# The Smart Heart

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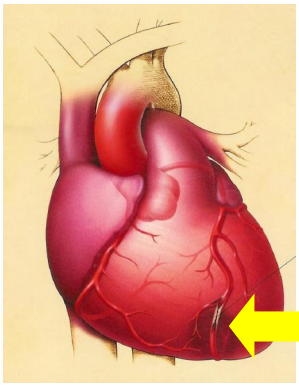
## The Heart at Work

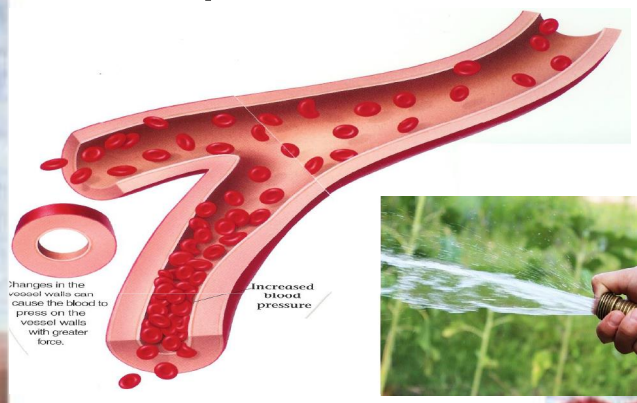
- Your heart beats an average of 115,000 beats per day
- Your heart has its own electrical system which can power a truck to drive 20 miles every day
- If you stretch out your blood vessels, they would cover approximately 60,000 miles
- Your heart pumps up to 2,000 gallons of blood per day
- Your blood travels approximately 12,000 miles every day – that's 4 times across the US
- The pressure in your arteries can project blood up to 30 feet
- In the average lifespan, your heart will pump 1.5 million barrels of blood - that's enough to fill 200 train tankers
- You would have to leave on the kitchen faucet on for 45 years to be equivalent to the amount of blood pumped for a lifetime

## Understanding the Heart

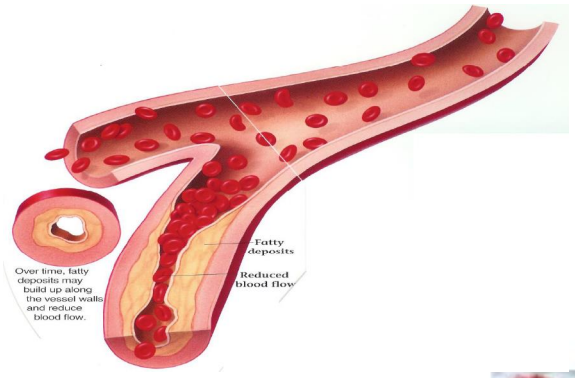


- Over time, excess fat & cholesterol build up in the arteries
- This reduces blood flow and may cause vessel damage

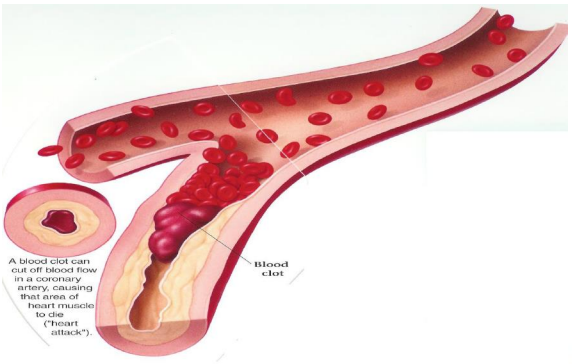
## Slow Damage to Vessels




## Continued Damage and Build Up

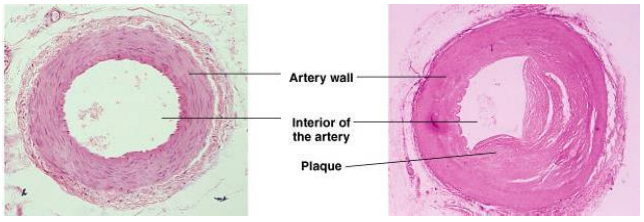



## Heart Attack from Blockage



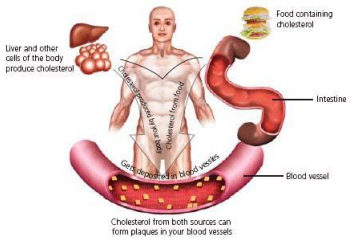

## Cardiovascular Disease

Cross-section of a normal artery and a partially blocked artery




## What is Cholesterol?

- Fat produced naturally by our body
- Found in food
  - Americans consume 275-700 mg average
- Our body requires cholesterol to function properly
- Essential nutrients
  - Provide energy
  - Help transport fat-soluble nutrients throughout the body
- Contribute greatly to the flavor and texture of food



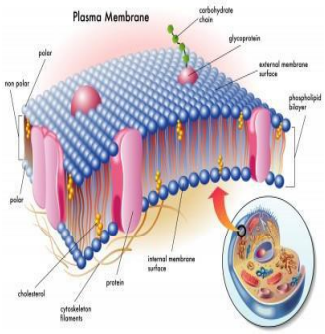
## What Are Lipids?

Non-Essential
- Bodies CAN make
- Saturated
- Omega-9

Essential
- Bodies can NOT make
- Omega-6 linoleic
- Omega-3 alpha-linolenic
- Deficiency is rare
  - TPN pts
  - Severe fat malabsorption

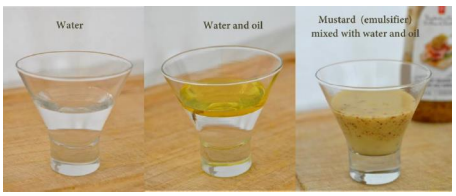
## Functions of Lipids

Cell membranes
- Double layer of phospholipids
- Selectively allow both fatty and water-soluble substances into the cell
- Store fatty acids temporarily
- Protects nerve cells



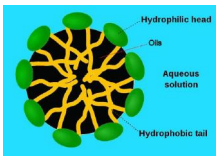

## Function of Lipids

Emulsifiers (lecithin)
- Lecithin used as an emulsifier to combine two ingredients that don't ordinarily mix, such as oil and water
- Allows ingredients in salad dressing to mix well and remain mixed




## Lipids in the Body

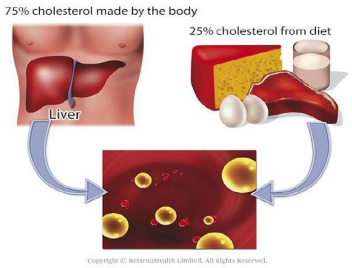
Lipid transportation and absorption
- Micelles
  - Water-soluble globules with a fatty core
  - Carry monoglycerides and long-chain fatty acids to microvilli
- Chylomicron
  - Deliver dietary lipids from intestines to cells and liver
- **Lipoprotein**
  - **Transport lipids in the lymph and blood**



## Lipids in the Body

Digestion and absorption

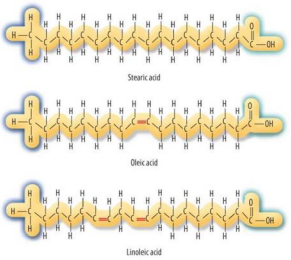
- Body absorbs about 50 percent of dietary cholesterol
  - Dietary fat increases absorption
  - Plant sterols and dietary fiber decrease absorption




## Fatty Acids Are Key Building Blocks

Saturation

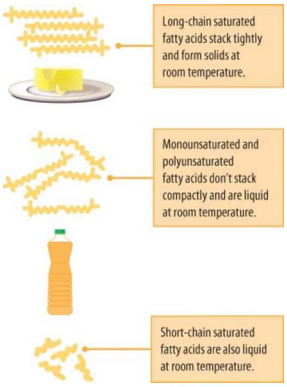
- Saturated fatty acid
  - When all bonds between carbon atoms in a chain are single bonds
- Unsaturated fatty acid
  - When one or more bonds between carbon atoms is a double bond
- Monounsaturated fatty acid
  - When there is one carbon–carbon double bond
- Polyunsaturated fatty acid
  - When there is more than one carbon–carbon double bond




## Fatty Acids Are Key Building Blocks

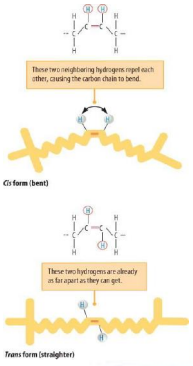
Chain length of Fatty Acids

- Long Chain
- Medium Chain
- Short Chain
  - Shorter fatty acids remain liquid at room temperature and even with refrigeration
  - Shorter fatty acids also are more water-soluble




## Fatty Acids Are Key Building Blocks

- *Cis* vs. *trans*
  - Unsaturated fatty acids can vary in shape
  - *Cis* fatty acids
    - Chain is bent
    - Occur naturally
  - *Trans* fatty acids
    - Chain is straighter
    - Produced by hydrogenation
    - Resemble saturated fatty acid



## Trans Fats in the Nutrition Facts


**Ingredients:** Potatoes, Sunflower Oil and/or Corn Oil, and Salt.
No Preservatives.

**Nutrition Facts**
Serving Size 1 oz.

**Amount Per Serving**
**Calories** 150 Calories from Fat 90
% Daily Value*
**Total Fat** 10g 16%
Saturated Fat 1g 6%
Polyunsaturated Fat 4.5g
Monounsaturated Fat 3g
Trans Fat 0g
**Cholesterol** 0mg 0%
**Sodium** 180mg 7%
**Potassium** 353mg 9%
**Total Carbohydrate** 15g 5%
Dietary Fiber 1g 4%
Sugars 0g
**Protein** 2g
Vitamin A 0% • Vitamin C 10%
Calcium 0% • Iron 2%
Vitamin E 6% • Thiamin 2%
Niacin 6% • Vitamin $B_6$ 4%
Phosphorus 4% • Magnesium 4%
* 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 |
| Sat Fat | Less than | 20g | 25g |
| Cholesterol | Less than | 300mg | 300mg |
| Sodium | Less than | 2,400mg | 2,400mg |
| Potassium | | 3,500mg | 3,500mg |
| Total Carbohydrate | | 300g | 375g |
| Dietary Fiber | | 25g | 30g |

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

## Fatty Acids Are Key Building Blocks

- The omega-3 fatty acids
  - Alpha-linolenic acid elongated and desaturated to EPA and DHA
    - Dilate blood vessels, discourage blood clotting, and reduce inflammation
    - Reduces triglycerides
    - Improves cholesterol
- American Heart Association recommends 2 servings per week

## Recommended Omega 3 Intake

- Patients without documented coronary heart disease (CHD)
  - Twice a week
- Patients with documented CHD
  - 1 g of EPA+DHA per day
  - EPA+DHA in capsule form could be considered
- Patients who need to lower triglycerides
  - 2 to 4 grams of EPA+DHA per day provided as capsules under a physician's care

## Fish

- Fatty fish
  - Mackerel
  - Lake trout
  - Herring
  - Sardines
  - Albacore tuna
  - Salmon
  - **eicosapentaenoic acid (EPA)**
  - **docosahexaenoic acid (DHA)**

## Nuts

- Walnuts
  - Omega 3 Fatty Acids
- Almonds
  - Monounsaturated fats

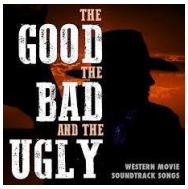
- Portion Size
- Mixed nuts


## Fatty Acids Are Key Building Blocks

- The omega-6 fatty acids
  - Linoleic acid = main dietary omega-6 fatty acid
  - Elongation/desaturation steps convert linoleic acid to arachidonic acid
    - These constrict blood vessels, promote blood clotting, and promote inflammation

## Types of Cholesterol

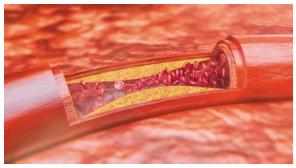
- **LDL Cholesterol (Bad):** Low Density Lipoprotein
- **HDL Cholesterol (Good):** High Density Lipoprotein
- **Triglycerides (Ugly):** Triglycerides are produced by the breakdown of certain sugars and visible animal fat consumed in your diet. Triglycerides are stored as body fat




## Good Cholesterol

- HDL – High Density Lipoprotein
- Contains very little cholesterol
- Removes LDL "bad" cholesterol from blood stream
- HDL can be increased with exercise
- This lipoprotein attaches to the LDL (bad) cholesterol and removes it from the blood stream. This can help prevent the build up of plaque and reduce your risk of heart attack or stroke.

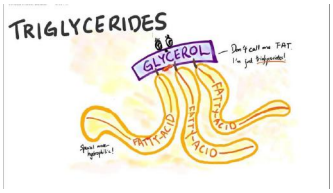
## Bad Cholesterol



- LDL – Low Density Lipoprotein
- Majority is cholesterol
- Builds up in arteries
- Helps make up the plaque-like substance
- Main focus of the ATP-III study – need to lower this level
- Plaque can cause a blockage leading to a heart attack or stroke

## The Ugly

- Triglycerides are stored as body fat for energy
- Commercial processing of fats
  - Removes phospholipids, plant sterols, and other phytochemicals
  - Further processing increases trans fatty acids
- Reduces waste, prevents spoilage, increases availability of calorie-rich oils



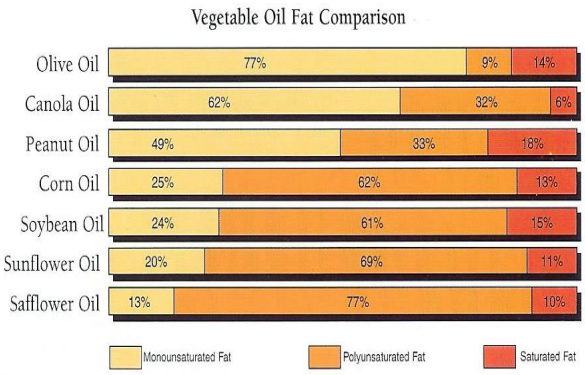

## Monounsaturated Fats

- Liquid at room temperature
- Will start to thicken under refrigeration
- Sources: olive, canola, almond, peanut oils
- Lower LDL and protect HDL


## Polyunsaturated Fats

- Liquid at room temperature and remain liquid under refrigeration
- Sources: corn, soybean, safflower, sunflower
- Lower LDL and may reduce HDL if used in large quantities

## Visual Comparison of Fats




## Example of Trans Fat Free & Olive oil Blend


## Plant Based Spreads

- Sterols come from soybeans
- Stanols come from other plant sources
- compete with the body's ability to absorb cholesterol
- Best used if taken approximately 3 servings per day
- Studies indicate patients already on lipid lowering medications have enhanced benefits



## Why the Confusion?

1912- Nikolai Anichkov

- Rabbits showed atherosclerosis after feeding on cholesterol

- What do RABBITS EAT?

## Why the Confusion?

- 1958 - Ancel Keys
- Powerful researcher and doctor
- Worked for Mayo Foundation
- Founders American Heart Association
- Developed rations for World War II using Cracker Jack boxes (K-rations)
- Seven Seas Study
  - Results from 22 countries, only 7 used
    - Hypothesis all fat causes heart disease
    - 1956 – American Heart Association released to public to avoid all fat
    - Mediterranean Diet
    - Results never validated or restudied

1972 - John Yudkin
- Pure White and Deadly, citing sugar as the culprit for many diseases including heart disease

2009 – Robert Lustig restudied all findings and proved Keys study to be inaccurate

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The RESULTS?????

## Results of Confusion




## Lipids and Health

- Healthy People 2020 objectives recommend
  - Lowering total fat intake
  - Lowering saturated and *trans* fat intake
  - Maintaining healthy body weight
  - Exercising on a regular basis
  - Eating fruits, vegetables, legumes, and grains to lower cholesterol levels
  - Substituting fish or soy foods for high-fat meats and cheeses

## Diet Principals

- Weight loss is recommended to reduce blood pressure in adults with elevated blood pressure or hypertension if you are overweight or obese
  - ***A 1-kg (2.2 pounds) reduction in body weight will drop blood pressure***
- The DASH (Dietary Approaches to Stop Hypertension) diet will help weight loss and lower blood pressure
- Sodium reduction is recommended for adults (50 years and younger) with elevated blood pressure or hypertension
  - *Optimal goals:*
  - *<1500 mg/d for 50 years and younger with hypertension*
  - *2300 mg for the general population*

***If you can not achieve the above, reduce at least a 1000-mg/day from your normal intake***

## Diet Principals

- Your diet should be rich in potassium, unless you have chronic kidney disease (CKD) or use drugs that affect potassium levels
  - ***Goal: 3500–5000 mg/d***
- Your exercise program is essential for the body to run more efficiently and help reduce body weight and blood pressure
  - **Aerobic (high intensity)** ***90–150 min/week***
  - **Dynamic resistance (sit ups, push ups)** ***90–150 min/week***
  - **Isometric resistance (yoga)** ***3 sessions/week***
- If you drink alcohol and have high blood pressures, it is recommended to drink no more than 2 (men) and 1 (women) standard drinks per day

## Avoid Sodium

- Found naturally in food
- Processing or shaking it on
- Required for our body to function properly
- Too much causes high blood pressure
- Choose "low or reduced" sodium, or "no salt added" versions of foods and condiments when available.
- Choose fresh, frozen, or canned ("low or reduced sodium" or "no salt added") vegetables.
- Use fresh poultry, fish, and lean meat, rather than canned, smoked or processed types.
- Choose ready-to-eat breakfast cereals that are lower in sodium.
- Limit cured foods (such as bacon and ham), foods packed in brine (such as pickles, pickled vegetables, olives, and sauerkraut); and condiments (such as mustard, horseradish, ketchup, and barbecue sauce)
- Cook rice, pasta, and hot cereals without salt. Cut back on instant or flavored rice, pasta, and cereal mixes, which usually have added salt.

· Choose "convenience" foods that are lower in sodium. Cut back

## Avoid Sodium

Choose "convenience" foods that are lower in sodium. Cut back on frozen dinners, mixed dishes such as pizza, packaged mixes, canned soups or broths, and salad dressings—these often have a lot of sodium.

· Rinse canned foods, such as tuna and canned beans, to remove some of the sodium.

· Use spices instead of salt. In cooking and at the table, flavor foods with herbs, spices, lemon, lime, vinegar, or salt-free seasoning blends. Start by cutting salt in half.

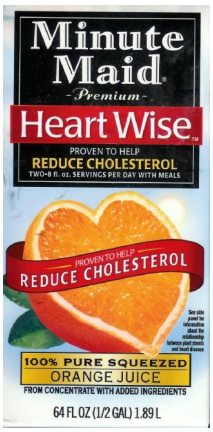
· On Nutrition Labels aim for foods that are less than 5% of the daily value of sodium. Foods with 20% or more daily value of sodium are considered high.

## Functional Foods

- Specific functions either added to or found naturally in foods.
- Plant sterols or stanols
- Naturally occurring phytochemicals found in many fruits, vegetables, nuts and cereals.
- Similar to structure to cholesterol
- Fight for absorption with cholesterol causing the body to absorb the sterol or stanol instead
- Reduces the amount of bad cholesterol found in your blood
- 2 grams per day to help lower LDL

| | |
|---|---|
| SmartBalance® Heart Right Fat Free Milk, (Cow's Milk) 8oz | 0.40 grams |
| Benecol®Spread, Tbsp | 0.50 grams |
| Rice Dream® Heart Wise Rice Milk, 8oz | 0.65 grams |
| Lifetime® Low-Fat Cheese Slices, 1 slice | 0.65 grams |
| Corazonas™ Heartbars, 1 bar | 0.80 grams |
| Benecol® Smart Chews, 2 chews | 0.80 grams |
| Minute Maid HeartWise®, 8oz | 1.00 grams |

## Plant Sterols


## CoroWise



## Fiber

- 90% Americans do not get enough fiber
- Eating approx 30g fiber daily can decrease heart attacks by 40%
- Most Americans eat 5g or less per day
- National Academy of Sciences
  - Recommends 25g for women 19-50, 21g for women 50+. 38g for men 19-50 and 30g for 50+

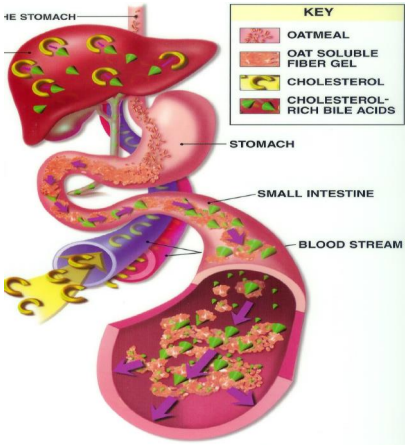
## Fiber

- Insoluble fiber
  - fiber provides bulk
- Soluble fiber
  - Turns into a gel when exposed to water
  - Attaches to LDL (bad) cholesterol from the blood stream
- The goal is to consume 5-10 grams per day.

| Food Sources | Grams |
|---|---|
| Peanut Butter, 1 Tbsp | 0.3 |
| Cheerios®, 1 cup | 1.0 |
| Kashi® Heart to Heart cereal, 1 cup | 1.0 |
| Flaxseed, 1 Tbsp | 1.1 |
| Oat flakes, 1 cup | 1.5 |
| Asparagus, ½ cup | 1.7 |
| Oranges, 1 small | 1.8 |
| Apricots, 4 with skin | 1.8 |
| Sweet Potato with skin | 1.8 |
| Brussels sprouts, ½ cup | 2.0 |
| Cooked oat bran cereal, ¾ cup | 2.2 |
| Oatmeal, regular or steal cut, ¾ cup dry | 3.0 |
| Beans (e.g. navy, kidney, black), 1 cup | 4.0-4.8 |

## The Magic of Soluble Cholesterol





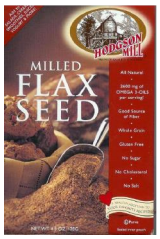
## Soy Products

- 25g of soy protein a day
- Soy milk, tofu, tempeh
- Shown to reduce cholesterol
- Phytochemicals : prostate cancer, breast cancer, bone health, cognitive function




## Flax Seed

- Contains Omega 3 fatty acids (alpha – lenolenic acid)
- Good fiber source – both soluble and insoluble
- Phytochemicals – lignans
- Ground flax vs. flax pills or oils (no lignans)


## Lipid Level Recommendations

- Total cholesterol – less than 200
- LDL (bad cholesterol) – less than 100
- HDL (good cholesterol) – greater than 60
  *(less than 40 is a single risk factor)*
- Triglycerides – less than 150
- Blood pressure – 120/80 (less than)

## Summary

- Not all fat is created equal
- The heart is a muscle – use it or lose it
- Give your arteries TLC – reduce pressure
- All foods still fit
- Use functional foods to benefit your heart
- Keep active
- You are what you eat

Questions?