CHEM 103: Chemistry in Context

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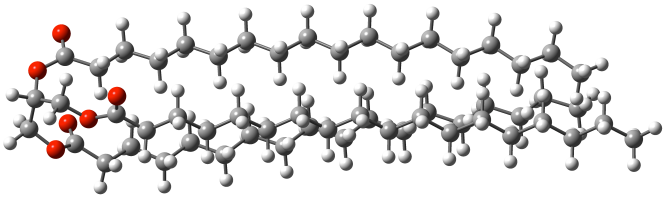
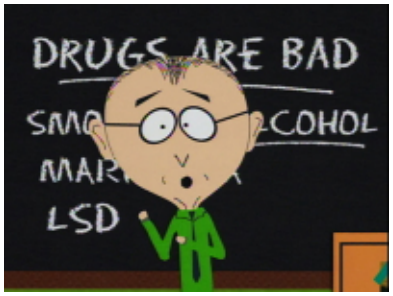
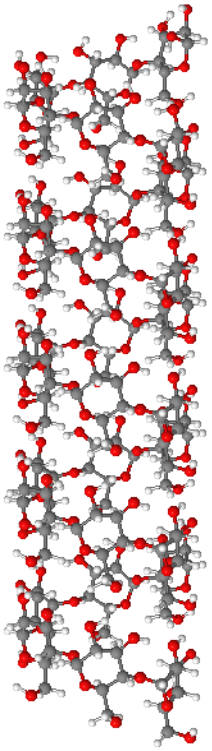
Department of Chemistry, CSU

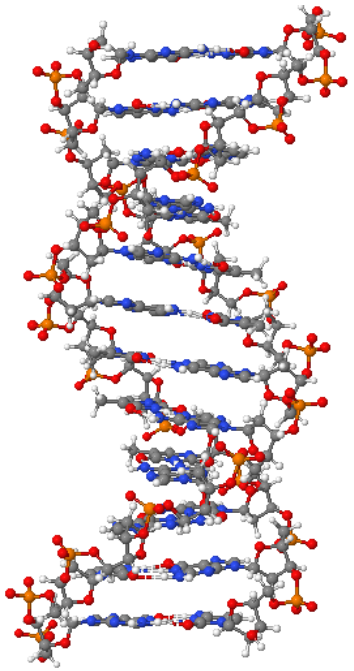
Molecules of Life

Biochemistry:
- fats
- sugars
- proteins
- DNA/RNA





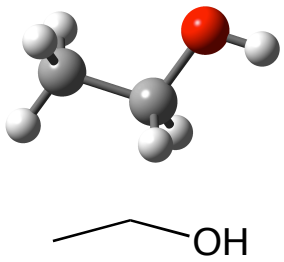




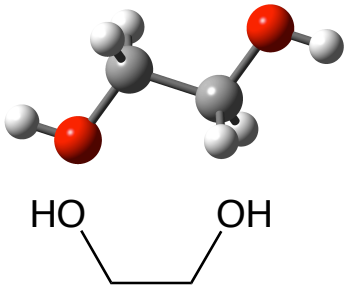
O-Containing Functional Groups

Functional groups from organic chemistry:

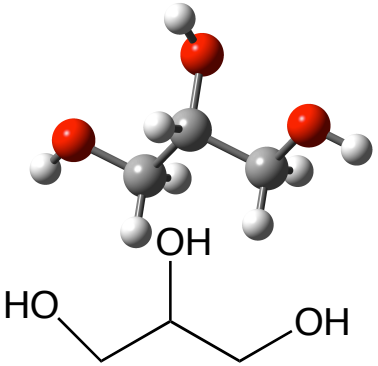
Hydroxyl (alcohols, -OH)



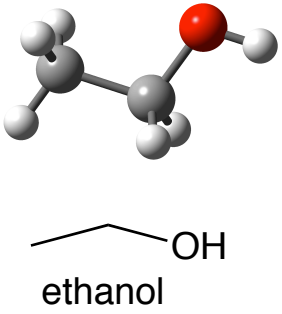
ethanol



ethylene glycol
(antifreeze)

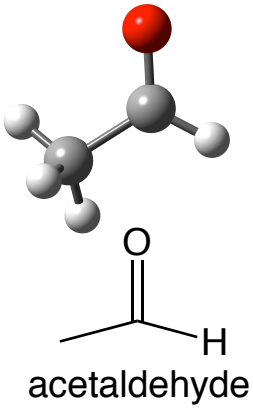


glycerol
(glycerin,triglycerides)



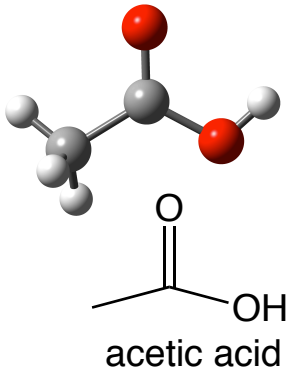
ethanol

oxidized



acetaldehyde

oxidized



acetic acid

vinegar

Aldehyde (-C(=O)H) Carboxylic acid (-COOH)

Fatty Acids, Fats and Oils (Ch. 11.2)

fatty acid: long chain hydrocarbon w/ even # of C atoms, plus a carboxylic acid end group

triglyceride: chemical combination of three fatty acids with glycerol; releases 3 equivalents of water

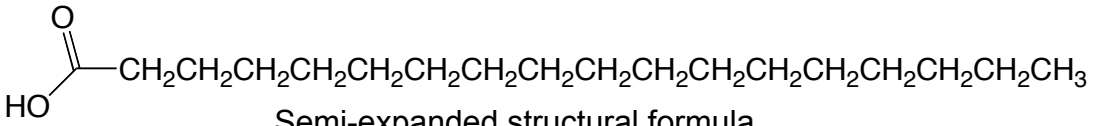
fat: triglyceride that is solid at room temperature

oil: triglyceride that is liquid at room temperature

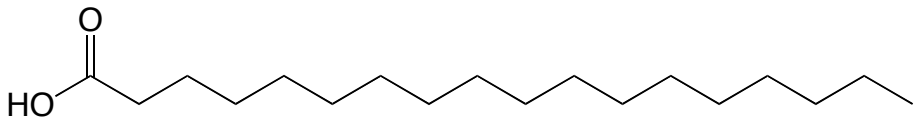
more double bonds → lower triglycercide melting points

$CH_3(CH_2)_{16}COOH$

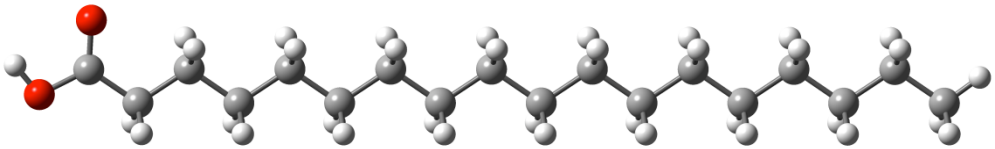
Condensed structural formula



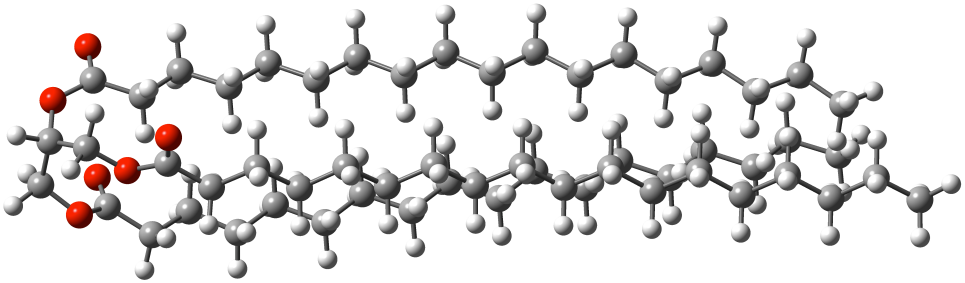
Semi-expanded structural formula



Line-angle drawing



Ball and Stick drawing



Real World Example

e.l.f. Studio Lengthening & Volumizing Mascara

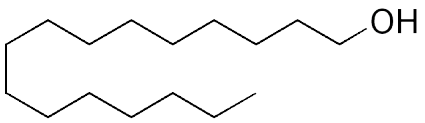
Achieve thicker, fuller, and longer lashes that are beautiful and natural. The enlarged brush coats your lashes evenly for an enhanced appeal. The unique formula is clump free and quick drying so you can have color that stays on all day with no smudging and no flaking.

Looking for a waterproof version?Click for here for our Waterproof Lengthening & Volumizing Mascara

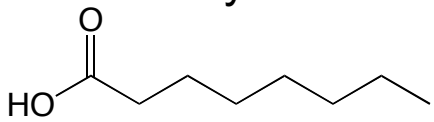
DIRECTIONS **INGREDIENTS**

Aqua(Water), Caprylic/Caprictri Glycerides, Cera Carnauba (Carnauba) Wax, Synthetic Beeswax, Styrene/Acrylates/Ammonium Methacrylate Copolymer, Stearic Acid, Cetyl Alcohol, Glyceryl,Stearate SE, PVP, Triethanolamine, Triacontanyl PVP, Hydroxyethyl Cellulose, Benzyl Alcohol, Methylchloroisothiazolinone, Methylisothiazolinone
May Contain: Iron Oxides(CI 77891, CI 77892, CI 77899)

Glycerides
Stearic Acid
Various alcohols



Cetyl alcohol



Caprylic acid

Margarine

I Can't Believe It's Not Butter!® Original Soft Spread

Made with a blend of nutritious oils such as soybean and canola oil, ***I Can't Believe It's Not Butter!***® Original Soft Spread has 70% less saturated fat and 30% fewer calories than butter.* Plus, it has no hydrogenated oils (so there's 0g trans fat*), is cholesterol free and is an excellent source of omega-3 ALA.** Enjoy the fresh butter taste you love!

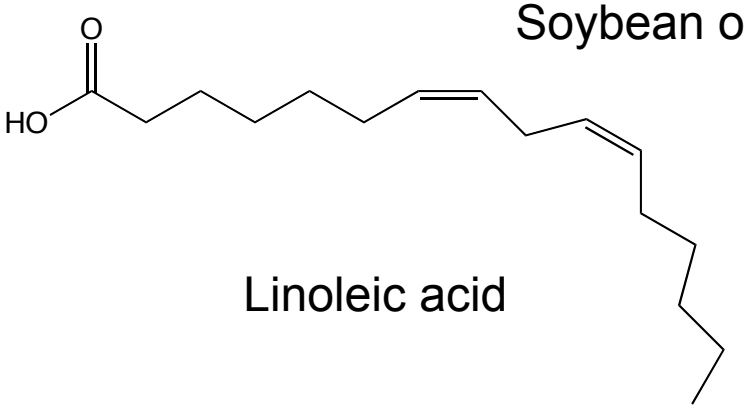
Nutrition Facts for Original Soft Spread

Serving Size:	1 tbsp. (14g)	
Servings Per Container:	30 (15 oz.), 96 (3 lb.)	
Calories:	70	
Calories from Fat:	70	
	Amount Per Serving	% Daily Value***
Total Fat:	8g	12%
Saturated Fat:	2g	10%
Trans Fat:	0g	
Polyunsaturated Fat:	4g	
Monounsaturated Fat:	2g	
Cholesterol:	0mg	0%
Sodium:	90mg	4%
Total Carbohydrate:	0g	0%
Protein:	0g	
Vitamin A:		10%

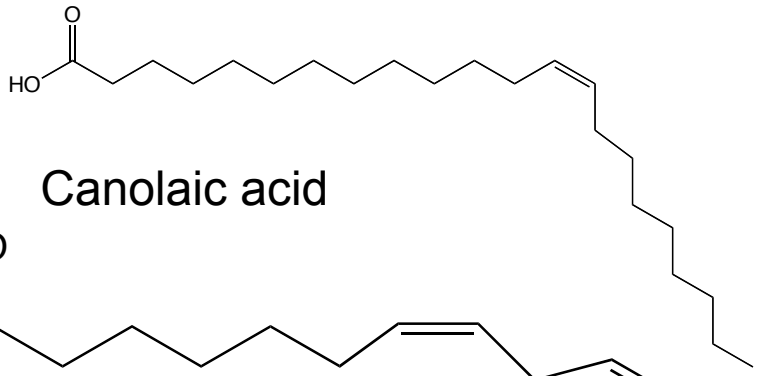
Not a significant source of dietary fiber, sugars, vitamin C, calcium and iron.

*Vs. butter. I Can't Believe It's Not Butter!® 58% vegetable oil spread contains 8g of fat (2g sat. fat, 0g trans fat, 70 calories) per serving.
**A blend of soybean and canola oils. Contains 460mg of omega-3 ALA per serving; 28% of the daily value of ALA (1300mg).
***Percent daily values are based on a 2000-calorie diet.

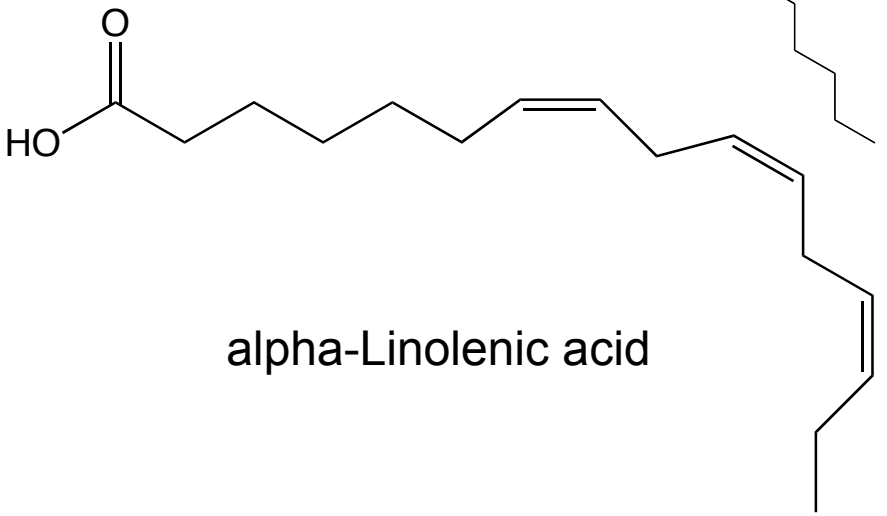
Soybean oil



Linoleic acid

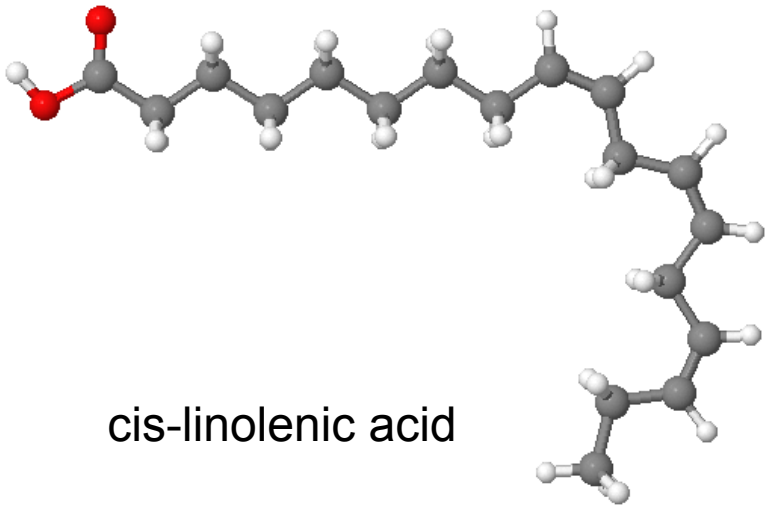


Canolaic acid

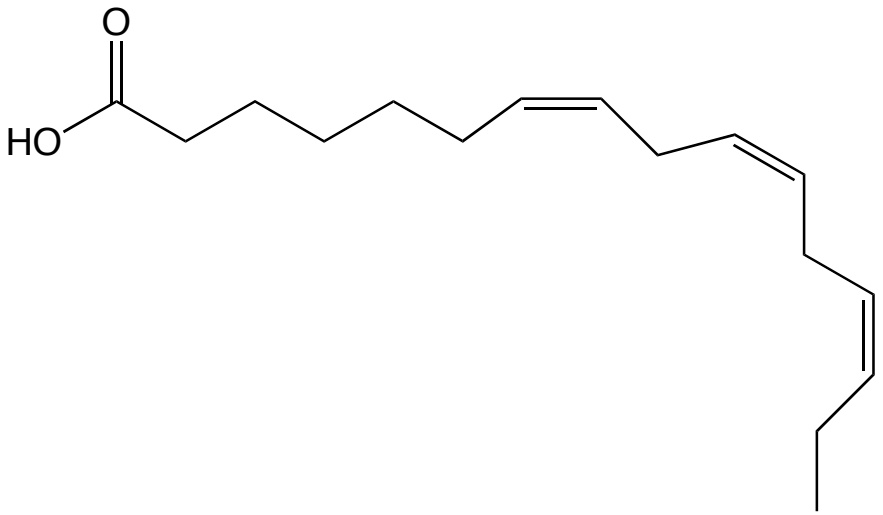


alpha-Linolenic acid

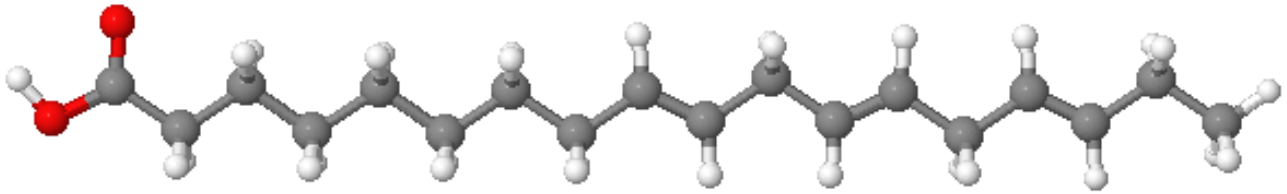
Cis versus Trans fatty acids

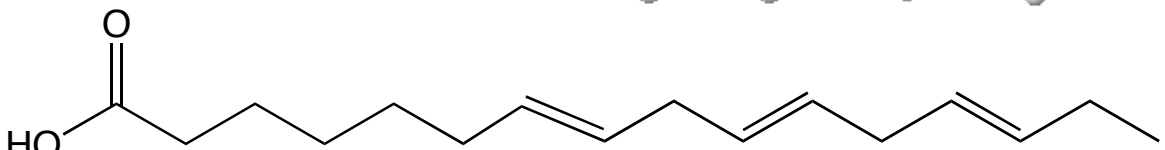


cis-linolenic acid



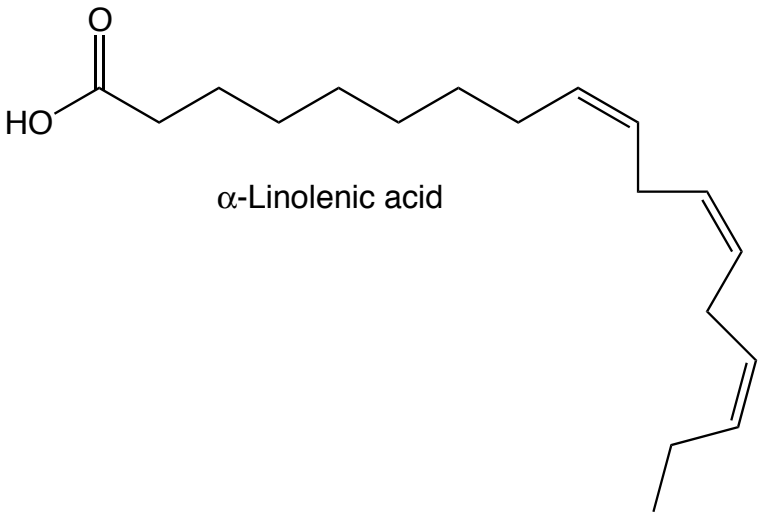
partial hydrogenation



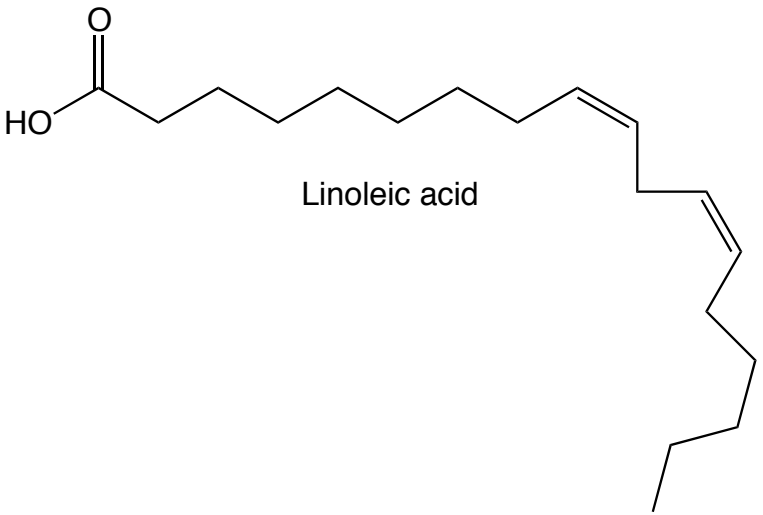


trans-linolenic acid

Essential fatty acids

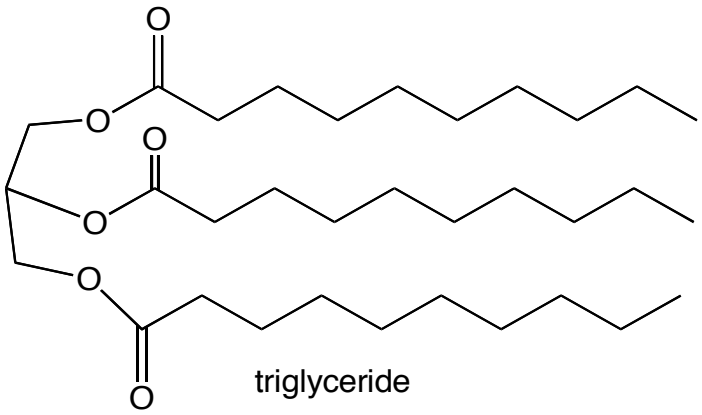


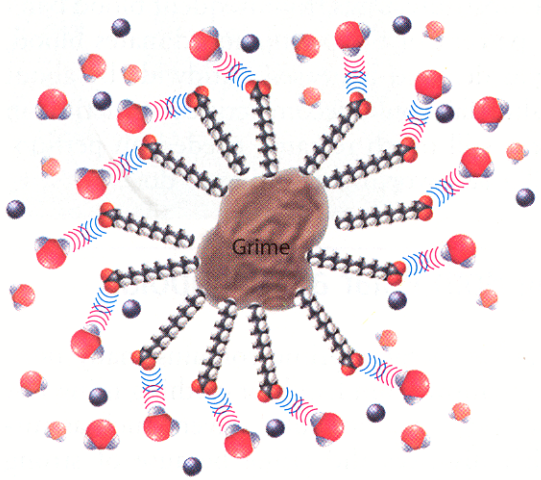
α-Linolenic acid



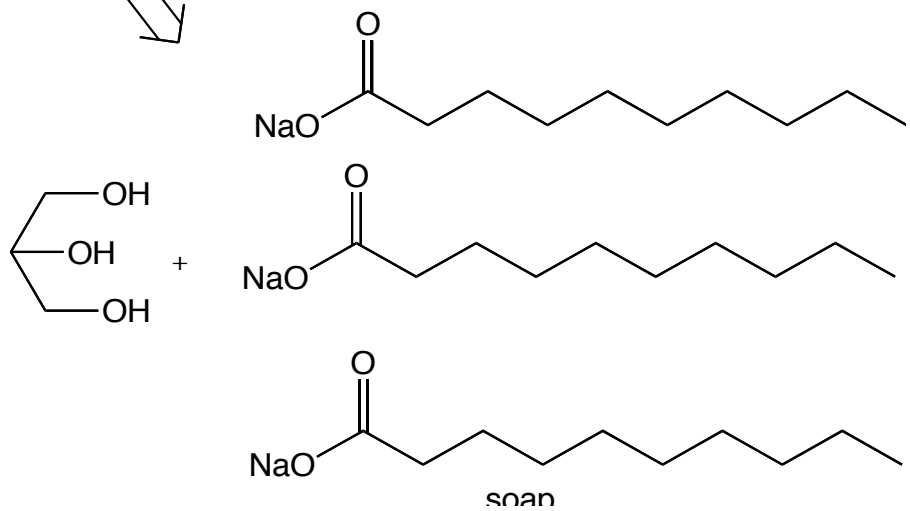
Linoleic acid

Soap





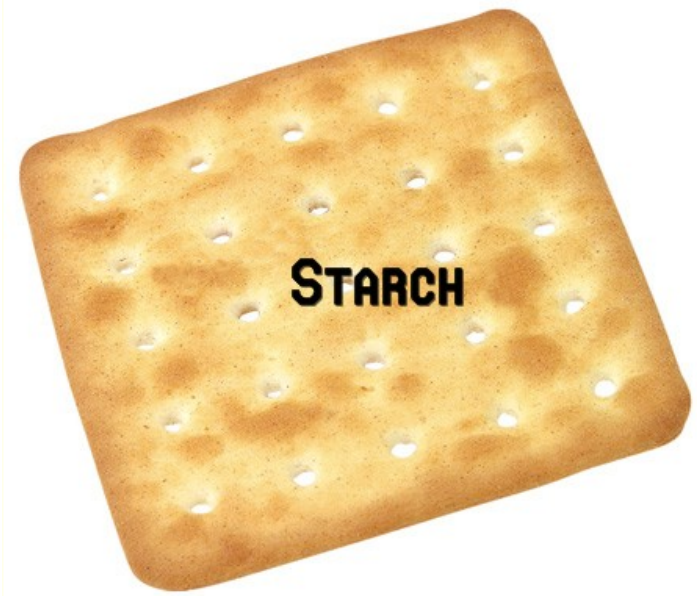
NaOH (Sodium Hydroxide, Lye)



"Conceptual Chemistry" 2nd Ed
John Suchocki, 2004
Pearson Education Inc.

Carbohydrates (Chapter 11.3)

CRACKERS, SALTINE, UNSALTED TOPS



Nutrition Facts

Serving Size 5 crackers (16g)
Servings Per Container About 28

Amount Per Serving	
Calories 70	Calories from Fat 15
	% Daily Value*
Total Fat 1.5g	**2%**
Saturated Fat 0g	**0%**
Trans Fat 0g	
Polyunsaturated Fat 0.5g	
Monounsaturated Fat 0g	
Cholesterol 0mg	**0%**
Sodium 75mg	**3%**
Total Carbohydrate 13g	**4%**
Dietary Fiber 0g	**0%**
Sugars 0g	
Protein 1g	

Vitamin A 0% • Vitamin C 0%
Calcium 0% • Iron 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
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

INGREDIENTS: UNBLEACHED ENRICHED FLOUR (WHEAT FLOUR, NIACIN, REDUCED IRON, THIAMINE MONONITRATE {VITAMIN B1}, RIBOFLAVIN {VITAMIN B2}, FOLIC ACID), SOYBEAN OIL, PARTIALLY HYDROGENATED COTTONSEED OIL, SALT, LEAVENING (BAKING SODA AND/OR YEAST), MALTED BARLEY FLOUR.

CONTAINS: WHEAT.

KRAFT FOODS GLOBAL, INC.
NORTHFIELD, IL 60093-2753 USA
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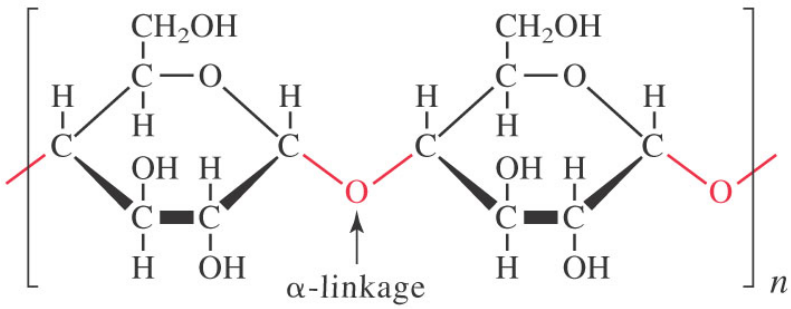
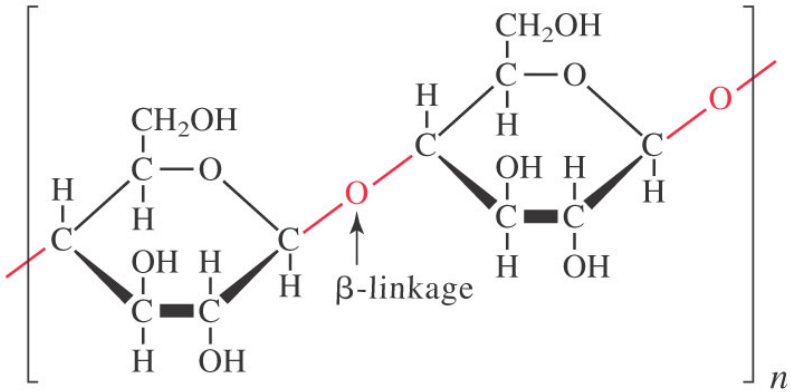
Carbohydrates (Chapter 11.3)

- Polysaccharides are formed from the condensation of thousands of glucose units
  - example of a biopolymer
- Alpha (α) linkage: H atoms adjacent to bridging O on "same" side
  - humans can digest these polymers (aka starches)
- Beta (β) linkage: we can't digest these sugars (e.g. cellulose)—cows get bacteria to do it for them…

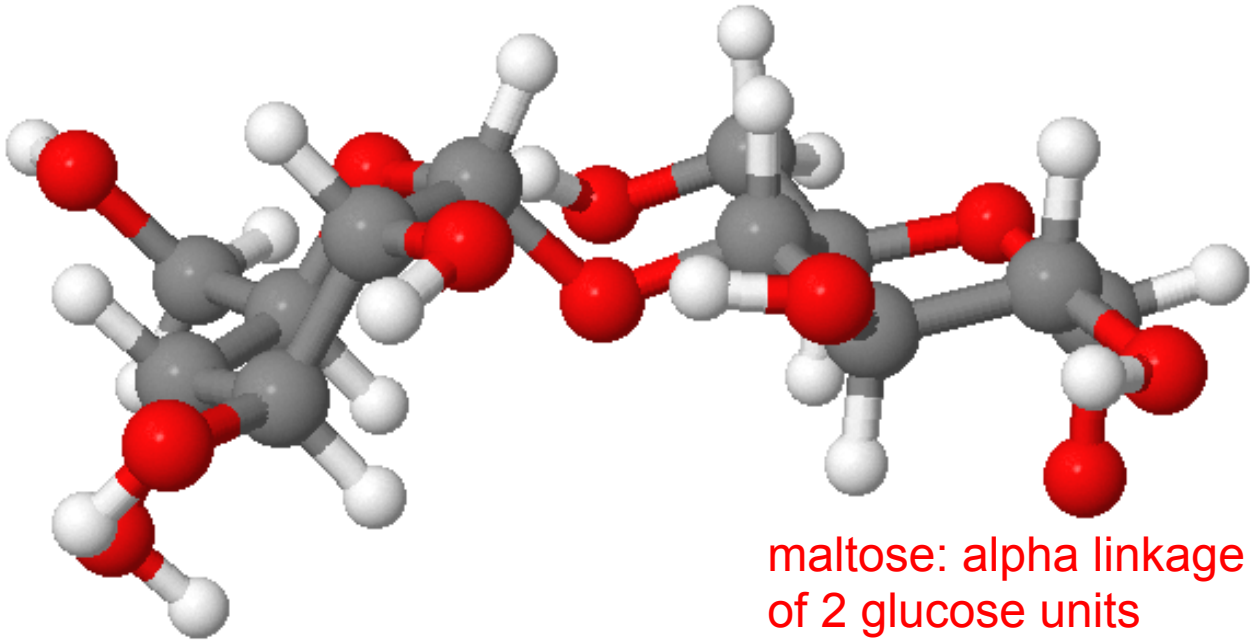


(a) Starch

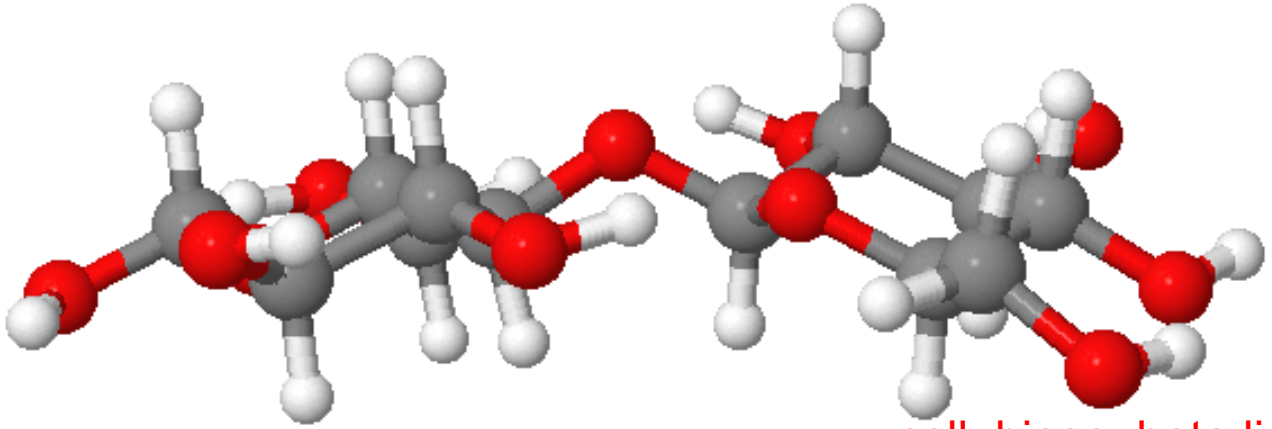


(b) Cellulose

Structure of Cellulose: Problematic for Digestion (by People)



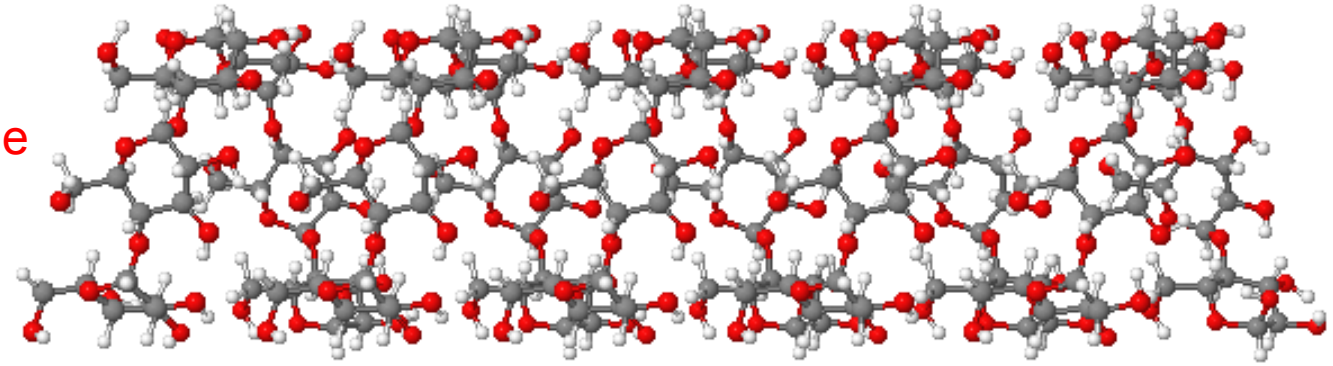
maltose: alpha linkage
of 2 glucose units



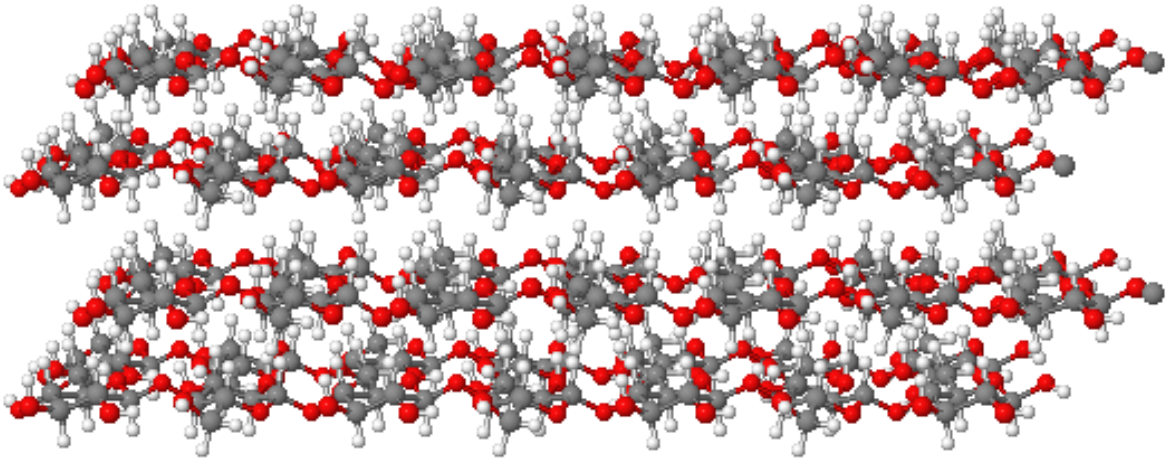
cellubiose: beta linkage
of 2 glucose units

Structural Effects of α vs β Linkages in Polysaccharides

amylose (starch): soluble in water, digestible by people



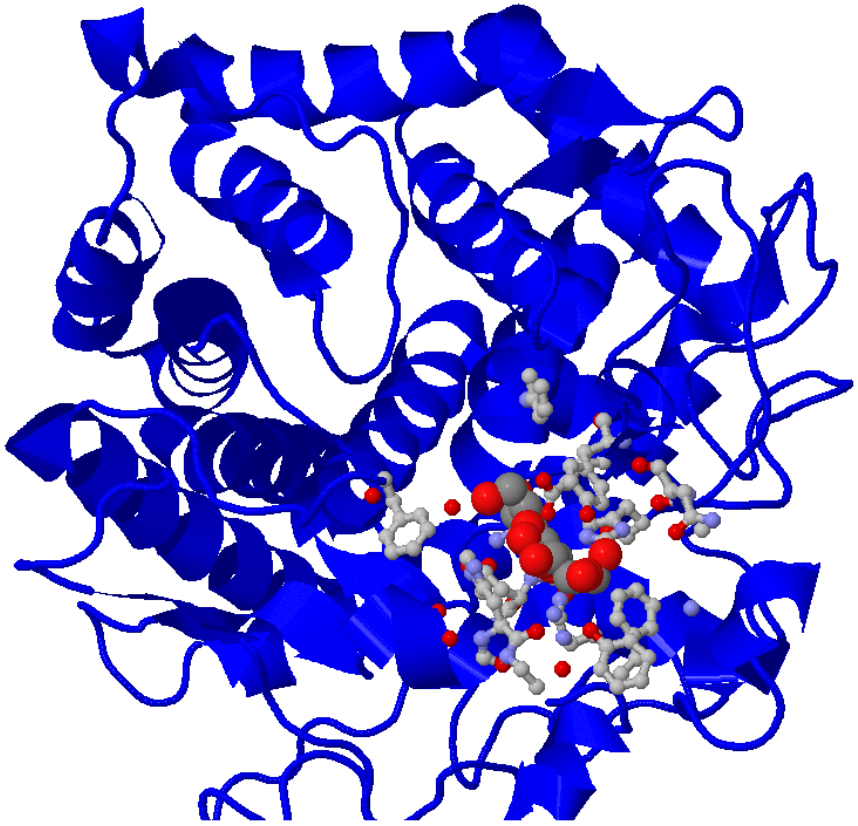
cellulose (a fiber): not soluble in water, not digestible by people, main component in plant cell walls, approximately 1/3 of all plant matter



Protein-Sugar Interactions

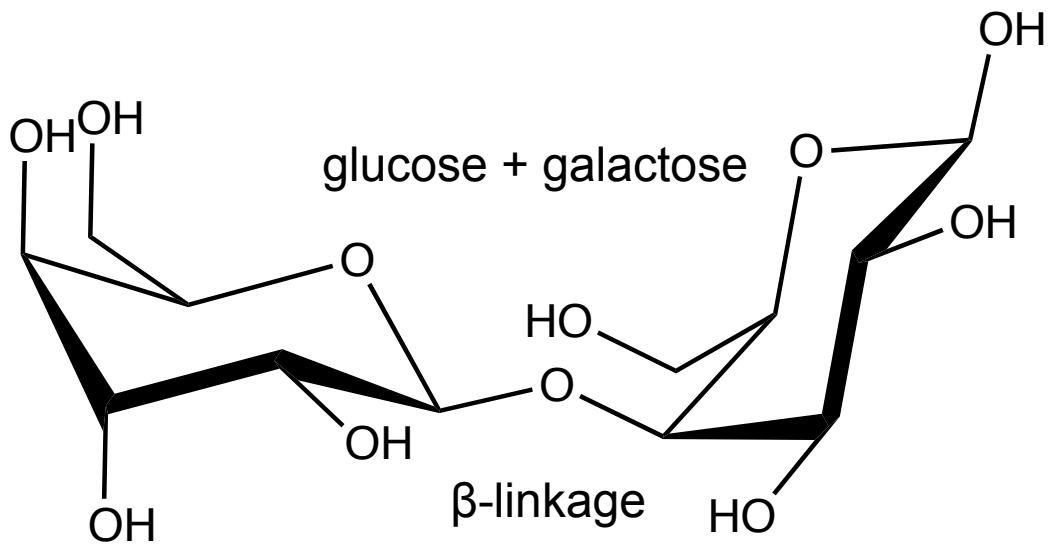
Enzymes catalyze the breakdown of polysaccharides into simple sugars that can be metabolized to release energy…if the molecule can fit into the enzyme…

Human Pancreatic a-amylase
+ inhibitor acarbose



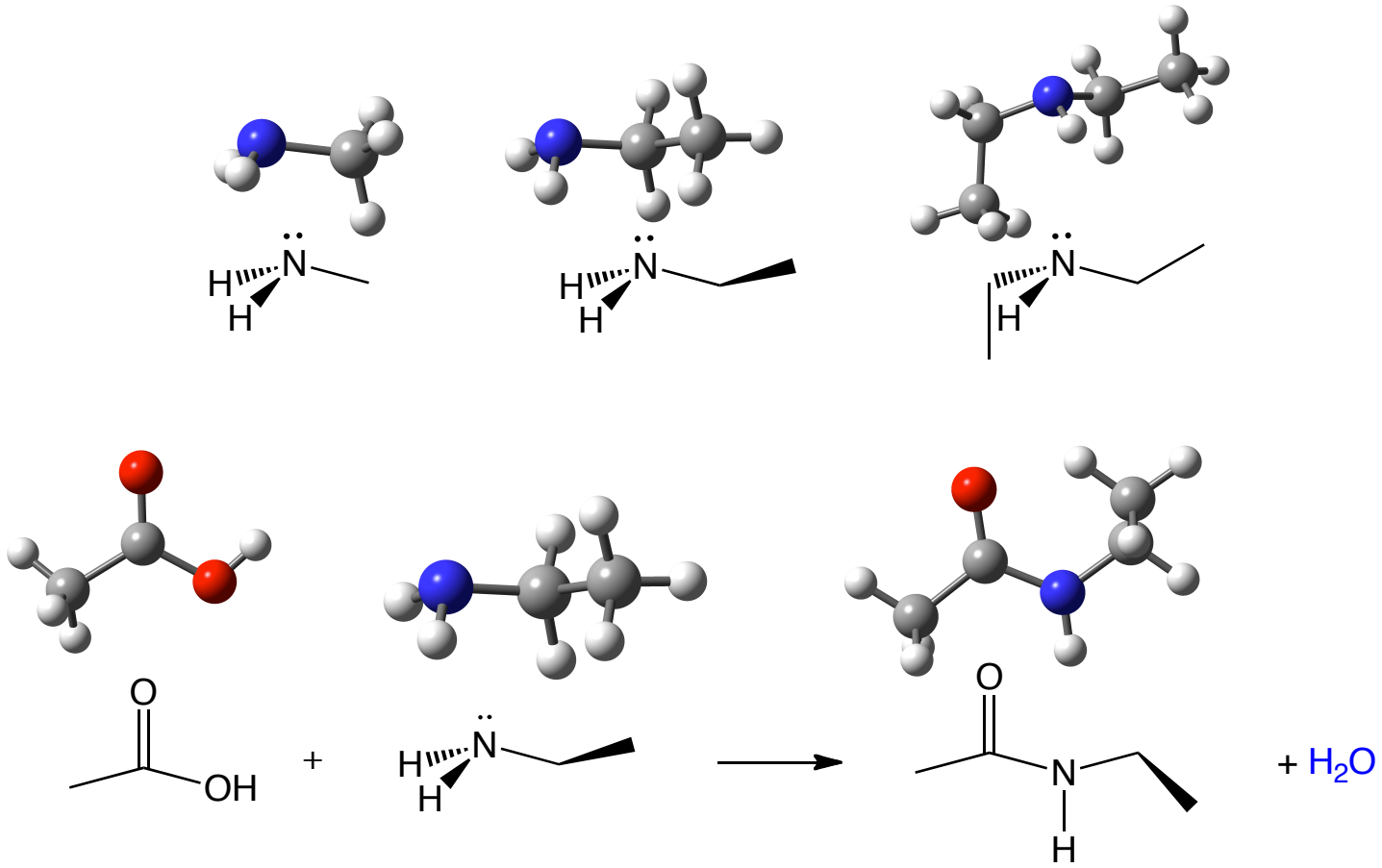
Cellulase CEL9M of C. Cellulolyticium
+ cellubiose

Lactose Intolerant?



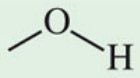
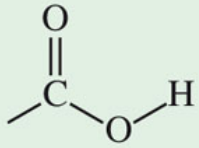
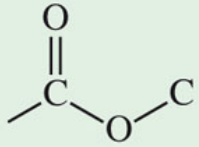
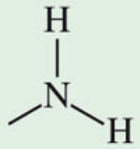
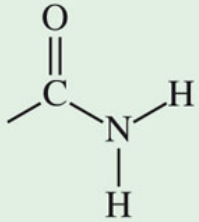
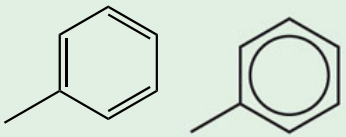
N-Containing Functional Groups

Amines (fishy smell –NHR, NR_2)



Functional Groups

Table 9.2 Selected Functional Groups

Name	Chemical Formula	Structural Formula
hydroxyl	—OH	
carboxylic acid	—COOH	
ester	—COOC—	
amine	—NH_2	
amide	—$CONH_2$	
phenyl	—C_6H_5	

+olefin/alkene (C=C)

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