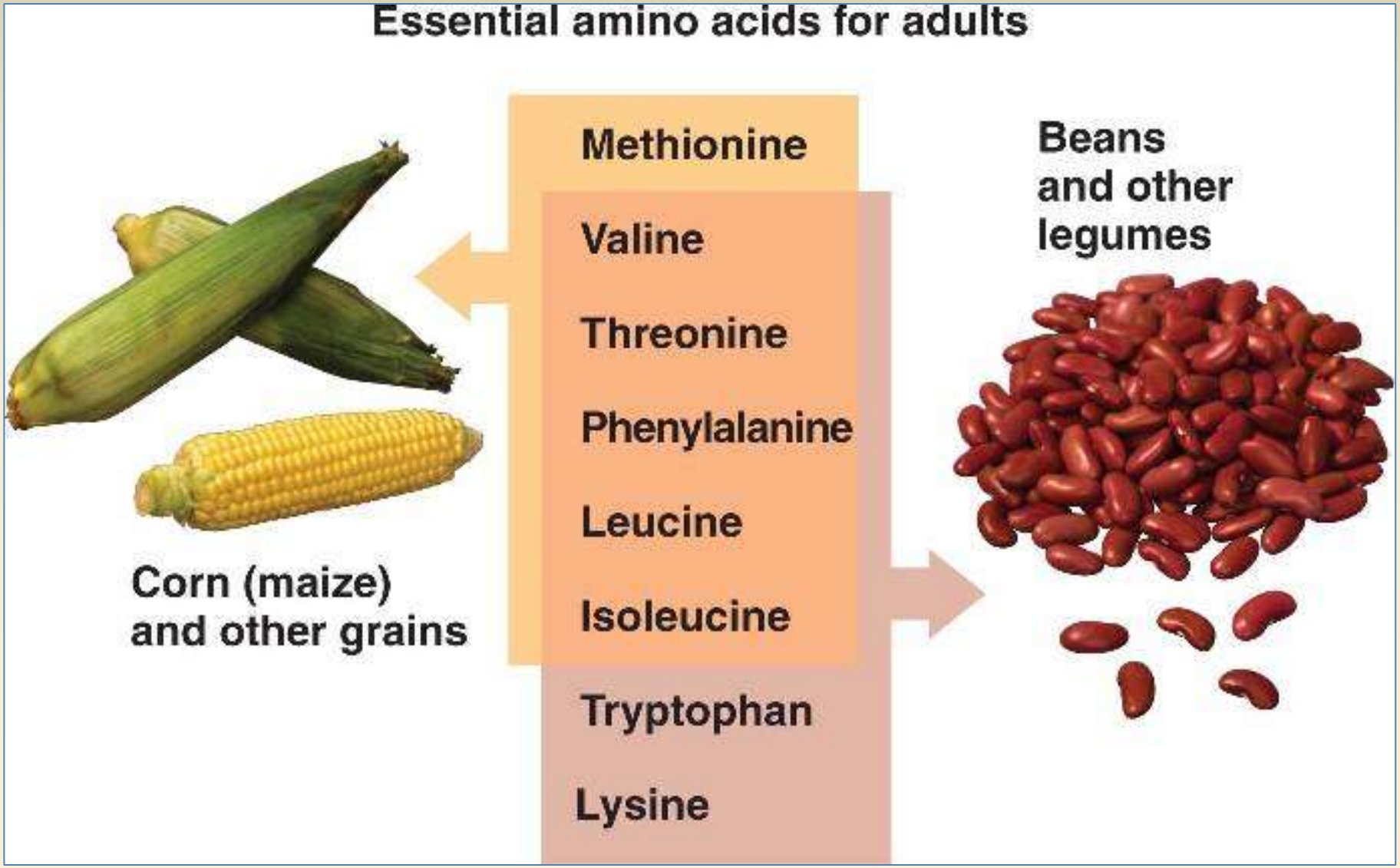
The R side chain is attached to central Carbon.
Each R side chain has a different structure to it
Twenty different types of side chains (20 amino acids)



Essential and Nonessential Amino Acids

Essential	Nonessential
Histidine	Alanine
Isoleucine	Asparagine
Leucine	Aspartic acid
Lysine	Arginine
Methionine	Cysteine
Phenylalanine	Glutamic acid
Threonine	Glutamine
Tryptophan	Glycine
Valine	Proline
	Serine
	Tyrosine

Combining proteins – Complementary proteins



Protein Complementarity Ideas

(for balanced amino acids)

Beans and Rice
Beans and Wheat
Beans and Cheese
Beans and Corn
Beans and Sesame Seeds
Potatoes and Milk
Potatoes and Cheese
Rice and Milk
Rice and Cheese
Rice and Sesame Seeds
Rice and Wheat and Seeds or Nuts
Sesame Seeds and Milk or Cheese
Wheat and Cheese

Whole Grains
Nuts
Seeds

\+

Legumes (beans, peas, or peanuts)

= A Complete, Balanced Protein

2 parts grains to 1 part legumes is the proper 2:1 ratio for a balanced protein.

Protein Content (in grams) of Some Common Food Items

1 ounce meat (beef, chicken, turkey)	7
1 ounce cheese	7
1 glass milk	8
1/2 cup beans	6
1 slice whole-wheat bread	4
1 egg	8
2 Tbsp. peanut butter	8
1 serving oatmeal	5

How much protein do we need each day?

- Amount of protein depends on many factors, including activity levels, age, muscle mass, physique goals and current state of health.

- The DRI (Dietary Reference Intake) is 0.8 grams of protein per kilogram of body weight, or 0.36 grams per pound .
- This amounts to about:

  56 grams per day for the average sedentary man.

  46 grams per day for the average sedentary woman.

- Eat more if trying to gain wait, less if trying to lose weight.

- Eat more if athletic, pregnant, elderly

Protein in Your Diet

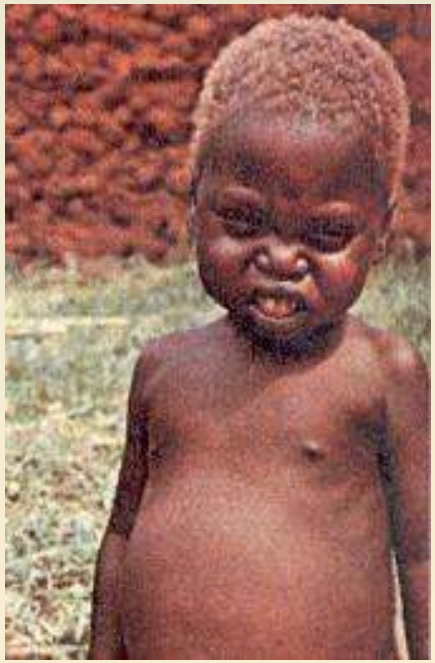
It's not hard to get this amount if you eat two to three servings of protein-rich foods a day:

- A small 3-ounce piece of meat has about 21 grams of protein. A typical 8-ounce piece of meat could have over 50 grams of protein.
- One 8-ounce container of yogurt has about 11 grams of protein.
- One cup of milk has 8 grams of protein.
- One cup of beans has about 15 grams of protein.

Protein should take up no more than one-third of your plate at meals

Kwashiorkor – protein deficiency

- disease that mostly affects children and is caused by an inadequate amount of protein in the diet.
- usually develops in areas afflicted by famine or drought or in places where food is scarce.



Characteristic signs: an enlarged and swollen stomach, hair develops a reddish tinge and becomes very brittle, weight loss is excessive and growth becomes stunted.

Gluten Intolerance – Celiac Disease

Gluten

- Proteins found in wheat and other grains.
- Provide an elasticity hold flour products together
- Often used in sauces, flavorings, binders

Celiac Disease - 1/133 people

- Gluten trigger immune system to overreact
- Villi that line the walls of your intestine wear down
- May take time to show up

Symptoms -

- Bloating, abdominal discomfort or pain, diarrhea, constipation, muscular disturbances, headaches, migraines, severe acne, fatigue, and bone or joint pain.
- Symptoms disappear once you remove wheat and gluten from diet

Wheat Allergy

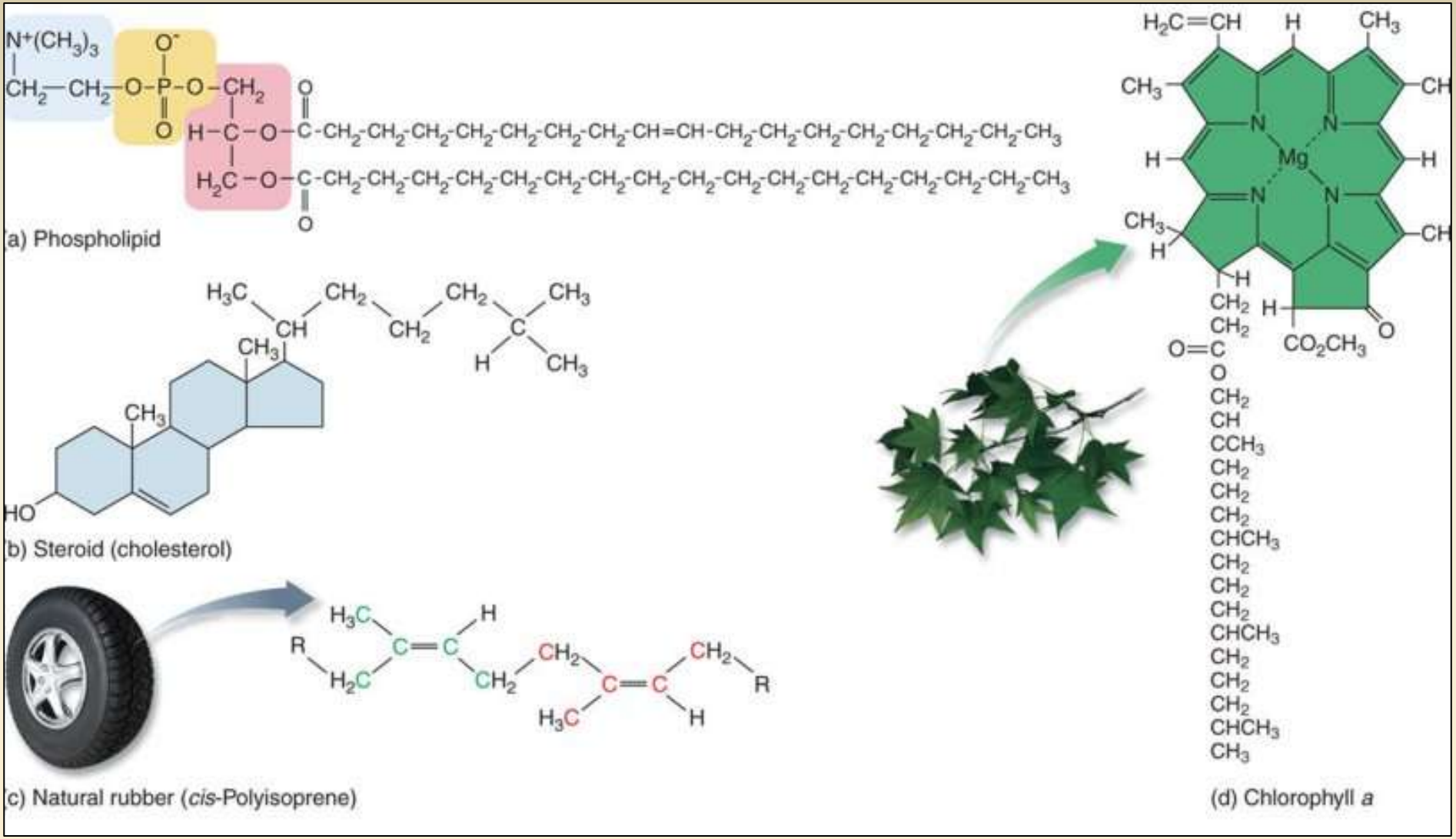
- histamine response to gluten, like hay fever or hives, response felt soon after eating wheat

Gluten-Free Diet

Allowed Food	Avoid unless labeled Gluten Free	Avoid Food
Beans, seeds, nuts in their natural, unprocessed form	Beer	Barley (malt, malt flavoring and malt vinegar)
Fresh eggs	Breads, bread crumbs	Rye
Fresh meats, fish and poultry	Cakes, pies, cookies, crackers	Triticale (a cross between wheat and rye)
Fruits and vegetables	Candies	Wheat, bulgur
Most dairy products	Cereals	Seitan
Teff (tef)	Salad dressings, sauces including soy sauce	Durum flour
Amaranth	Croutons	Farina flour
Buckwheat	French fries	Graham flour
Corn (maize)	Gravies	Kamut
Millet	Imitation meat or seafood	Semolina
Quinoa	Matzo	Spelt
Rice	Pastas	Couscous
Sorghum	Processed luncheon meats	Triticale

Fats and Cholesterol

Lipids


(a) Phospholipid
(b) Steroid (cholesterol)
(c) Natural rubber (cis-Polyisoprene)
(d) Chlorophyll a

Fats and Cholesterol (Lipids)

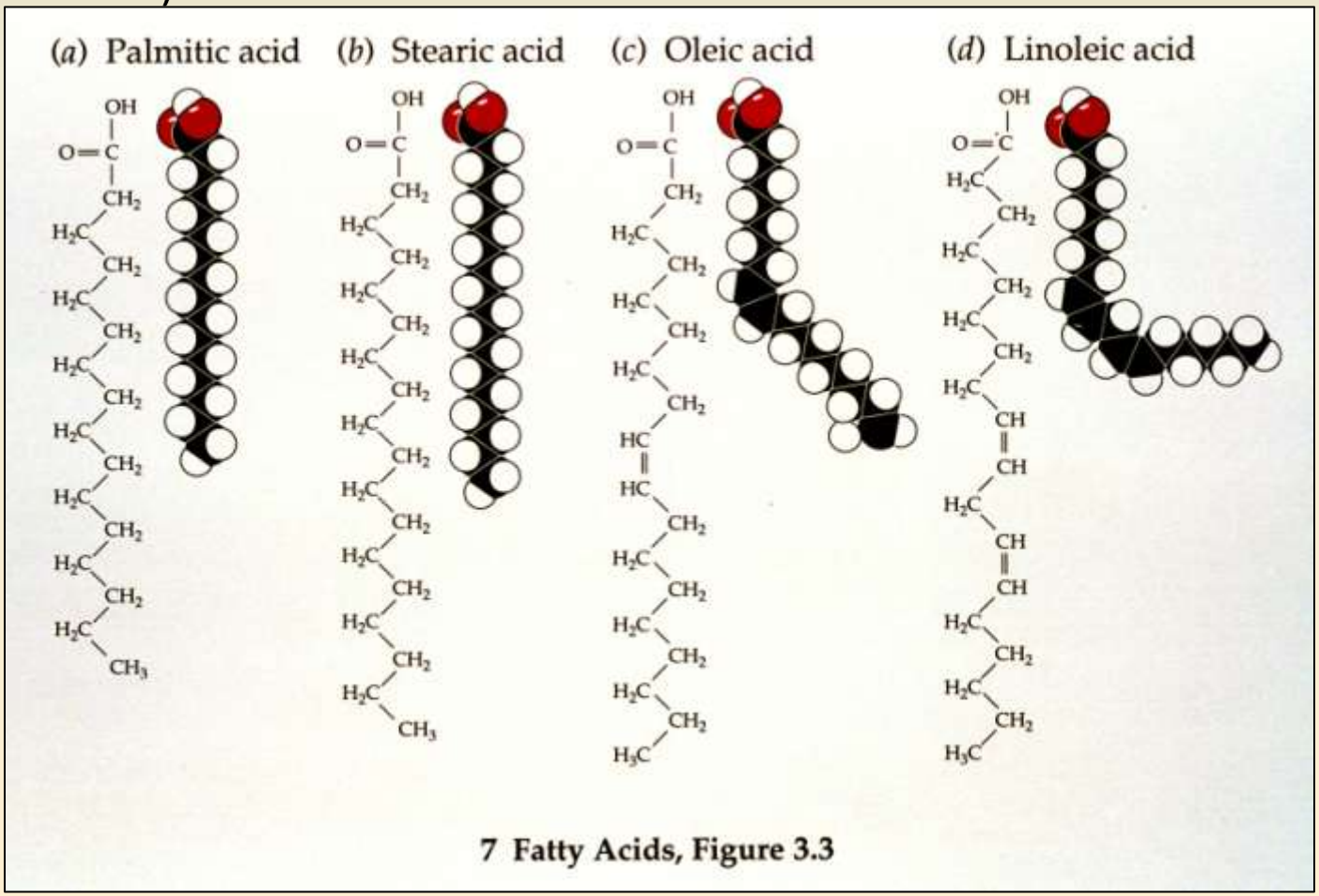
- store energy and insulate the body.
- cell membranes, myelin sheaths, and certain hormones.
- from animal fat and vegetable oils.

Functions of Lipids

Type of Lipid	Function	Examples
Triglyceride	Energy, storage	Animal fat, vegetable oils
	Insulation	Subcutaneous fat
Steroid	Structure	Cholesterol in membranes
	Hormonal regulation	Cortisol, estrogen, testosterone
Phospholipid	Structure	Phosphatidylcholine in cell membranes

Fatty acids

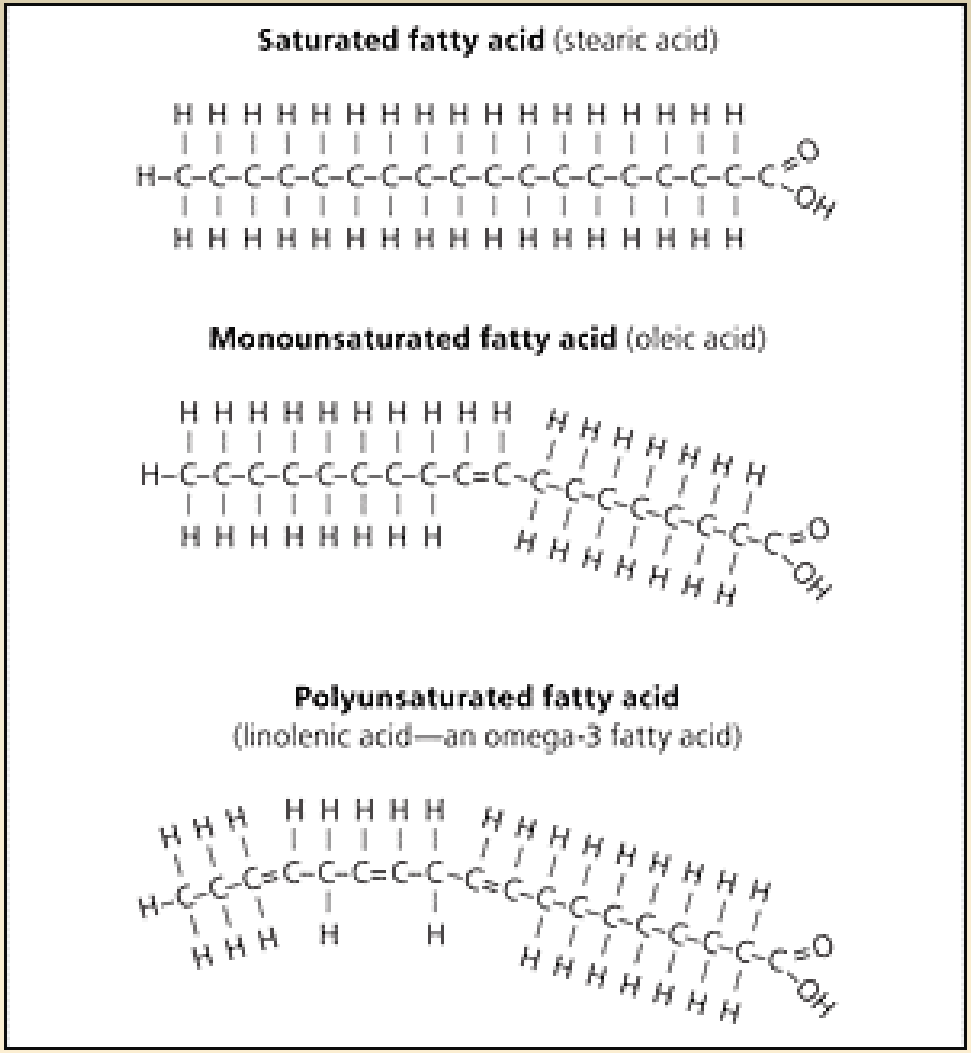
- Long neutral carbon chains (C-C-C-C-C-C-C-C-C-C-C-C-C-C) with carboxyl group at one end.
- They come in many different lengths, get many different fatty acids.
- They are non-polar, so they clump together in water (oil and water don't mix.)



7 Fatty Acids, Figure 3.3

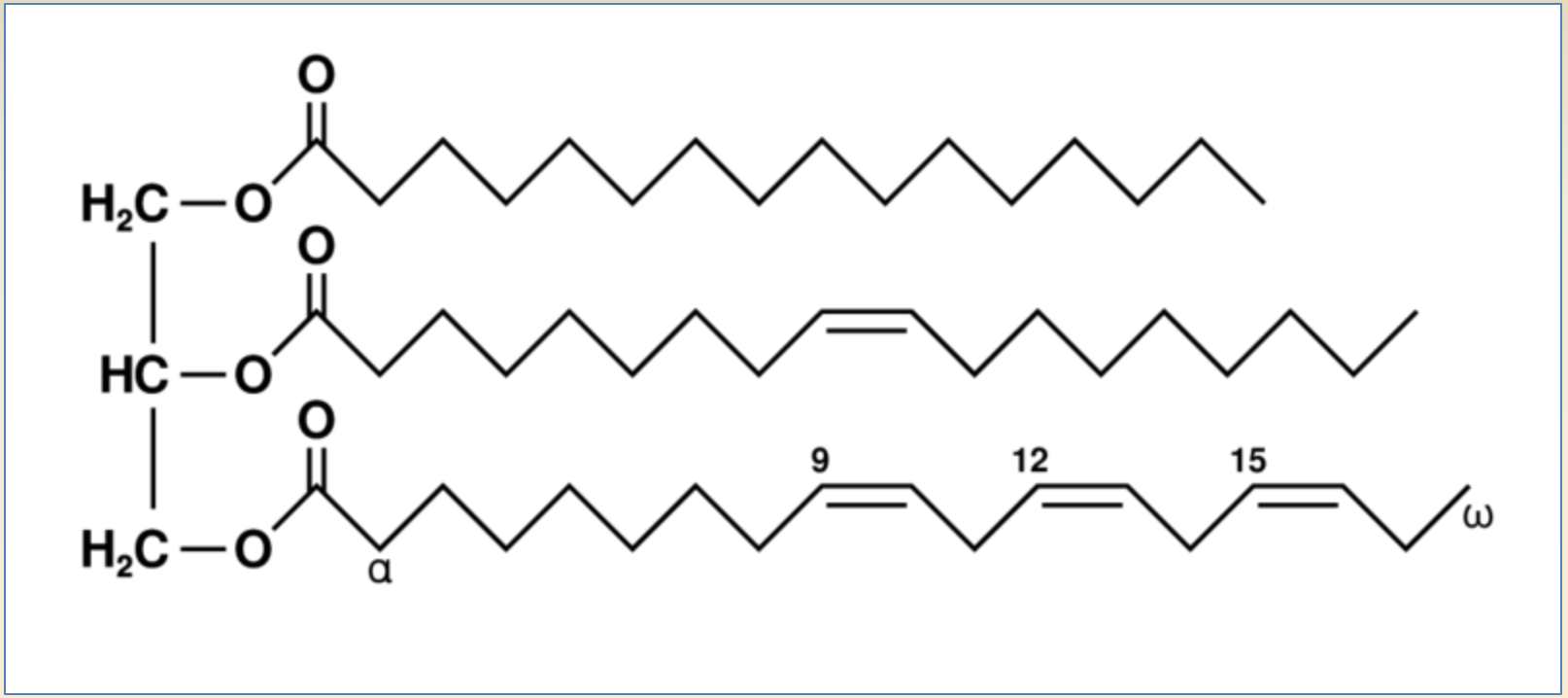
Fatty Acid Saturation

- **Saturated** – have single bonds (C-C) between the carbon atoms,
- **Unsaturated** – have one or more double bonds (C=C) between carbon atoms
  - Monounsaturated
  - Polyunsaturated



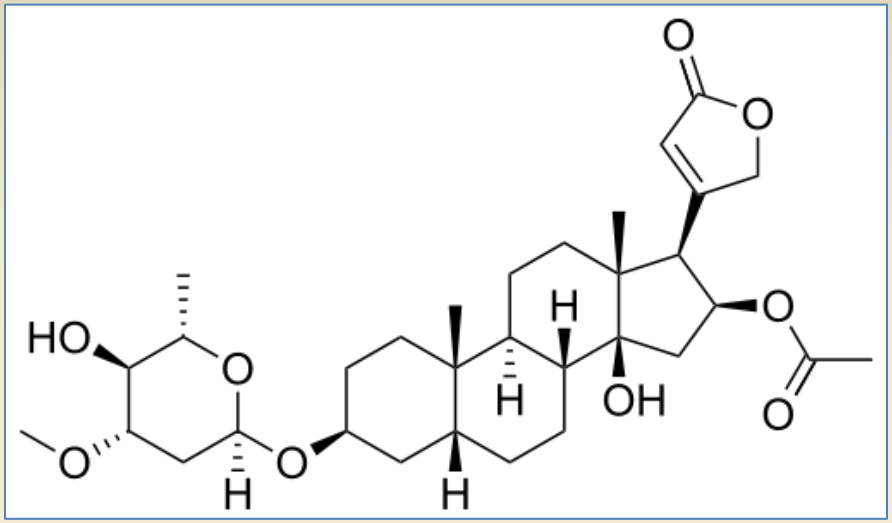
Triglycerides

Three fatty acids linked by **glycerol**.

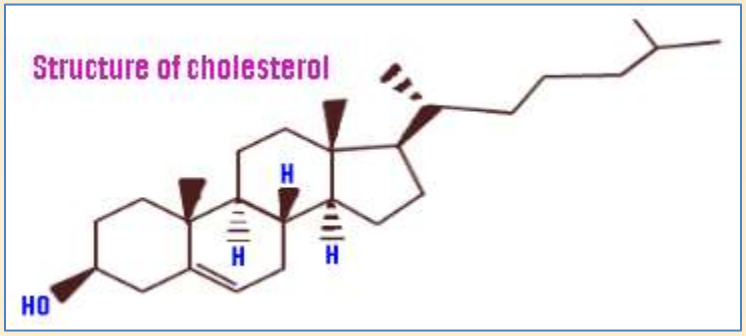


left part: glycerol
right part from top to bottom: palmitic acid, oleic acid, alpha-linolenic acid
chemical formula: $C_{55}H_{98}O_6$

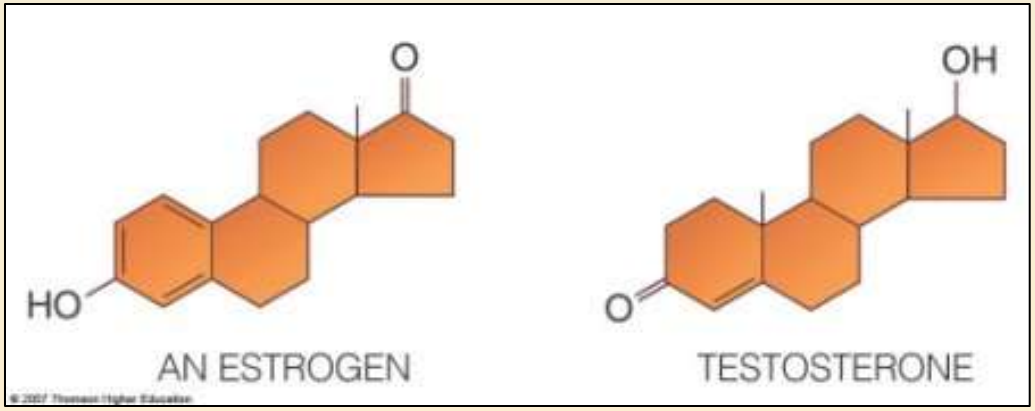
Steroids – lipids



Oleandrin
a toxic cardiac glycoside from
Nerium oleander



from meat



animal sex hormones

GOOD FATS

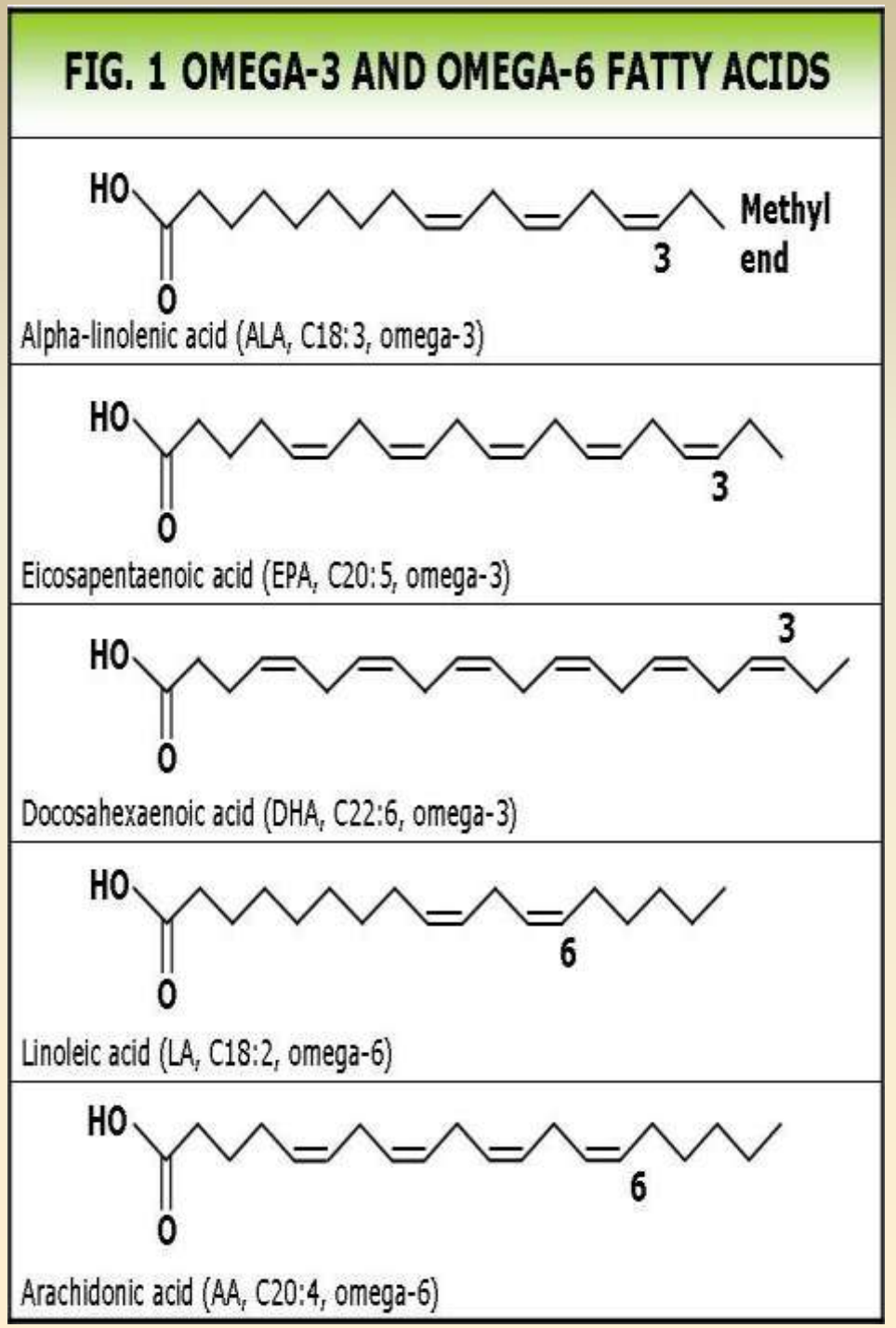
VS.

BAD FATS

Essential Fatty Acids

- Omega-3 fatty acids, the <u>first double bond occurs on the third carbon atom</u>, counting from the methyl end (denoted as omega)

- Omega-6 fatty acids, the first double bond is on the sixth carbon atom



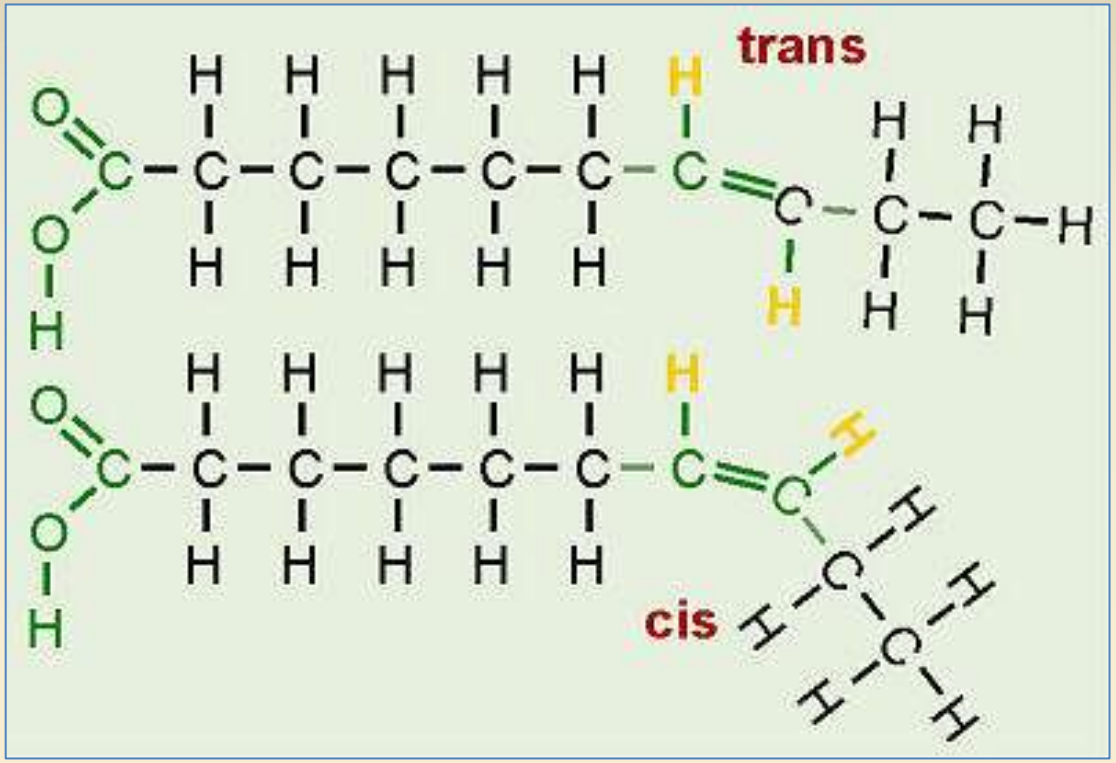
Omega-3 fatty acids are found in oily fish like salmon and flaxseed and canola oils

A.D.A.M.

Trans Fatty Acids (=Trans Fat)

Refers to configuration of H around the carbon=carbon double bonds

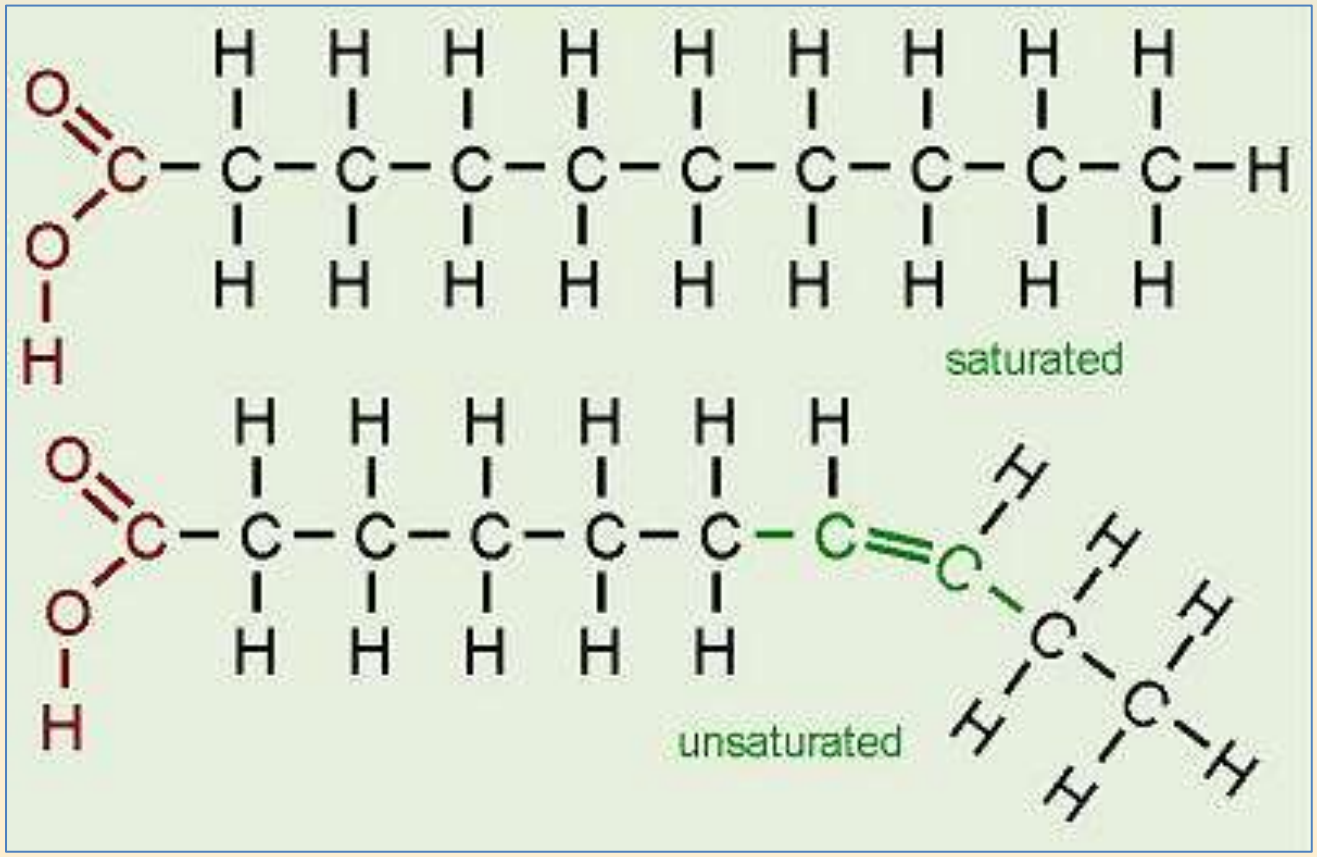
- cis – same side
- trans – opposite sides



Trans fats “stack” easier, tend to be more solid

Saturated Fats - Hydrogenated Oils

Hydrogenation – adding H to C=C bonds, changes unsaturated to saturated with H, converts liquid oils to solid state. e.g. peanut butter, margarine



Hydrogenated and Trans Fatty Acids

- Stabilize polyunsaturated oils to prevent them from becoming rancid and to keep them solid at room temperature.
- Hydrogenated fats are/were used in stick margarine, fast foods, commercial baked goods (donuts, cookies, crackers), processed foods, and fried foods. Look at food labels!

Trans Fats

- A diet high in trans fats raises LDL cholesterol levels, increases coronary heart disease.
- Diets high in trans fats are correlated with onset of Type 2 Diabetes.
- They may be particularly dangerous for the heart and may pose a risk for certain cancers.
- Many food manufacturers now use different methods for hydrogenating vegetable oils, fewer trans fats now – but still some.

- Since 1983 the FDA requires saturated fat, trans fat, and cholesterol be listed on food labels
- The rule of thumb is that no more than 30% of your daily calories should come from fat. Higher fat foods should be eaten in smaller portions.

Nutrition Facts

Serving Size 4 oz. (113g)
Servings Per Container 4

Amount Per Serving

Calories 280	Calories from Fat 130
	% Daily Value*
Total Fat 14g	**22%**
Saturated Fat 3.5g	**18%**
Trans Fat 2.5g	
Cholesterol 120mg	**40%**
Sodium 640mg	**27%**
Total Carbohydrate 13g	**4%**
Dietary Fiber 1g	**4%**
Sugars 0g	
Protein 24g	

Vitamin A 2%	• Vitamin C 2%
Calcium 2%	• Iron 6%

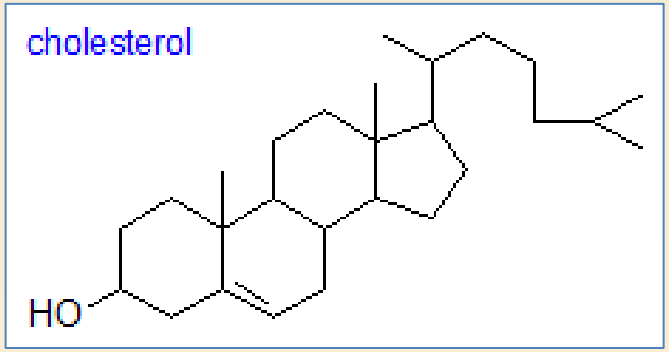
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

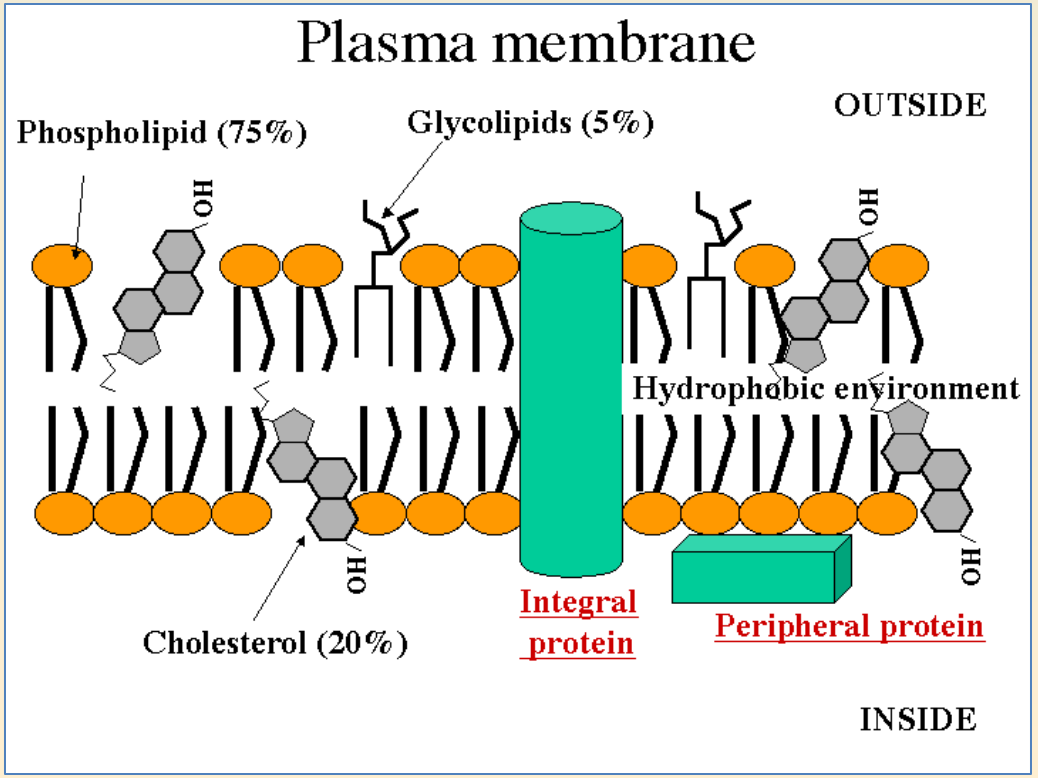
	Calories	2,000	2,500
Total Fat	Less Than	65g	80g
Saturated Fat	Less Than	20g	25g
Cholesterol	Less Than	300mg	300 mg
Sodium	Less Than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

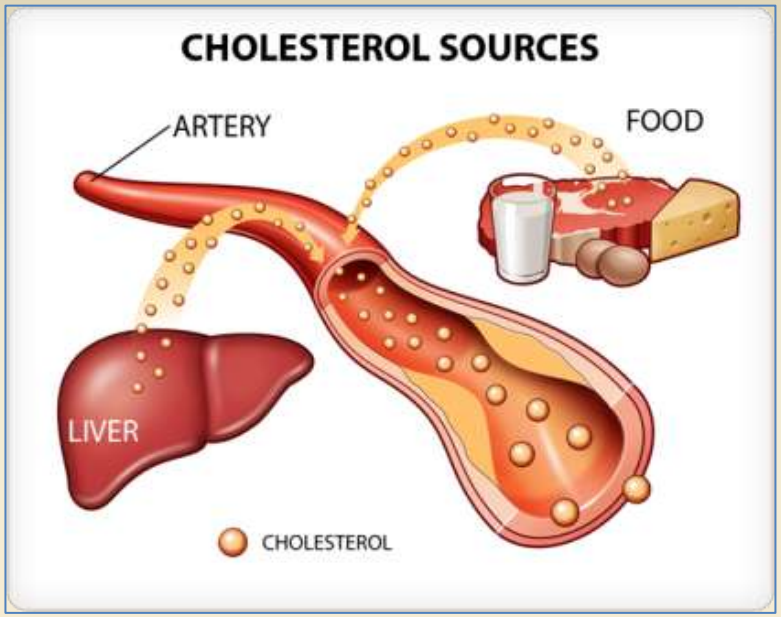
Cholesterol is found in every cell of our body.

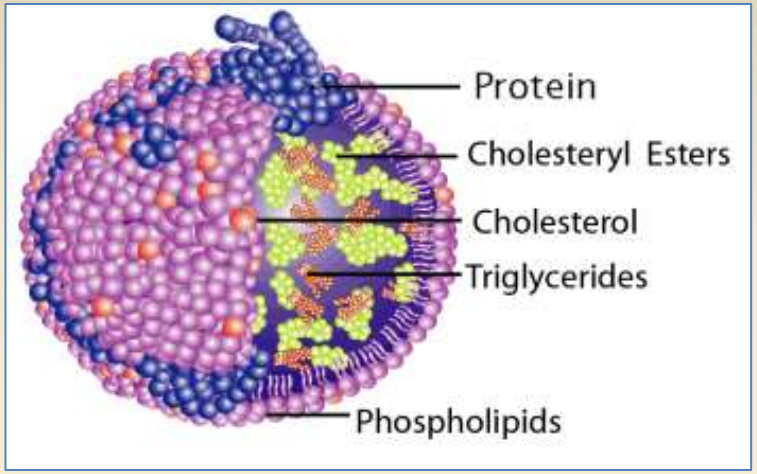
- especially abundant in the membranes of cells
- helps maintain the integrity of membranes
- plays a role in facilitating cell signaling, ability of the cells to communicate with each other
- required to form Vitamin D, testosterone, and estrogen



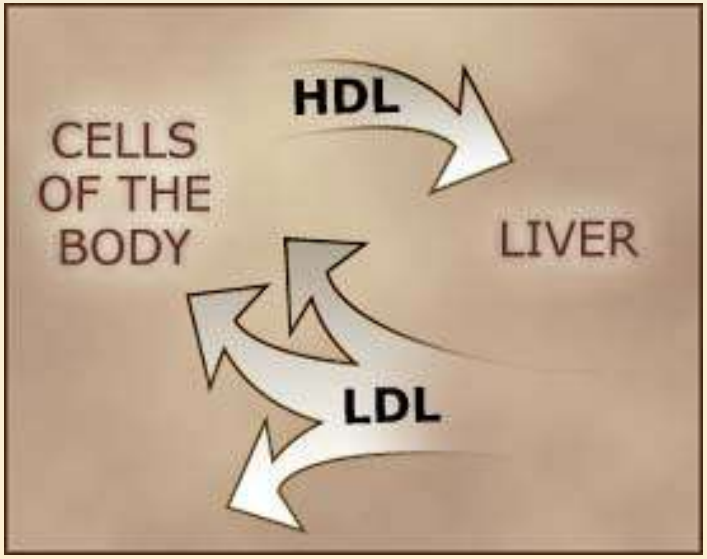


Cholesterol – produced by liver, and from food
Lipoproteins – transport cholesterol around the body

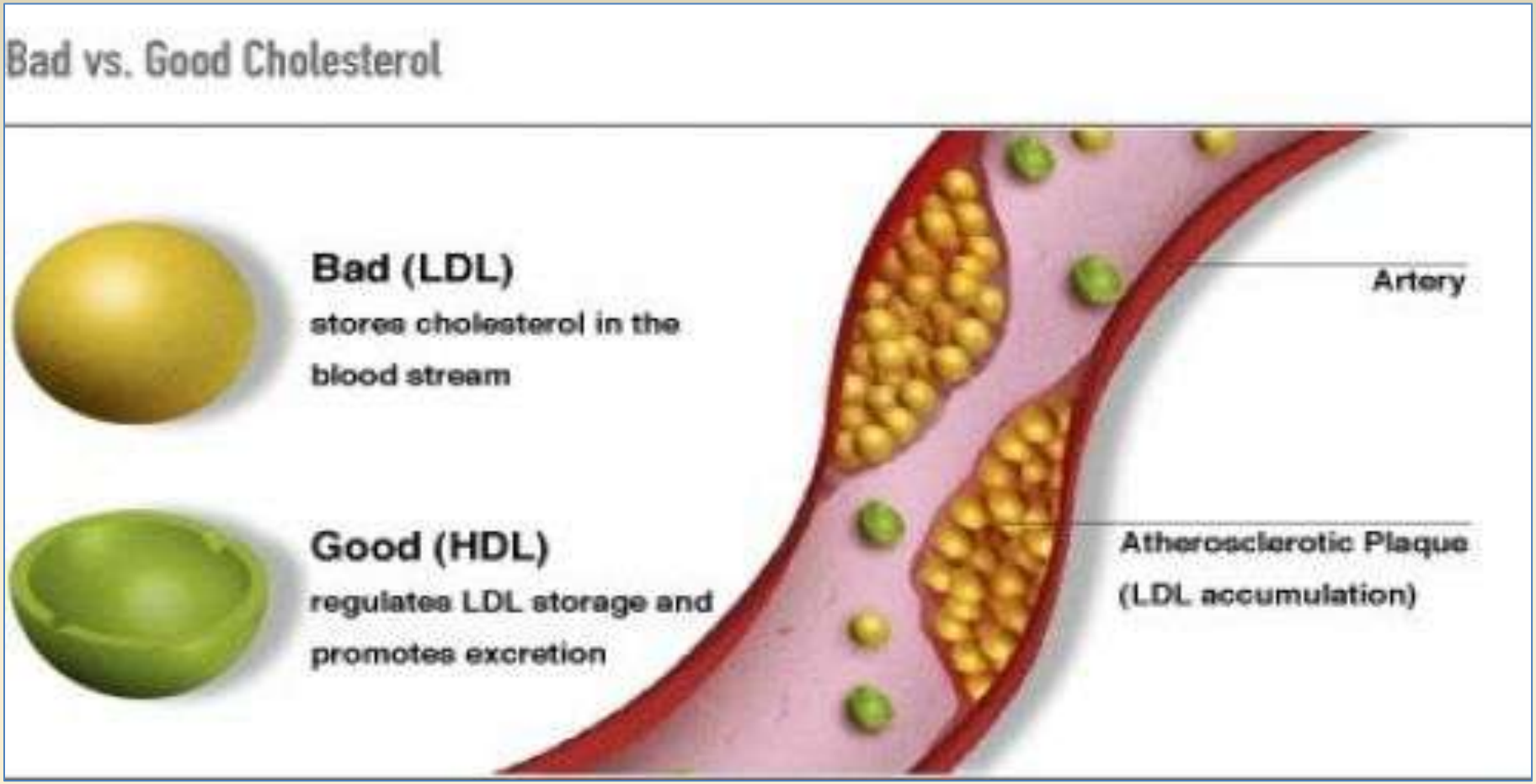




Low Density Lipoproteins – **LDLs**
High Density Lipoproteins - **HDLs**



Cholesterol – produced by liver, and from food
Lipoproteins – transport cholesterol around the body



LDLs transport cholesterol to all body, <u>can form plaques in arteries</u>
HDLs carry cholesterol away from the arteries and back to the liver

Lifestyle changes for managing your cholesterol and lowering your risk of heart disease and stroke

- **Eat a Heart Healthy Diet**
  A diet rich in vegetables, fruits, whole grains, high-fiber foods, lean meats and poultry, fish at least twice a week and fat-free or 1% dairy products — low in saturated and trans fats and cholesterol — is a delicious way to help your cholesterol levels.
- **Get Moving**
  Enjoy at least 30 minutes of physical activity more days than not. Walk, bike, swim, jog, dance — whatever you love to do, do it.
- **Avoid Tobacco Smoke**
  If you smoke, your cholesterol level is one more good reason to quit. And everyone should avoid exposure to secondhand smoke

Vitamins and Minerals

- Required in small amounts (micronutrients)
- Most function as coenzymes in enzymatic reactions.
- Most can be synthesized by plants.
- Animals have lost the ability to make these.
- **Humans need at least 13 different vitamins**, each with specific metabolic roles.
- Normally found in a healthy diet.

Water Soluble Vitamins

- don't get stored as much in your body. Instead, they travel through your bloodstream
- Excreted rapidly
- Need to be replaced more frequently

Water-Soluble Vitamins

Vitamin	Dietary Source	Results of Deficiency
B_1 (thiamine)	Whole grains, legumes, seeds, nuts	Beriberi
B_2 (riboflavin)	Dairy products, whole grains, leafy green vegetables, poultry	Mouth sores, lesions of eyes
Niacin	Meat, eggs, seeds, legumes	Pellagra
B_6 (pyridoxine)	Dried fruits, seeds, poultry, leafy green vegetables	Irritability, muscle weakness, skin disorders
Pantothenic acid	Dried fruits, seeds, poultry, leafy green vegetables, nuts	Insomnia, weakness
Folic acid (folate)	Legumes, whole grains, green vegetables	Anemia, diarrhea, neural tube defects
Biotin	Legumes, vegetables, meat, egg yolks	Fatigue, dermatitis
B_{12} (cobalamin)	Meat, eggs, dairy products	Pernicious anemia
C	Fresh fruits and vegetables	Scurvy

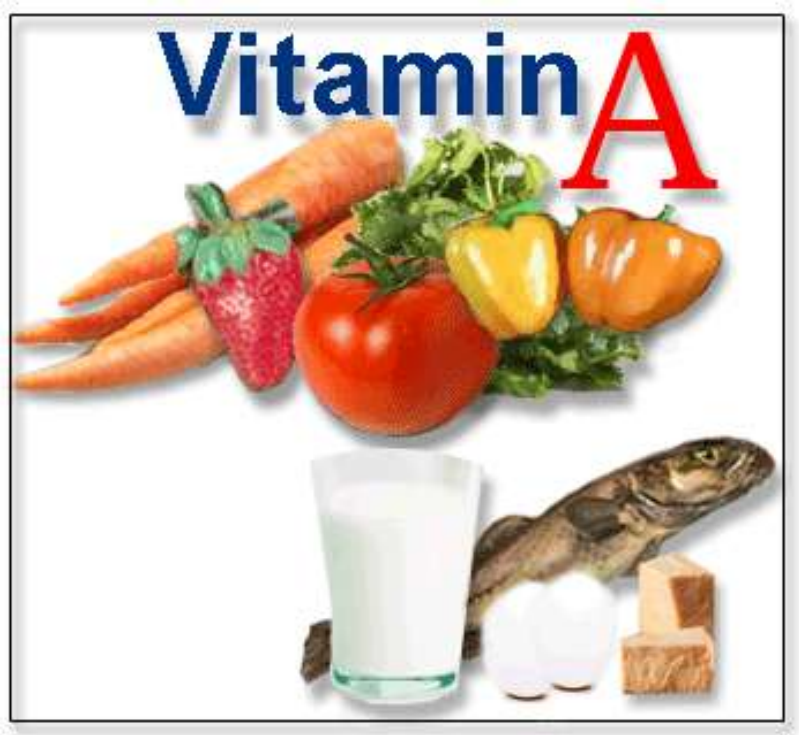
Fat Soluble Vitamins

- Stored in the fat tissues in your body and in liver. They wait around in your body fat until your body needs them
- Stay stored in your body for awhile, some stay for a few days, some for up to 6 months

Fat-Soluble Vitamins

Vitamin	Dietary Source	Results of Deficiency
A	Yellow, orange, and dark green vegetables and fruits; dairy products	Night blindness, xerophthalmia
D	Eggs and enriched dairy products	Rickets
E	Seeds, leafy green vegetables	Unknown
K	Leafy green vegetables	Poor blood clotting

Vitamin A



Vitamin A comes in two forms:

- vitamin A or retinol in foods of animal origin, or
- carotene found in plants.

Retinol is absorbed quickly, but carotene must be converted in the body into vitamin A before it can be absorbed

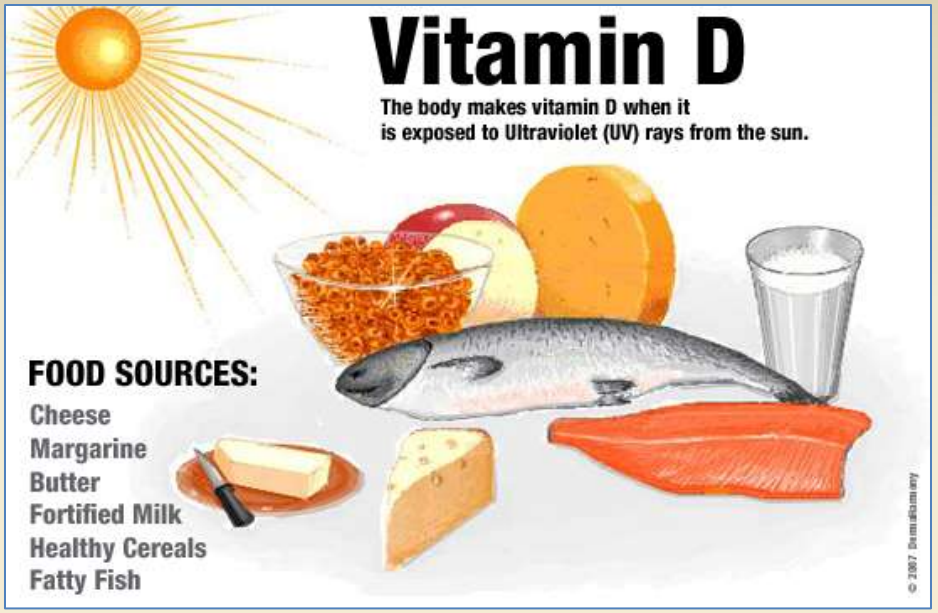
Night Blindness - Vitamin A Deficiency -

Difficulty seeing at night

Complete blindness in extreme cases of vitamin A deficiency

Vitamin D

- Functions in regulation of calcium and phosphorous levels
- Can be synthesized by human body with exposure to sunlight
- Since people are indoors so much, they need to have Vitamin D in food.
- None occurs in plant sources.
- Limited amounts in egg yolks, cream, liver, some fish
- Fortified milk

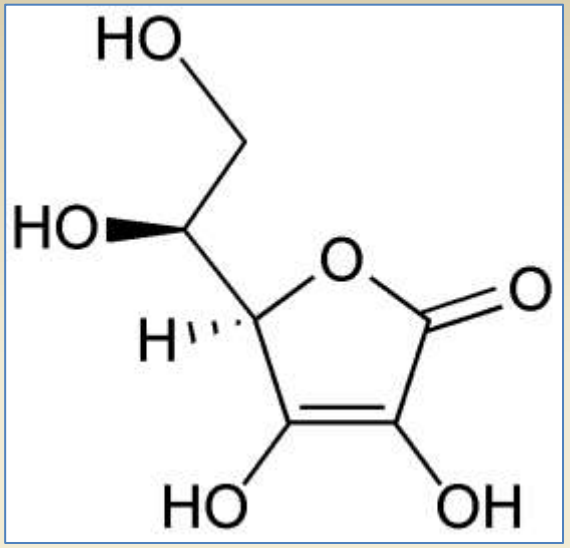


Rickets - Vitamin D Deficiency

Figure 10.3 Characteristic bowing of the legs and knees in rickets, a disease due to insufficient vitamin D.

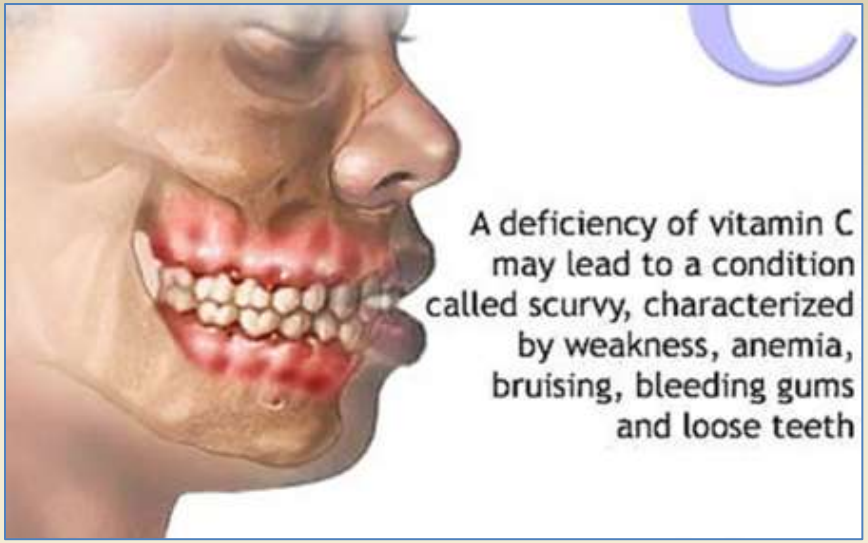
Bones start turning to jelly

Vitamin C – Ascorbic Acid



- Functions mainly as an anti-oxidant
- Synthesis of collagen, skin elasticity, bones, blood vessels, maintain capillaries, teeth and gums, protect other vitamins from oxidation, helps the absorption of iron, promotes healing

Scurvy – Vitamin C Deficiency



Swollen, blackened limbs

Rough, dry skin

Vitamin B Complex

- Group of 8 vitamins, often found in foods together.
- Function as coenzymes in thousands of metabolic reactions.

- Essential for energy production, red blood cell synthesis
- Complex of ***eight*** essential vitamins out of the 13 needed
- All water soluble

Thiamine
Vitamin B_1 helps release energy from carbohydrates, maintains muscles, nerves, and heart.

Riboflavin
Vitamin B_2 helps release energy from carbohydrates, fats and proteins, helps maintain mucouis membranes, good vision, skin, hair and nails.

Niacin
Vitamin B_3 assists B_1 (thiamin) and B_2 (riboflavin) produce cell energy, promotes a healthy nervous and digestive system, maintains healthy skin and hair, aids blood circulation, assists in the breakdown of carbohydrates, fats, and proteins.

Folic Acid
Vitamin B_9 acts with B_{12} to synthesize genetic material, aids in the formation of hemoglobin and all cells, helps maintain a healthy nervous system and mental health.

Vitamin B Complex

Beriberi – Thiamine Deficiency

- Polished rice
- Weight loss, body weakness and pain, brain damage, irregular heart rate, heart failure, and death

Pellagra – Niacin Deficiency

- Corn diet
- 4 D's – dermatitis, dementia, diarrhea, death.
- Bright red tongue

Pellagra

Figure 10.4 Pellagra, caused by a lack of niacin, is characterized by dermatitis of the hands.

Folate – Vitamin B-9

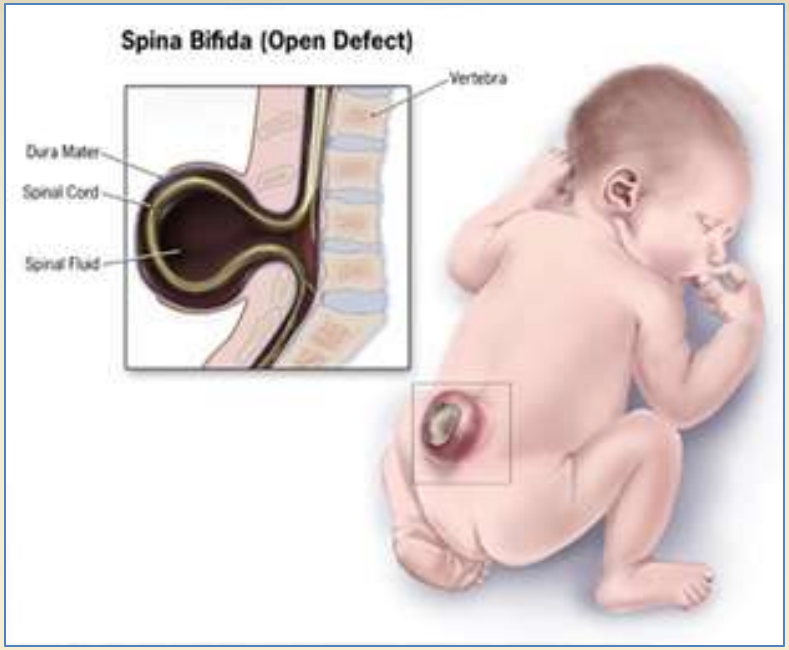
It helps to:

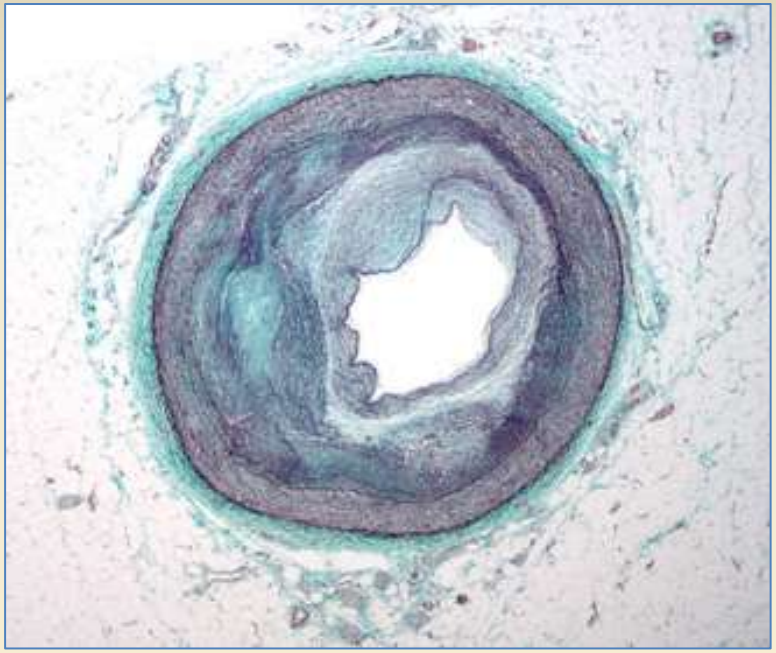
- make and repair DNA
- produce red blood cells
- can become low in just a few weeks if you don't eat enough folate-rich foods

Deficiency results in:

- anemia, too few RNCs, deprive tissues of oxygen, diarrhea
- deficiency during pregnancy can lead to birth defects, Spina bifida

Folate Deficiency





In pregnant women, neural tube defects (Spinal bifida) in the foetus with deleterious effects

In men, increased homocysteine levels, plaques (artherosclerosis or blockages) in blood vessels, which leads to heart problems

Mineral Requirements

- 17 minerals required for normal metabolism
- Major Minerals - need more than 100 mg per day
- Trace Minerals – need only a few mg per day
- Daily multivitamin?
- Probably better to get from foods if possible

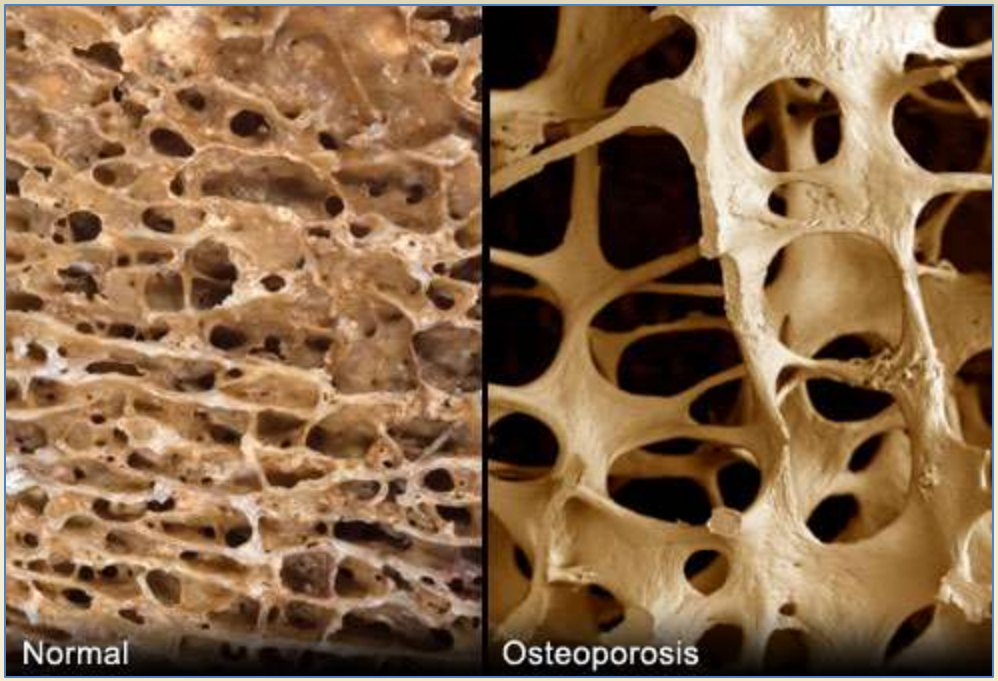
Dietary Mineral Requirements

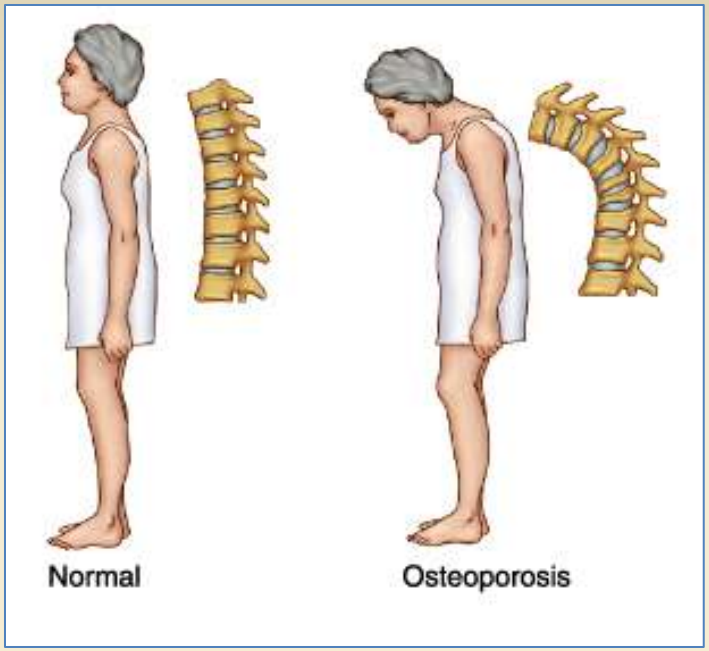
Mineral	Function
Major Minerals	
Calcium	Bone and tooth formation, blood clotting, nerve impulse transmission, muscle contraction
Phosphorus	Nucleic acids, bone and tooth formation, cell membranes, ATP formation
Sulfur	Protein formation
Potassium	Muscle contraction, nerve impulse transmission, electrolyte balance
Chlorine	Gastric juice
Sodium	Nerve impulse transmission, body water balance
Magnesium	Protein formation, enzyme cofactor
Trace Minerals	
Iron	Hemoglobin
Zinc	Component of many enzymes and insulin, wound healing
Iodine	Component of thyroid hormones
Fluorine	Bone and tooth formation
Copper	Enzyme component, red blood cell formation
Selenium	Antioxidant
Cobalt	Component of vitamin B_{12}
Chromium	Normal glucose metabolism
Manganese	Enzyme cofactor
Molybdenum	Enzyme cofactor

Calcium

- 90% in bones and teeth, rest in blood and tissues.
- Concentration under control of hormones and Vitamin D.
- Average adult contains 800 – 1,300 grams
- Function in nerve transmission, muscle actions, cofactor for enzymes
- Levels in blood are regulated

Osteoporosis – Calcium Deficiency

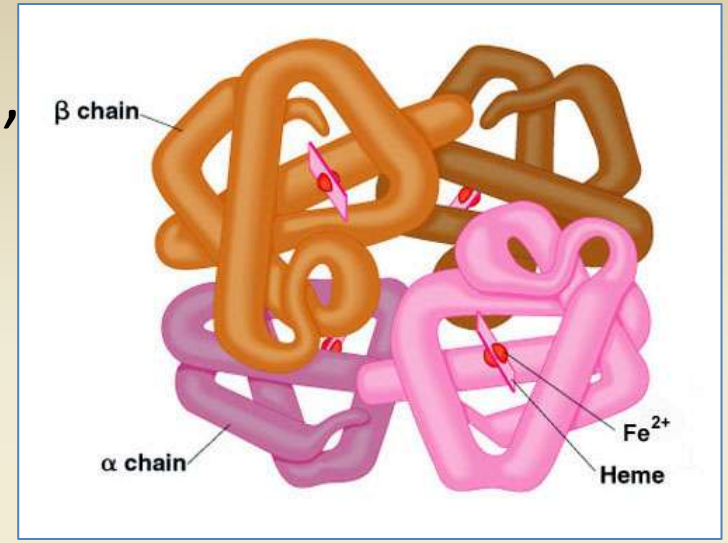




Osteoporosis means "porous bones." Our bones are strongest at about age 30, then begin to lose density. More than 10 million Americans have osteoporosis, which is significant bone loss that increases the risk of fracture. About half of women 50 and older will have an osteoporosis-related fracture in their lifetime

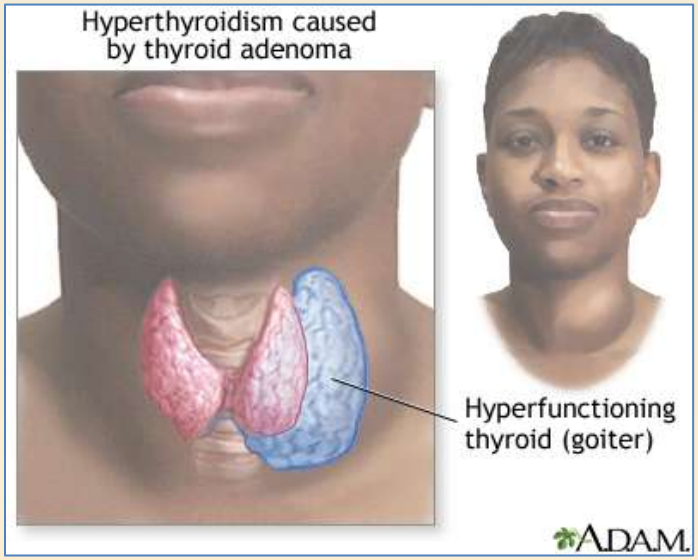
Iron - Fe

- Central atom in hemoglobin, RBCs, supply oxygen to cells
- Very common deficiency, causes fatigue, anemia, impairs mental development in young children and adult productivity
- Anemia resulting from severe iron deficiency causes deaths during childbirth of an estimated 50,000 women each year
- Found in meat, green vegetables



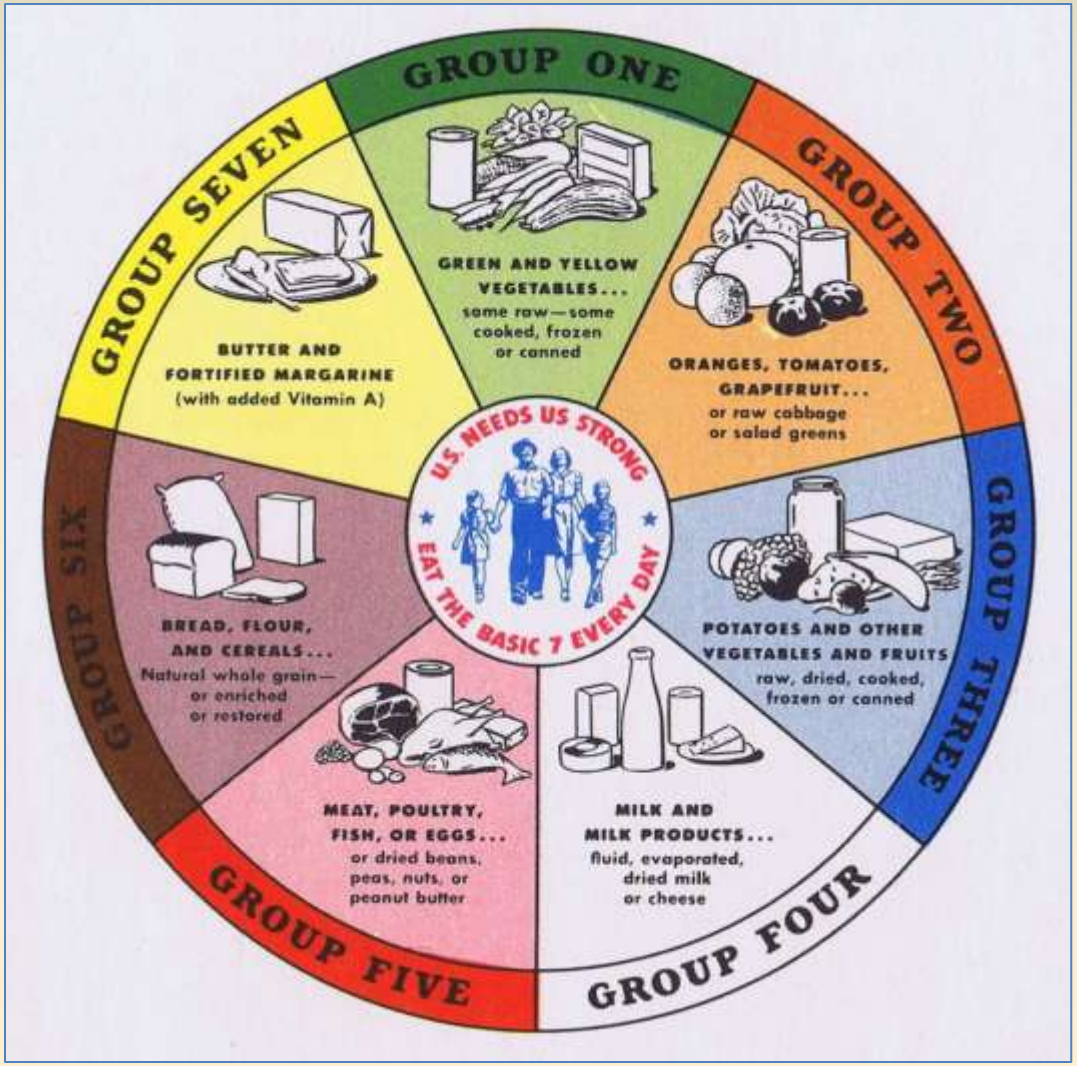
Iodine Deficiency - Goiter

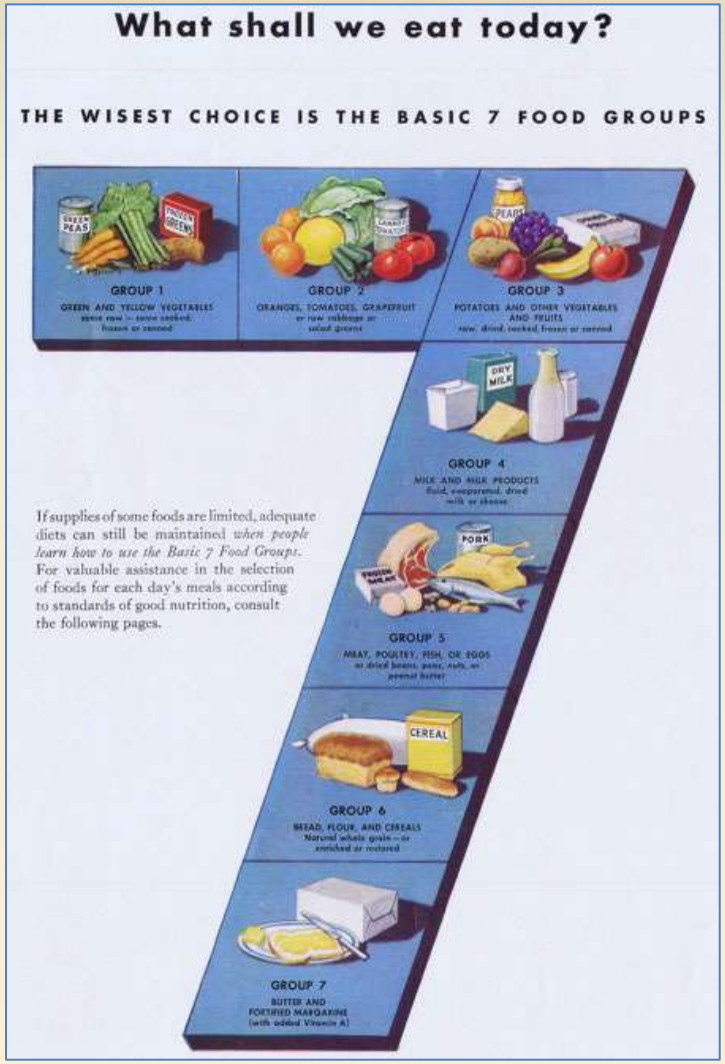
- Part of the thyroid gland hormone that regulate body growth, regulate metabolism in all cells
- Lack of iodine causes goiter, enlarged thyroid gland
- Cured by introducing iodized salt in the 1920s
- Still major problem in developing countries



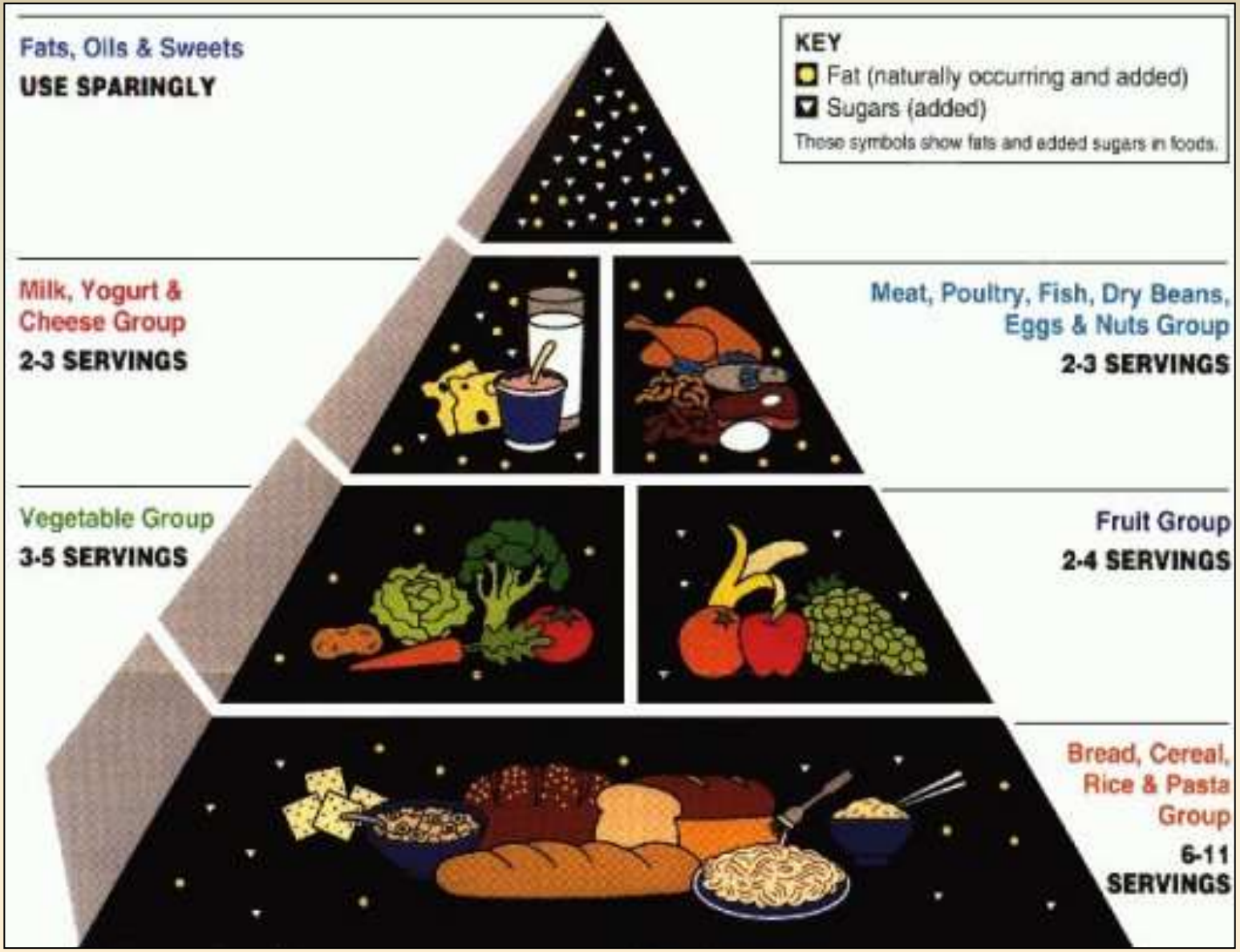
Government Dietary Guidelines

Basic Food Groups – grew out of World War II Dietary Concerns





Old USDA Food Pyramid



Too much carbohydrate? Not all oils bad?

New USDA Food Pyramid - 2005

Activity

Personalized

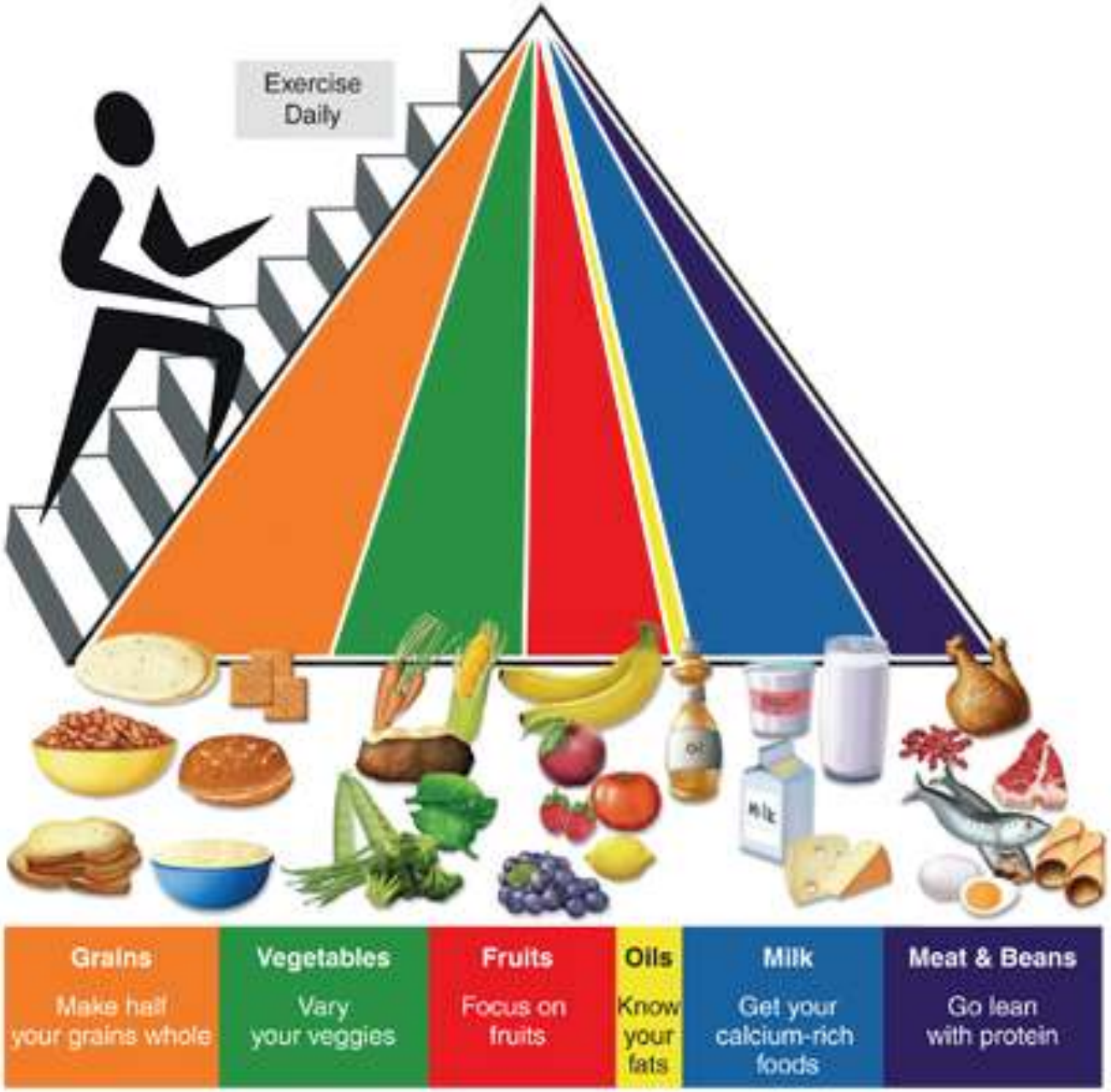


Figure 10.5 The 2005 USDA MyPyramid illustrates the daily recommended proportions for the six food groups by the width of each band at the base. The figure climbing the steps of the pyramid is a reminder to exercise daily.

Source: Redrawn from http://www.mypyramid.gov. Courtesy of USDA.

Grain Group

Make half your grains whole

- Eat at least 3 oz. of whole grains every day
  - Cereal -Breads
  - Crackers -Rice
  - Pasta

Vegetable Group

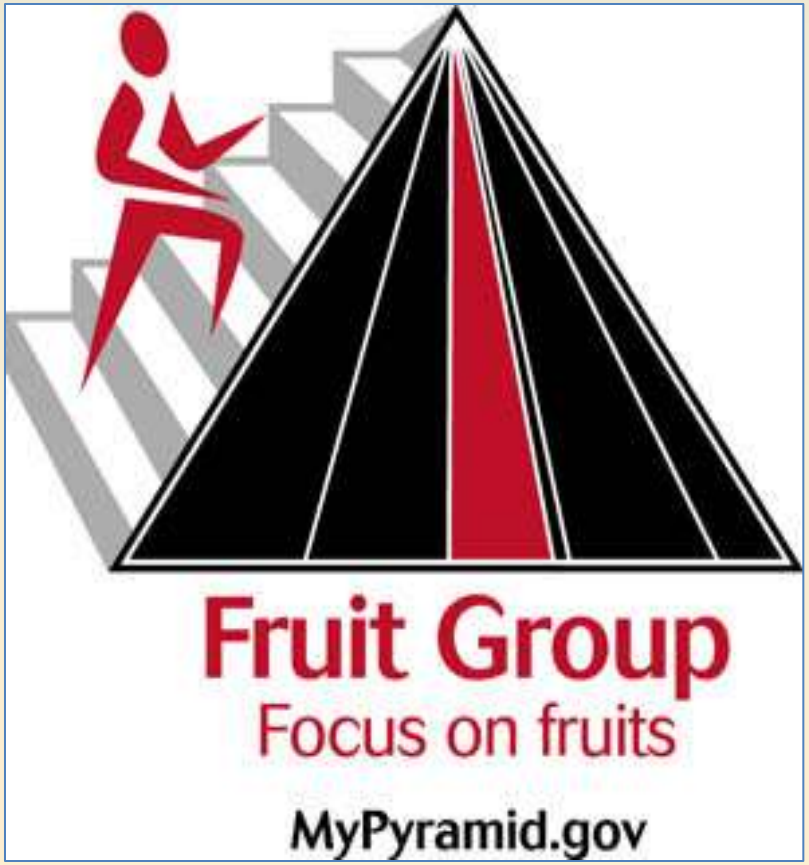
Vary your veggies

- Eat more dark green veggies like broccoli, spinach and other dark, leafy greens
- Eat more orange vegetables like carrots and sweet potatoes

Fruit Group

Focus on fruits

- Eat a variety of fruits
- Choose fresh, frozen, canned, or dried fruit
- Go easy on fruit juices



Oil/Fat Group

- Make most of your fat sources from fish, nuts, and vegetable oils.
- Limit solid fats like butter, stick margarine, shortening, and lard, as well as foods that contain these.
- Check the Nutrition Facts label to keep saturated fats, trans fats, and sodium low.
- Choose food and beverages low in added sugars. Added sugars contribute calories with few, if any, nutrients.

Milk Group

Get your calcium-rich foods

- Go low-fat or fat-free when you choose milk, yogurt, and other milk products
- If you don't or can't consume milk, choose lactose free products

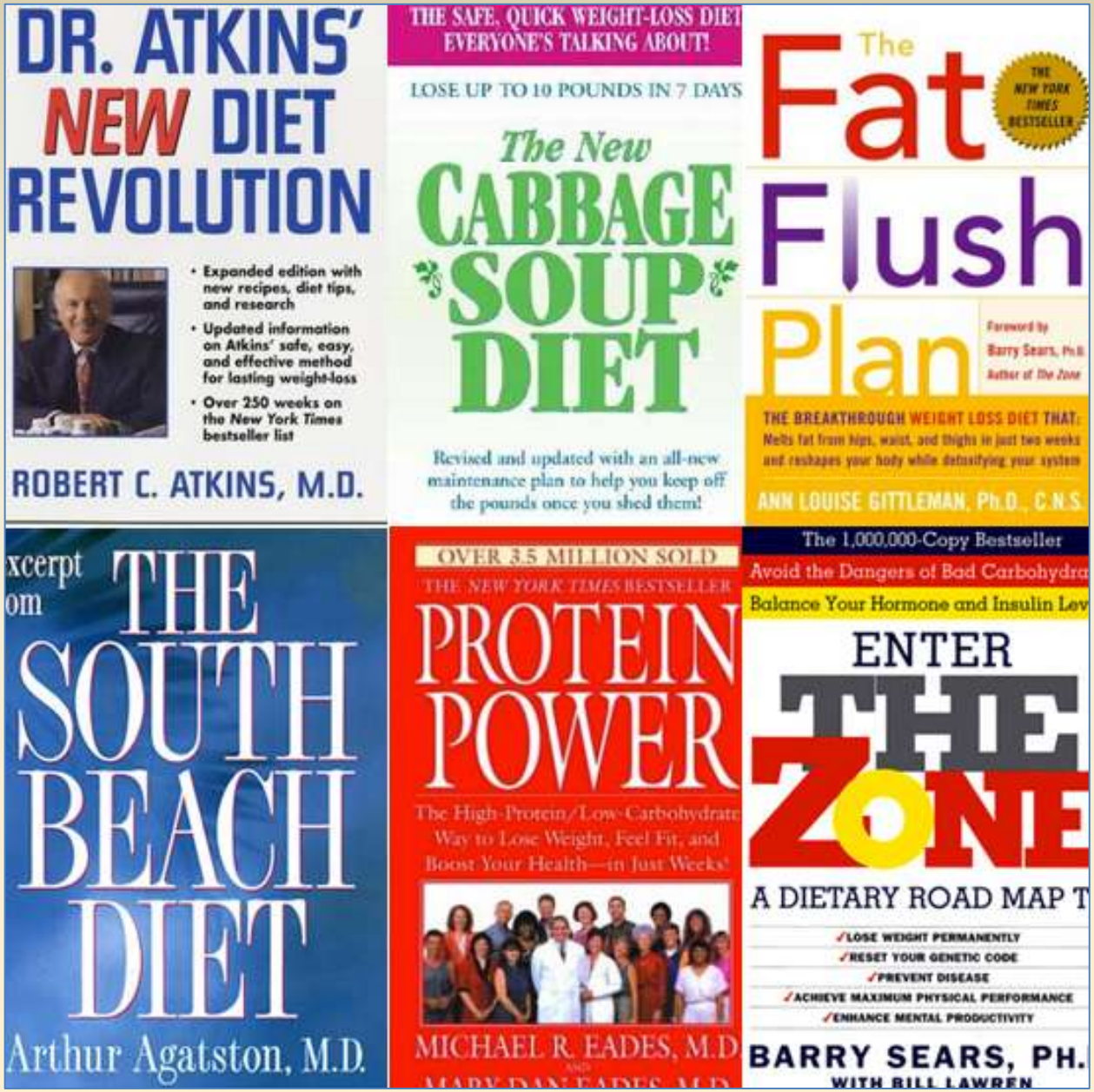
Meat & Bean Group

Go lean with protein

- Choose low-fat or lean meats and poultry
- Bake it, broil it, or grill it
- Vary your protein routine choose more

fish, beans, peas, nuts, and seeds

“Fad Diets” – hard to evaluate



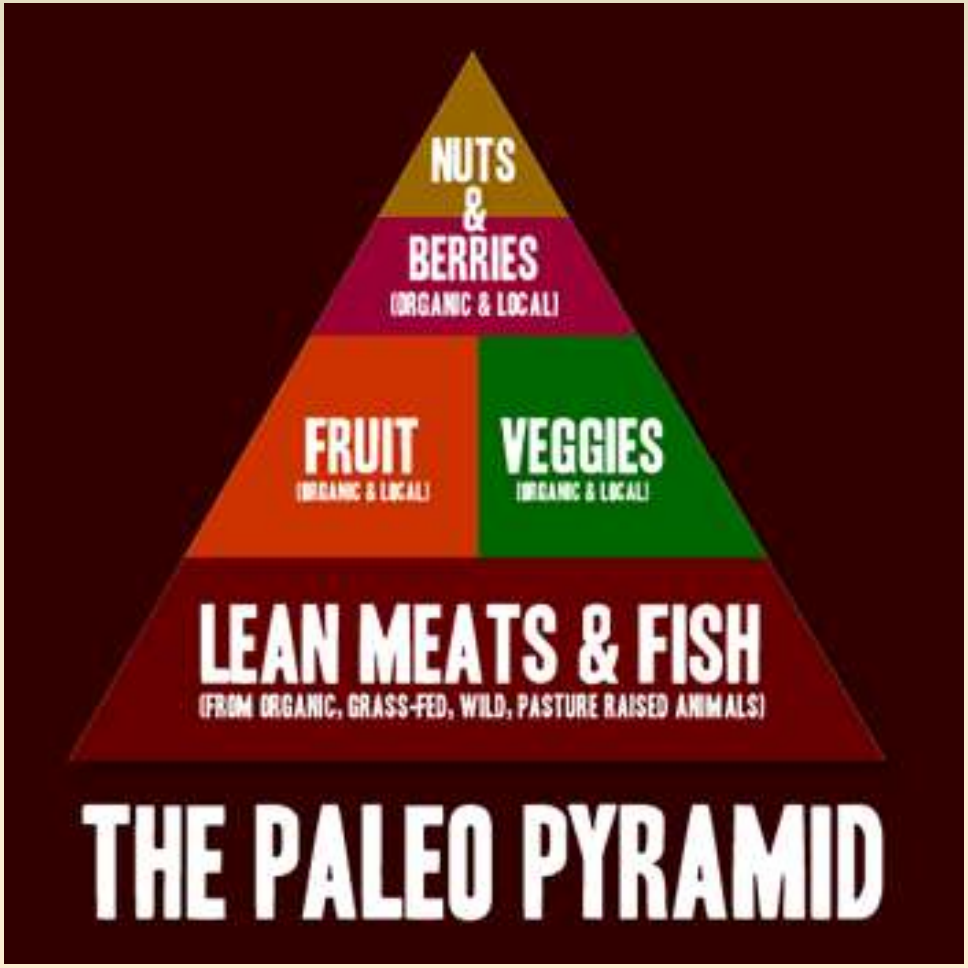
Vegetarian and Vegan Diets

Ovo-Lacto?

Watch the B vitamins, complete protein

Paleo Diet

We should return to our roots and eat like “cavemen”
No grains, sugar, dairy, refined foods



The Paleo Diet

Vegetables

Tart Fruits

Nuts

Wild Meats

Eggs

Coconut & Olive Oil

Not in the Paleo Diet

Refined, Processed Foods

Sugars, Candy Bars

Sweet Fruits, Juices

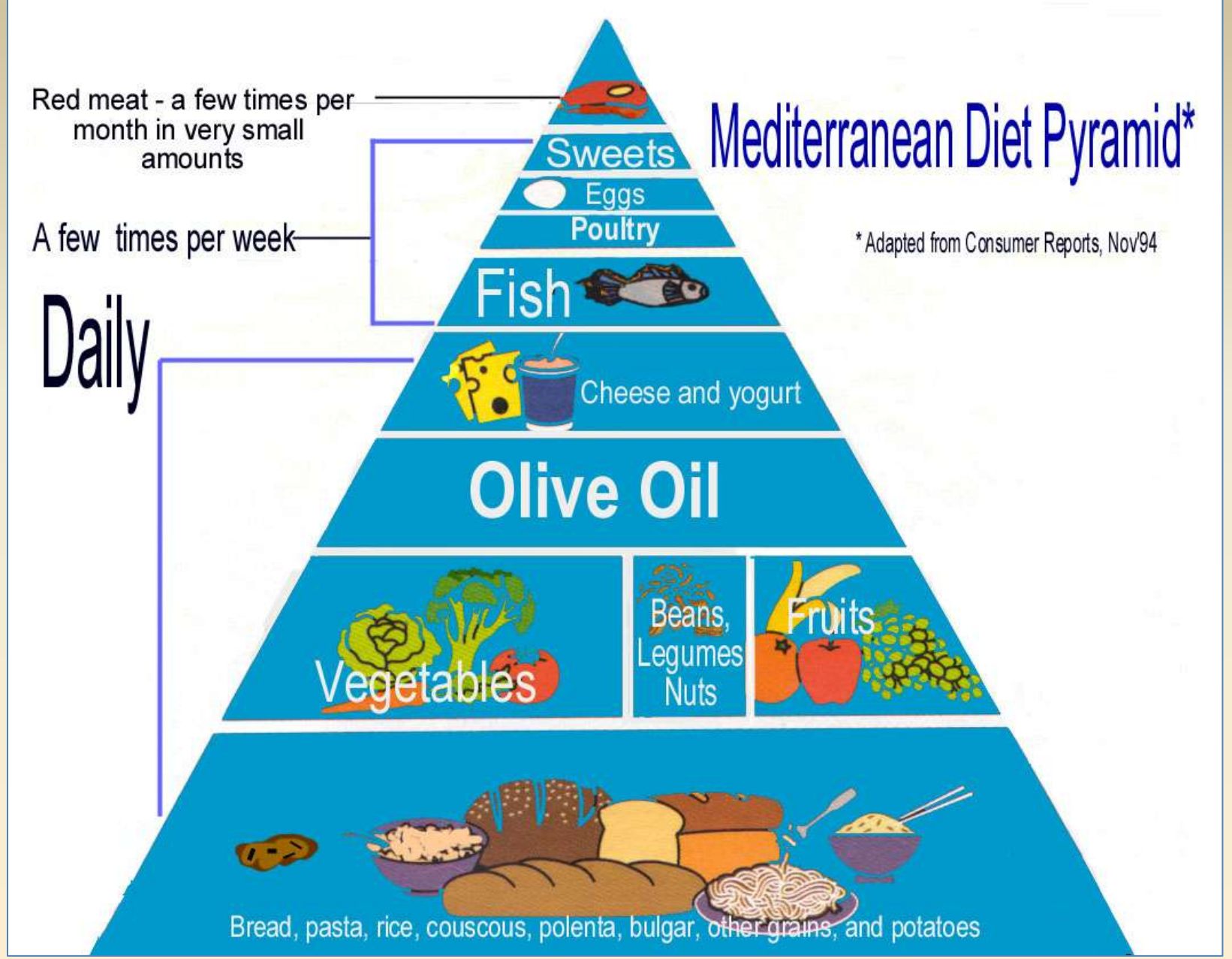
Grains, bread, beans, GMO foods

Extracted Seed Oils

Dairy

Mediterranean Diet – heart healthy?

- Mediterranean diets are plentiful in olives, fish and nuts.
- Lots of fruits and vegetables (fill half your plate)
- Whole grains (bread, pasta)
- Higher in fat, but very little saturated and trans fat.
- Lots of Olive oil.
- More fish and seafood , very little red meat



Regular physical exercise, drinking 6 glasses of water a day. and moderate consumption of wine or grape juice

Some general recommendations

- Moderation is key, use common sense
- Pay attention to daily calories, labels on food
- Use whole foods as primary source of nutrition
- Avoid over-processed, high-fat, refined foods
- Balance daily food choices with healthy variety
- Eat more often, smaller portions
- Eat lean, complete protein with each meal
- Eat veggies with each meal
- Ditch the calorie-containing drinks, soda. Low-fat milk, water and real fruit juice are healthier choices

End