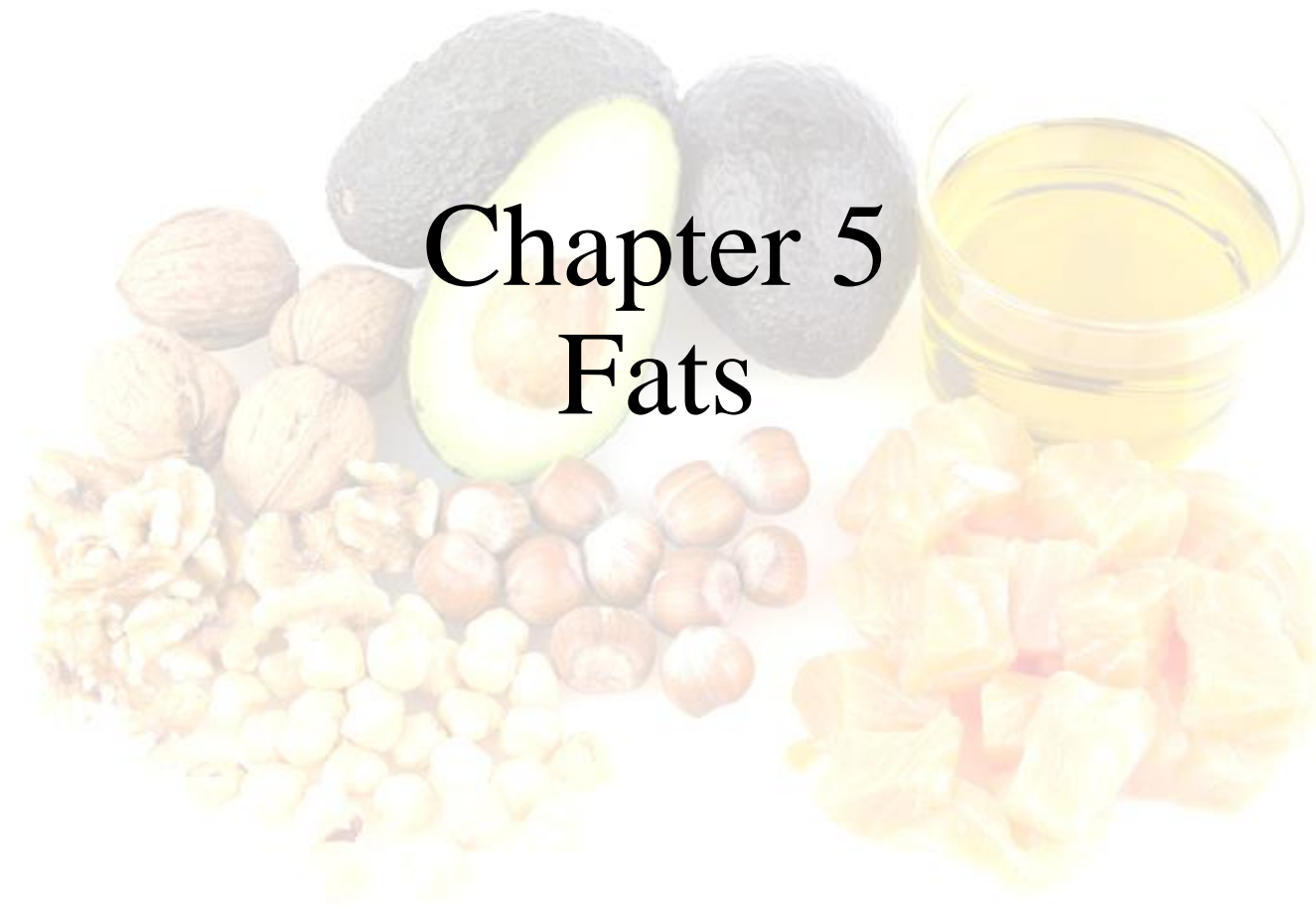


Chapter 5

Fats



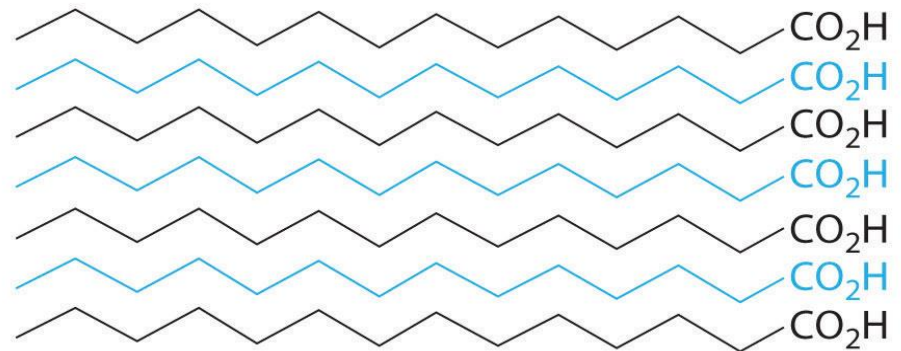
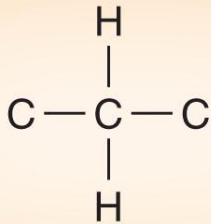
What Are Fats?

- Fats are one type of lipid
- **Lipids** are a diverse class of organic substances that are insoluble in water
 - Lipids (fats) do not dissolve in water
- **Note:**
 - Fats – solid at room temperature
 - Oils – liquid at room temperature



Saturated Fatty Acids

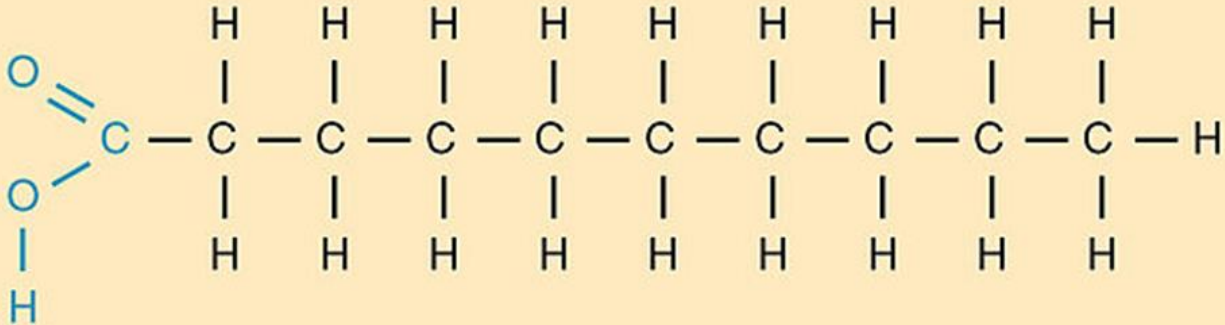
- **Saturated fatty acids** have hydrogen atoms surrounding every carbon in the chain; they have **no double bonds**
 - Saturated fatty acids can **pack tightly** together and are **solid** at room temperature
 - Coconut oil, palm oil, butter, lard cream, whole milk, animal fats are high in saturated fat



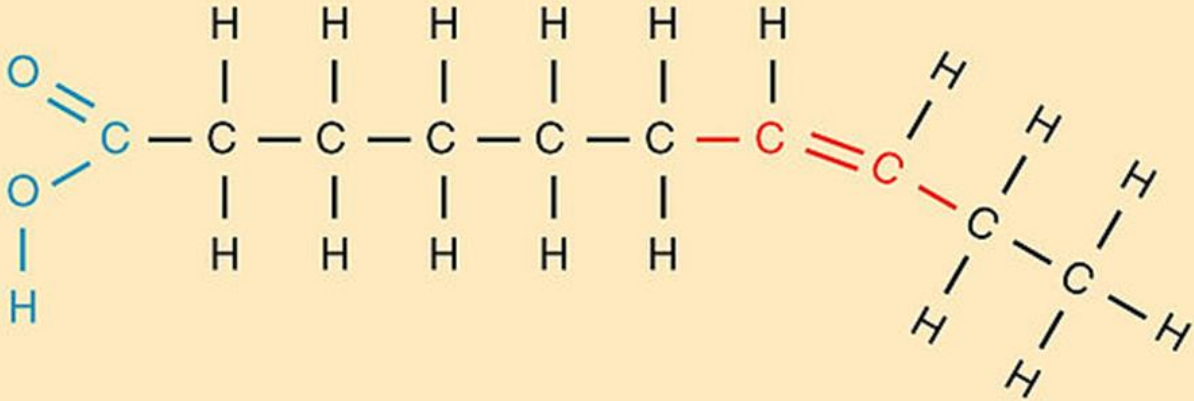
(a) Saturated fatty acid

Saturated vs Unsaturated Fats

Saturated

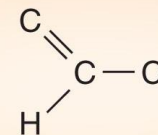


Unsaturated



Unsaturated Fatty Acids

- **Monounsaturated fatty acids** lack hydrogen atoms in one region; they have **one double bond**
 - Olive oil, canola oil, cashew nuts are high in monounsaturated foods
- **Polyunsaturated fatty acids** lack hydrogen atoms in multiple locations; they have **two or more double bonds**
 - Cotton seed, canola, corn, safflower are high in polyunsaturated fat
- Unsaturated fatty acids do not stack together well and are **liquid** at room temperature
 - Predominantly found in plants
(except in coconut and palm kernel oil)

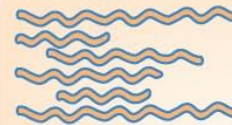
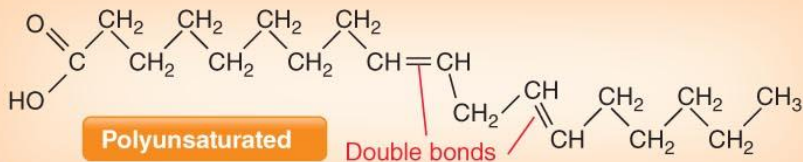
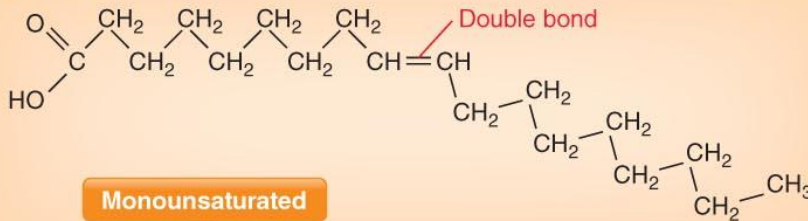
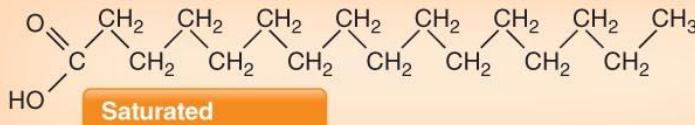


(b) Unsaturated fatty acid

Saturated & Unsaturated Fatty Acids

- The shape of a triglyceride is determined by the saturation of the carbon chains

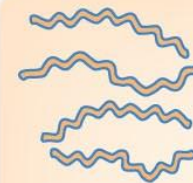
Fatty acids



Long-chain saturated fatty acids stack well together to make solid forms at room temperature.



(b)



Monounsaturated and polyunsaturated fatty acids do not stack well together because they are bent. These fatty acids are liquid at room temperature.

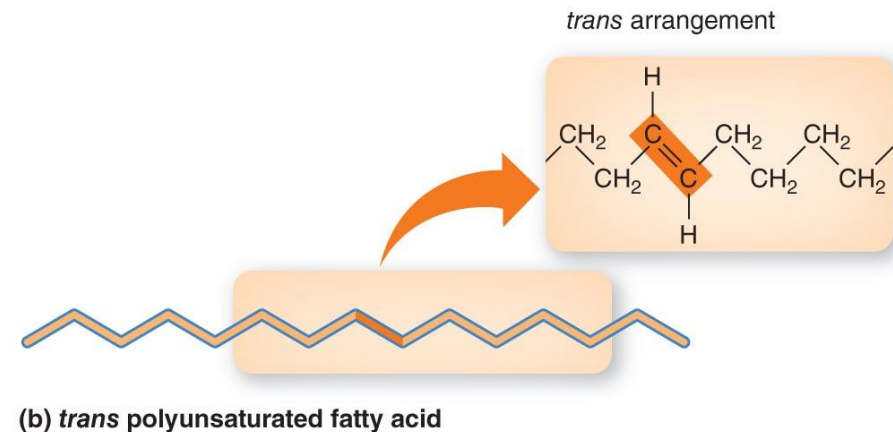
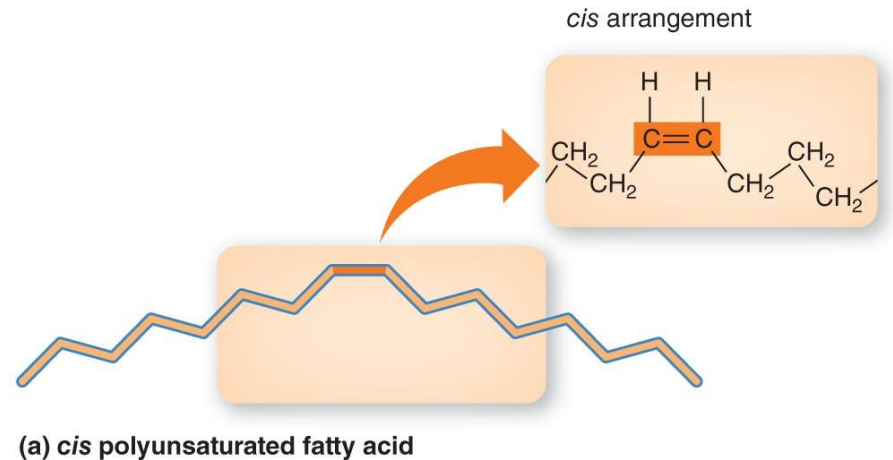


(a)

(c)

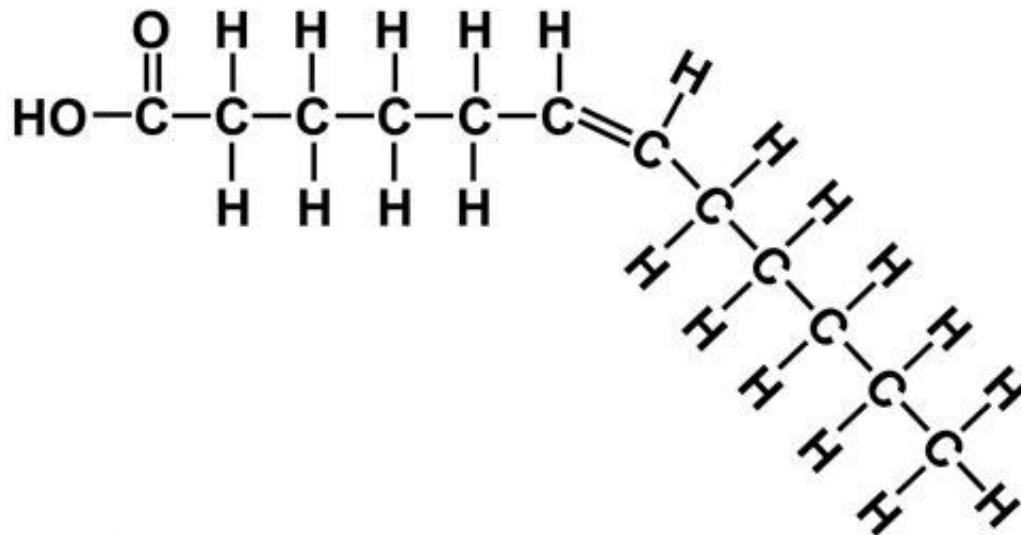
Cis & *Trans* Polyunsaturated Fatty Acids

- The hydrogen atoms at the unsaturated region can be arranged in different positions:
 - **Cis**: same side of the carbon chain
 - **Trans**: opposite sides of the carbon chain

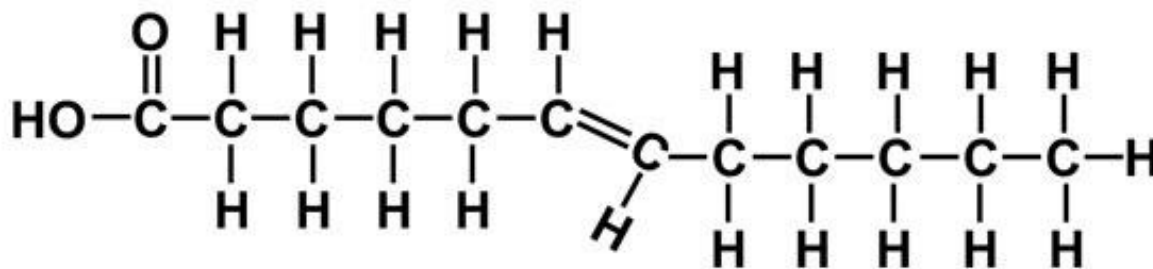


Cis & *Trans* Fatty Acids

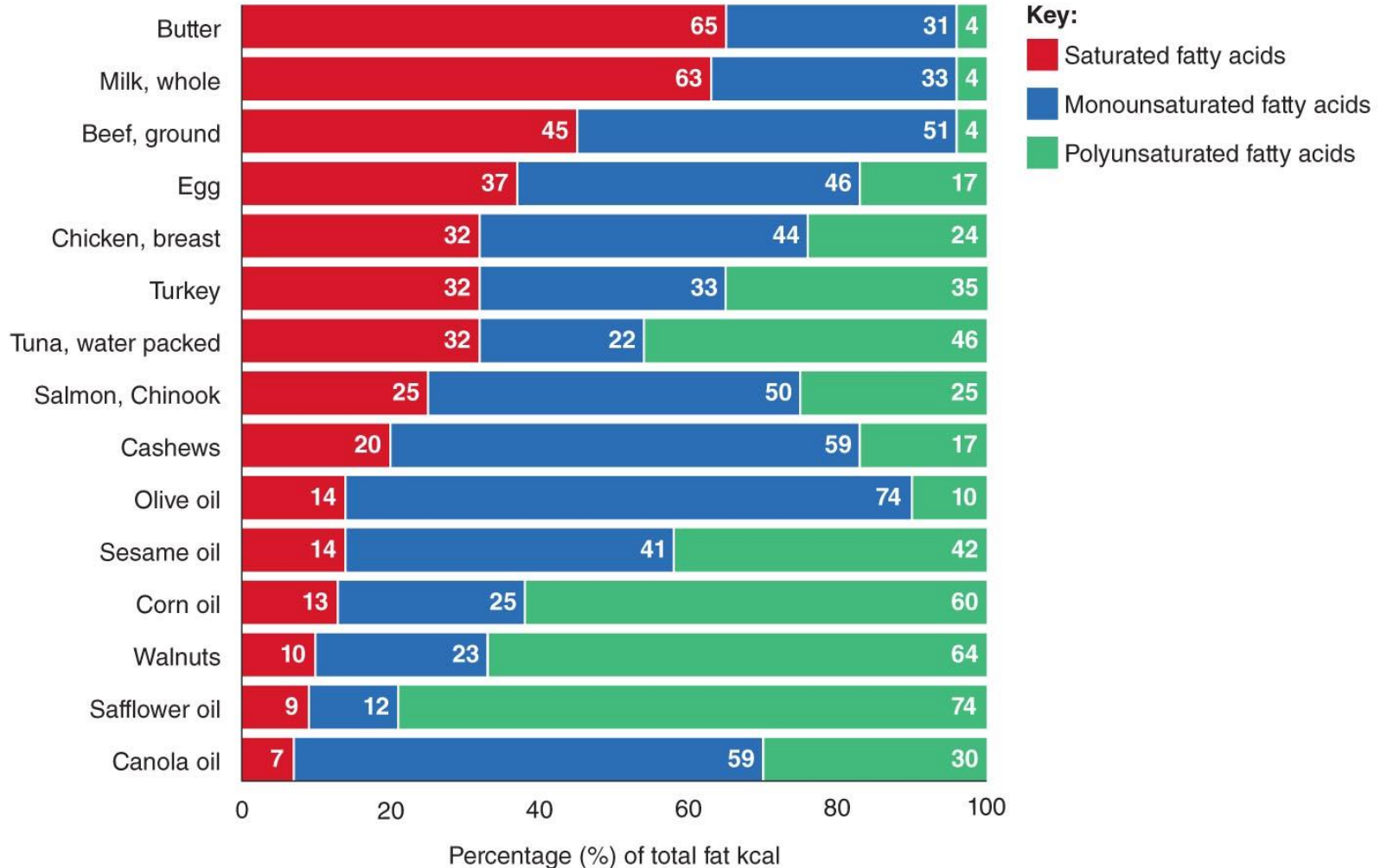
cis-fatty acid



trans-fatty acid



Major Sources of Dietary Fat

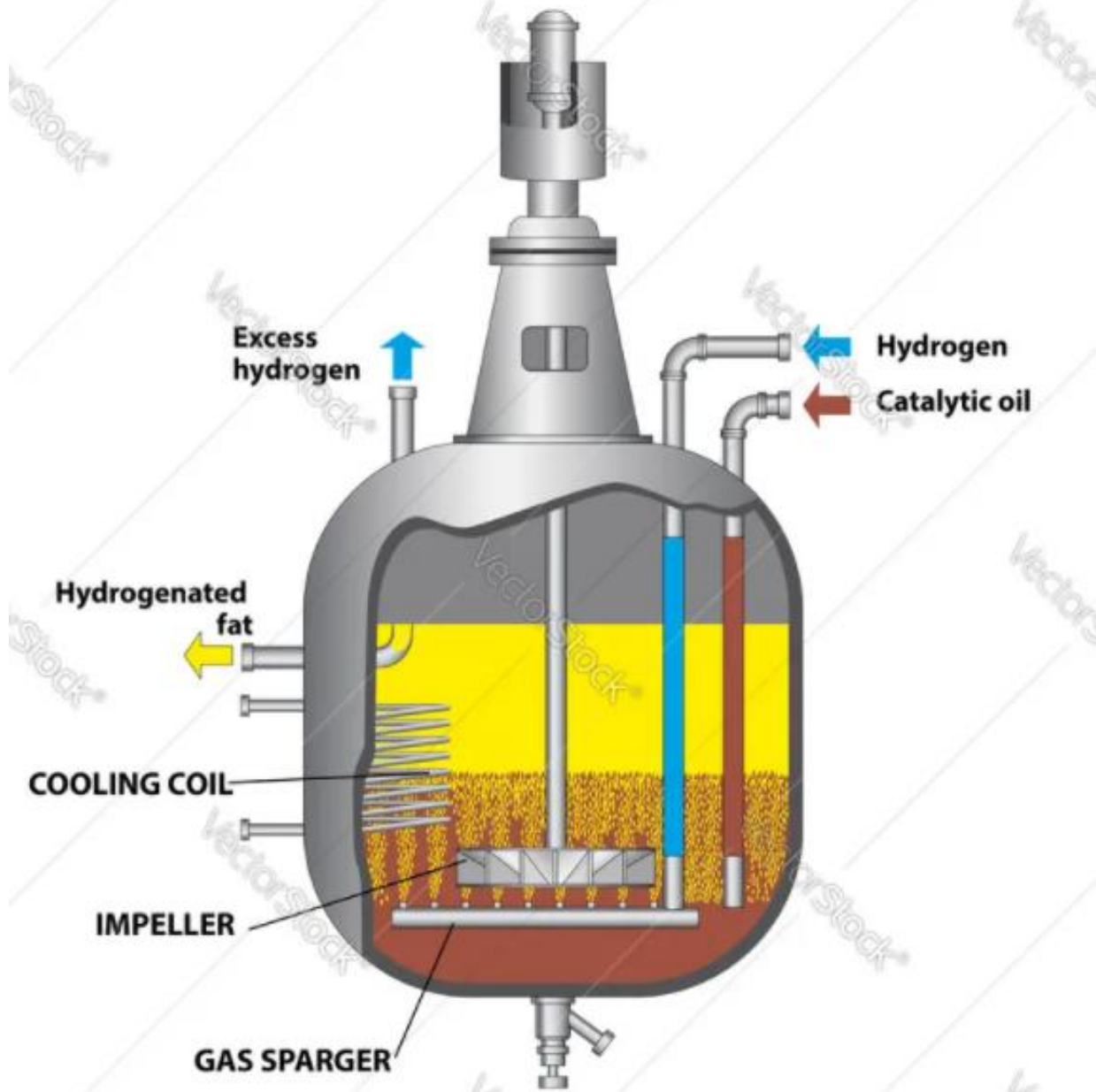


Hydrogenation

- **Hydrogenation** is the artificial and forced addition of hydrogen atoms to unsaturated fatty acids
 - Converts liquid fats (oils) into a semisolid (spreadable) or solid form
 - Used to create margarine from plant oil
 - **Often creates trans fatty acids**
 - Listed on food labels as **partially hydrogenated oil**



HYDROGENATION PROCESS OF FATS AND OILS



Trans Fats

- The majority of trans fats get into our foods during food processing (ex. frying).

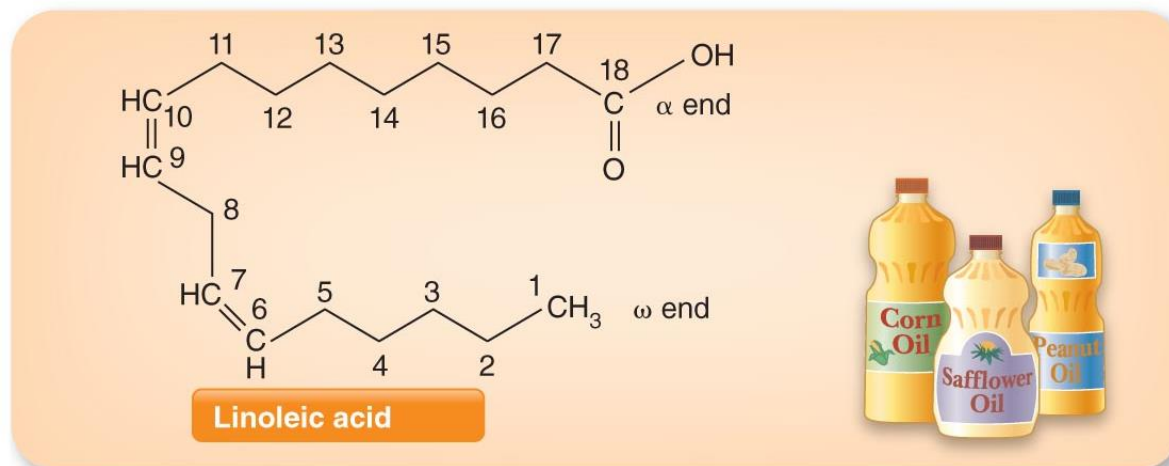
Why are trans fats so harmful?

The enzymes in our bodies cannot effectively break down these fats.



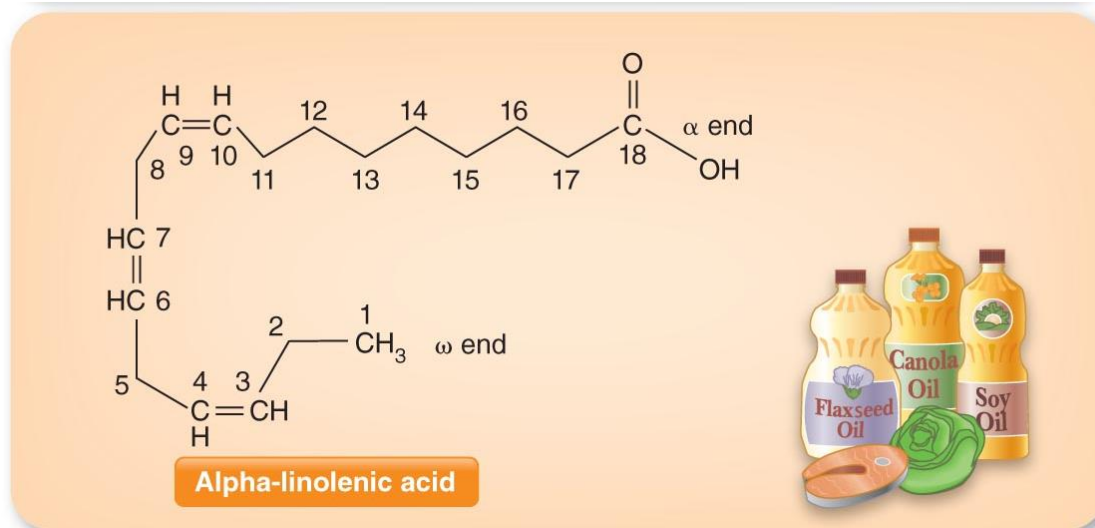
Essential Fatty Acids

- **Essential fatty acids** cannot be synthesized in the body and must be obtained in the diet.
 - **Omega-6** is a fatty acid that has its double bond six carbons from the end. Important for skin, hair, bone health.
 - Found in vegetable and nut oils, such as sunflower oil, safflower oil, corn, soy, and peanut oil
 - Daily intake: 14 – 17g (men); 11 – 12g (women)



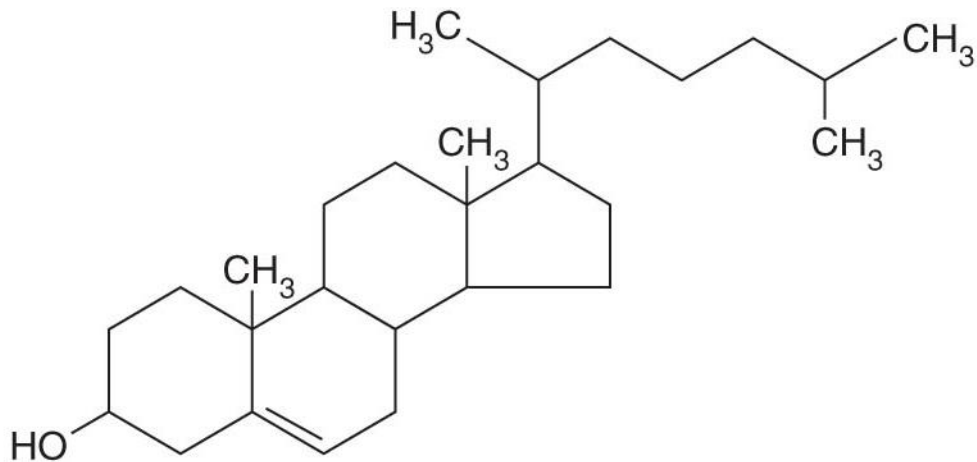
Essential Fatty Acids

- **Omega-3** is a fatty acid that has its double bond three carbons from the end. These are important for overall health, particularly brain and heart health.
 - Found in various fish (especially salmon, sardines, cod liver oil), flax, hemp and chia seeds, walnuts, soybeans, eggs, avocado, almonds, cashews, beans, and dark-green leafy vegetables.
 - Daily intake: 1.6 g (men); 1.1 g (women)
- **Note: it is important to consume more Omega-3 than Omega-6**



Sterols

- **Sterols** are lipids containing multiple rings of carbon atoms
 - Essential components of cell membranes and many hormones
 - Manufactured in our bodies and therefore not an essential component of our diet
 - Cholesterol is the major sterol found in the body



Dietary Cholesterol

Is it good or bad for us?

- **Both.**
HDL - higher levels are generally healthy.
LDL – lower levels are generally desired (can accumulate in coronary arteries).

Where is it found?

- Found in animal products such as butter, egg yolks, whole milk, red meats, and poultry.

Do we need to consume it?

- We do not need to consume cholesterol, as our bodies will synthesize it.

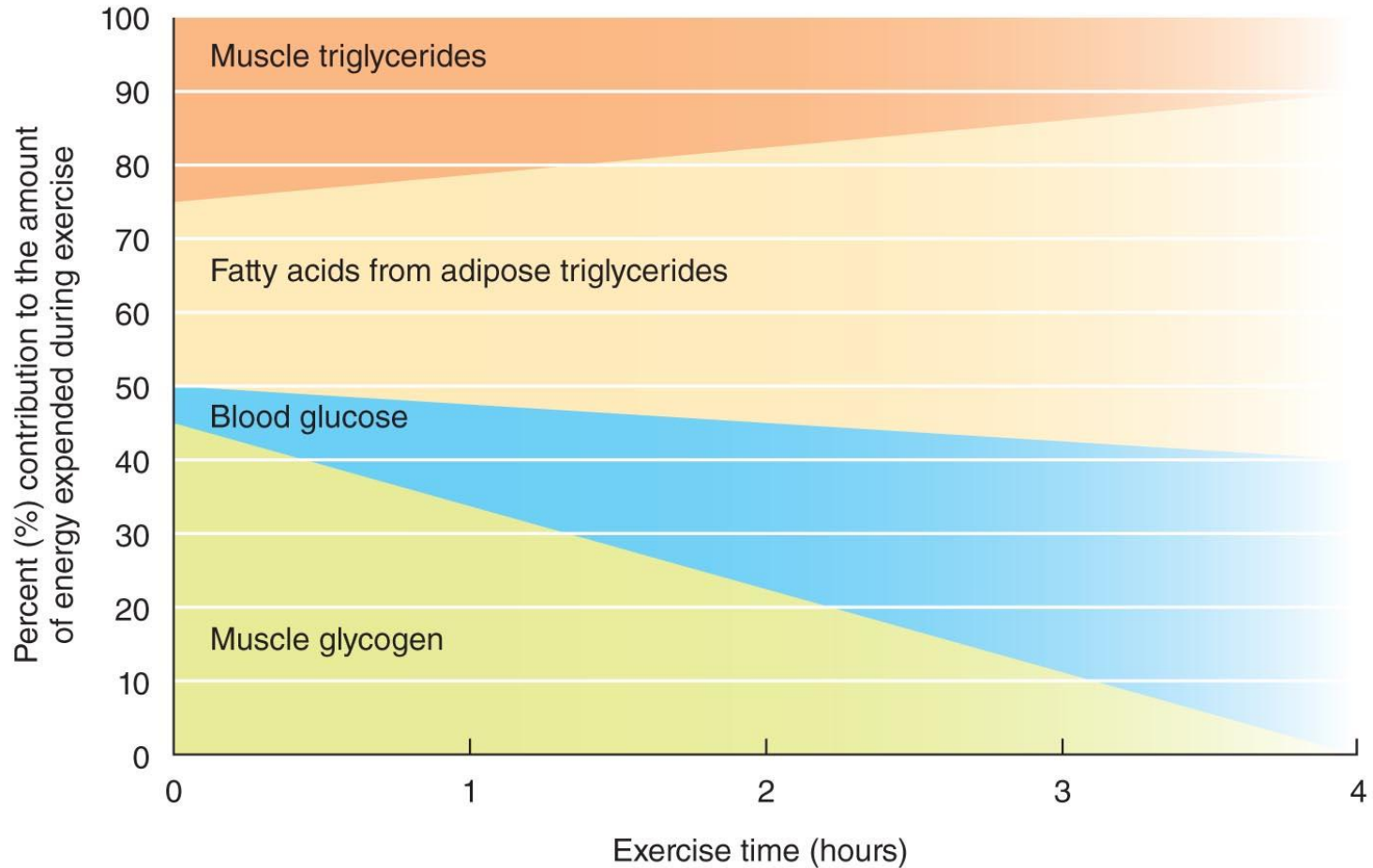
Why do we need it?

- Sex hormones, production of bile, adrenal hormones, and production of vitamin D, cell membrane production and maintenance

Energy From Fats

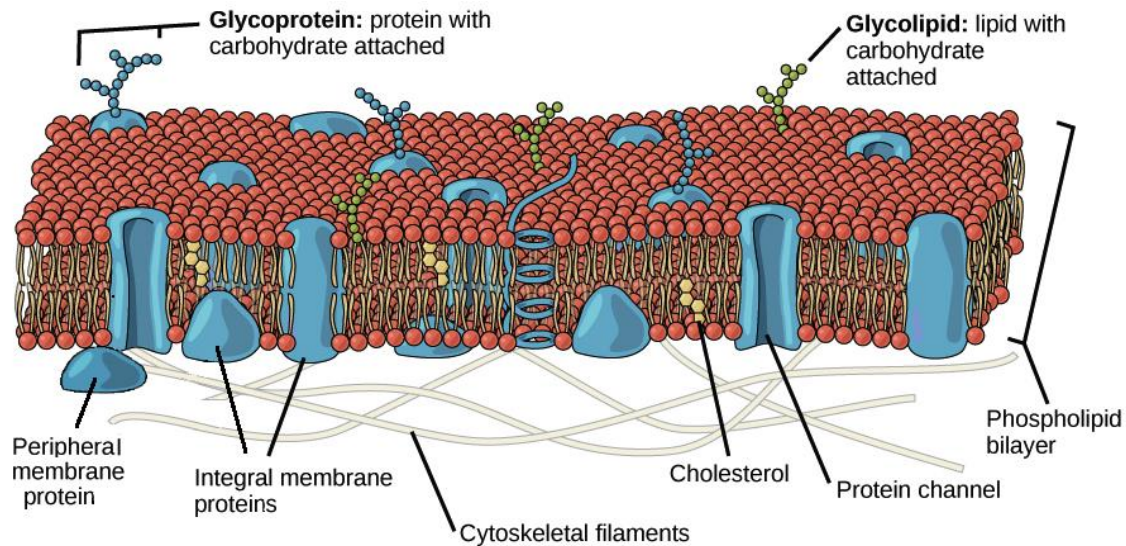
- One gram of fat contains 9 calories = **9 kcal/g**
- Energy from fats are used for
 - Fueling daily activity and metabolic function at rest
 - Exercise - especially after glycogen is depleted
- Fat is also used for energy storage

Energy From Fats



Why Do We Need Fats?

- Fat is essential to many body functions
 - Cell membrane structure
 - Nerve cell transmissions
 - Protection of internal organs
 - Insulation to retain body heat



How Much Fat Should We Eat?

- The Acceptable Macronutrient Distribution Range (AMDR) indicates that fats should make up **20%–35% of daily calorie intake**
- **Athletes and highly active people** may need more energy from carbohydrates and can reduce their fat intake to 20–25% of total calories



Recognize the Fat in Foods

- **Visible fats** are those we can see in foods or can easily see have been added to foods, such as dressing or chicken skin
- **Hidden fats** are those added to processed or prepared foods to improve texture or taste, which we may not be aware of, or that occur naturally
- Read the Nutrition Facts Panel on foods carefully
 - **Fat-free:** less than 0.5 g fat
 - **Low-fat:** 3 g or less fat
 - **Reduced fat:** 25% less fat than standard product
 - **Light:** 1/3 less calories or 50% less fat than standard product
- Lower-fat versions of foods may not always be lower in Calories

Comparison of Foods

TABLE 5.2 Comparison of Full-Fat, Reduced-Fat, and Low-Fat Foods

Product and Serving Size	Version	Energy (kcal)	Protein (g)	Carbohydrate (g)	Fat (g)
Milk, 8 oz	Whole, 3.3% fat	150	8.0	11.4	8.2
	2% fat	121	8.1	11.7	4.7
	Skim (nonfat)	86	8.4	11.9	0.5
Mayonnaise, 1 tbsp.	Regular	100	0.0	0.0	11.0
	Light	50	0.0	1.0	5.0
Margarine, corn oil, 1 tbsp.	Regular	100	0.0	0.0	11.0
	Reduced-fat	60	0.0	0.0	7.0
Peanut butter, 1 tbsp.	Regular	95	4.1	3.1	8.2
	Reduced-fat	81	4.4	5.2	5.4
Wheat Thins, 18 crackers	Regular	158	2.3	21.4	6.8
	Reduced-fat	120	2.0	21.0	4.0
Cookies, Oreo, 3 cookies	Regular	160	2.0	23.0	7.0
	Reduced-fat	130	2.0	25.0	3.5
Cookies, Fig Newton, 3 cookies	Regular	210	3.0	30.0	4.5
	Fat-free	204	2.4	26.8	0.0

Data from: Food Processor-SQL, Version 9.9, ESHA Research, Salem, OR.

Limit Saturated and Trans Fats

- Reduce your intake of saturated fats (7-10% of total calories)
- Foods that are high in saturated fats:
 - Animal products: beef pork, and lamb
 - Grain products: Pastries, cookies, muffins, tortilla chips, popcorn, and crackers
 - Vegetable products: Fried veggies, breaded veggies, or vegetables drenched in sauces
- **Note: Avoid trans fatty acids entirely!**

Role of Fats in Chronic Disease

Chronic diseases most closely associated with diets high in saturated fat are **cardiovascular disease** and **hypertension** (high blood pressure).

Note: Saturated fats are made by animals. **We are animals.** We make saturated fats out of **ANY** excess calories we consume. **This includes carbs.** We tend to burn a higher percentage of saturated fats we **CONSUME** as compared to storing a higher percentage of saturated fats we **MAKE**.

For many the problem is the bread and not the butter on the bread.

Modifiable risk factors for cardiovascular disease include:

- Being overweight
- Physical inactivity
- Smoking
- Type 2 diabetes
- Inflammation in the body
- Abnormal blood lipids

Cardiovascular Disease

