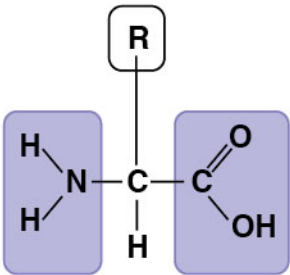
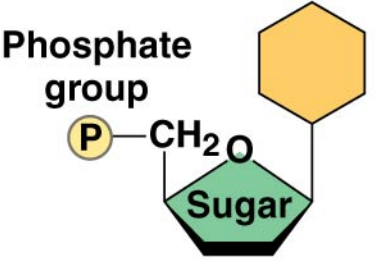




Ch. 3b Warm-Up

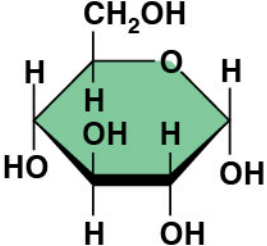
1. What are the 4 classes of macromolecules? Give an example of each.
2. Draw and label the parts of an amino acid.
3. How are 2 amino acids put together? Name the process and describe what happens.
4. Draw a tripeptide. (Use Google for help) Label the peptide bonds.



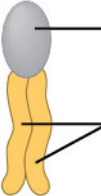
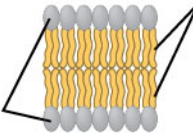
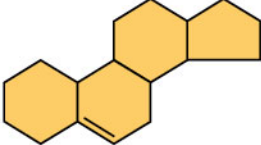
Components	Examples	Functions
 <p data-bbox="144 514 531 592">Amino acid monomer (20 types)</p>	<ul data-bbox="627 207 994 592" style="list-style-type: none"> • Enzymes • Structural proteins • Storage proteins • Transport proteins • Hormones • Receptor proteins • Motor proteins • Defensive proteins 	<ul data-bbox="1207 207 1845 592" style="list-style-type: none"> • Catalyze chemical reactions • Provide structural support • Store amino acids • Transport substances • Coordinate organismal responses • Receive signals from outside cell • Function in cell movement • Protect against disease

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Components	Examples	Functions
<p data-bbox="222 856 540 899">Nitrogenous base</p>  <p data-bbox="86 935 280 1021">Phosphate group</p> <p data-bbox="251 1106 386 1142">Sugar</p> <p data-bbox="135 1199 511 1235">Nucleotide monomer</p>	<p data-bbox="569 849 1091 906">DNA: </p> <ul data-bbox="569 906 1149 1042" style="list-style-type: none"> • Sugar = deoxyribose • Nitrogenous bases = C, G, A, T • Usually double-stranded <p data-bbox="569 1063 927 1120">RNA: </p> <ul data-bbox="569 1120 1149 1263" style="list-style-type: none"> • Sugar = ribose • Nitrogenous bases = C, G, A, U • Usually single-stranded 	<p data-bbox="1168 849 1700 885">Stores hereditary information</p> <p data-bbox="1168 1063 1845 1192">Various functions in gene expression, including carrying instructions from DNA to ribosomes</p>

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Components	Examples	Functions
 <p data-bbox="195 865 490 939">Monosaccharide monomer</p>	<p data-bbox="627 508 1122 582">Monosaccharides: glucose, fructose</p>	<p data-bbox="1246 508 1837 629">Fuel; carbon sources that can be converted to other molecules or combined into polymers</p>
	<p data-bbox="627 615 1199 651">Disaccharides: lactose, sucrose</p>	
	<p data-bbox="627 679 938 715">Polysaccharides:</p> <ul data-bbox="627 736 1116 922" style="list-style-type: none"> • Cellulose (plants) • Starch (plants) • Glycogen (animals) • Chitin (animals and fungi) 	<ul data-bbox="1246 736 1818 965" style="list-style-type: none"> • Strengthens plant cell walls • Stores glucose for energy • Stores glucose for energy • Strengthens exoskeletons and fungal cell walls

Components	Examples	Functions
<p>Glycerol</p>  <p>3 fatty acids</p>	<p>Triacylglycerols (fats or oils): glycerol + three fatty acids</p>	<p>Important energy source</p> 
 <p>Head with P</p> <p>2 fatty acids</p>	<p>Phospholipids: glycerol + phosphate group + two fatty acids</p>	<p>Lipid bilayers of membranes</p>  <p>Hydrophilic heads</p> <p>Hydrophobic tails</p>
 <p>Steroid backbone</p>	<p>Steroids: four fused rings with attached chemical groups</p>	<ul style="list-style-type: none"> • Component of cell membranes (cholesterol) • Signaling molecules that travel through the body (hormones)

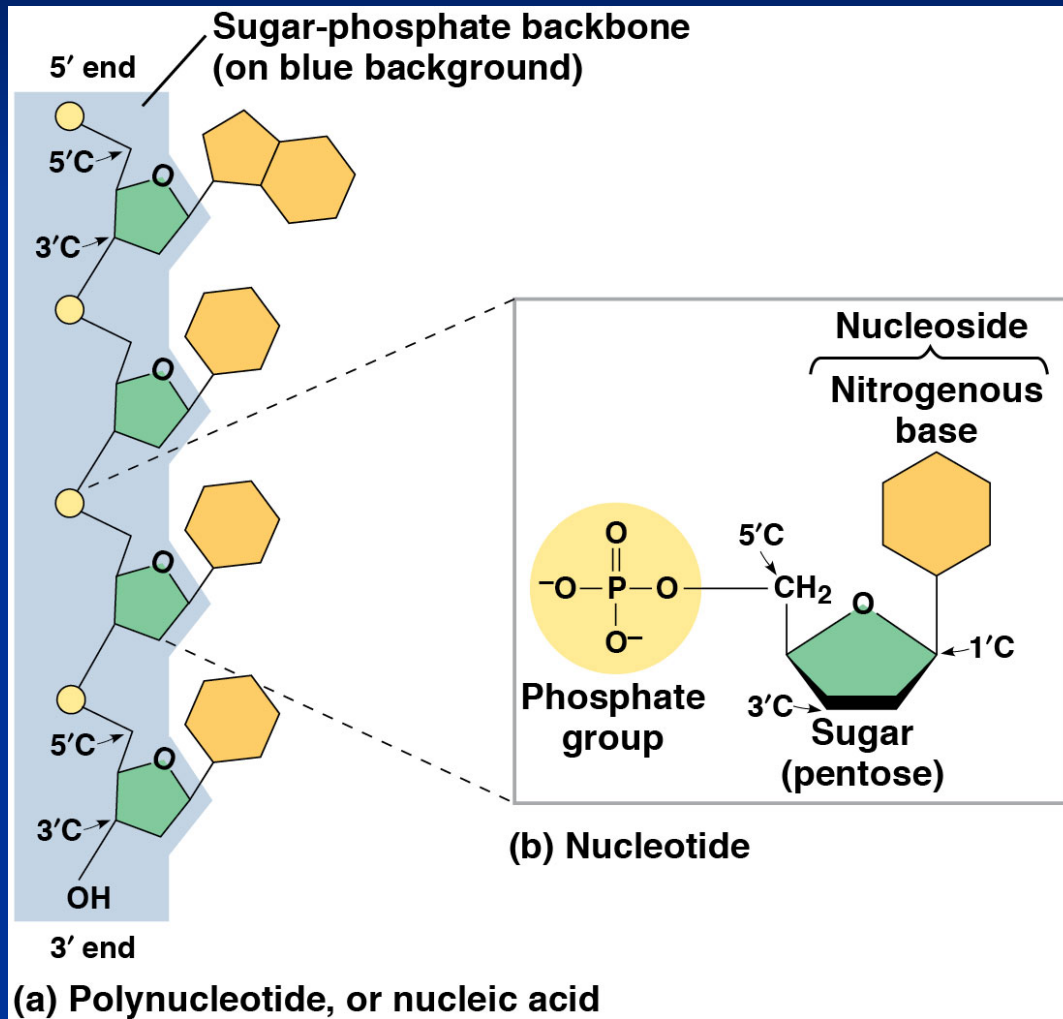
II. Nucleic Acids

Function: store hereditary info

DNA	RNA
<ul style="list-style-type: none">• Double-stranded helix• N-bases: A, G, C, <i>Thymine</i>• Stores hereditary info• Longer/larger• Sugar: deoxyribose	<ul style="list-style-type: none">• Single-stranded• N-bases: A, G, C, <i>Uracil</i>• Carry info from DNA to ribosomes• tRNA, rRNA, mRNA, RNAi• Sugar: ribose

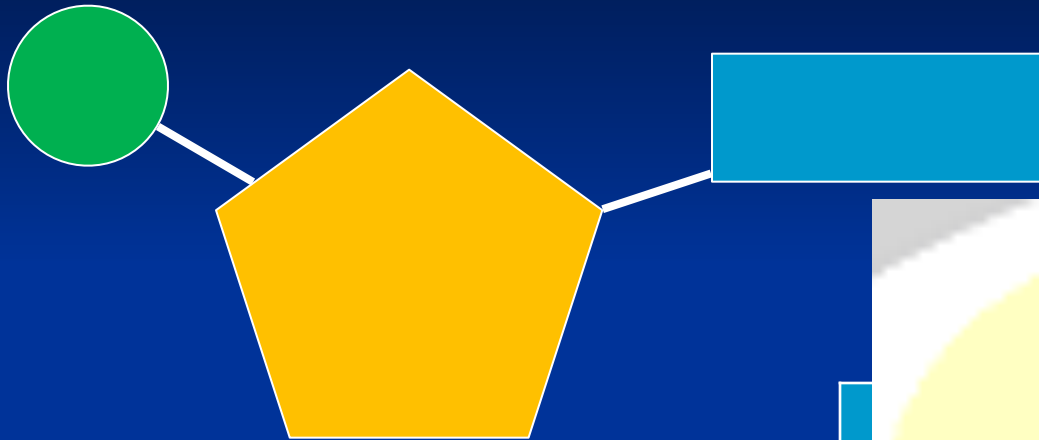
Nucleotides: monomer of DNA/RNA

Nucleotide = Sugar + Phosphate + Nitrogen Base



Nucleotide

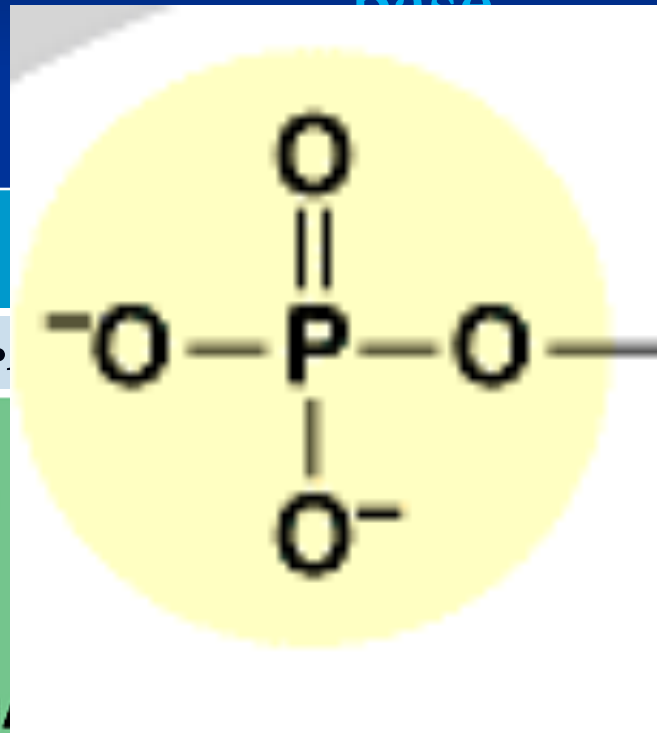
phosphate



5-C sugar

Nitrogen base

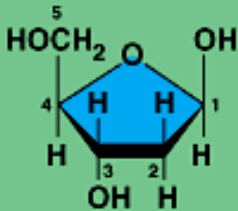
{ A - T
G - C



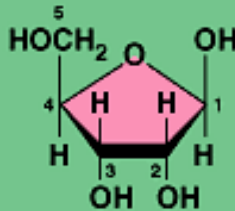
dines

(DNA)
(RNA)

g

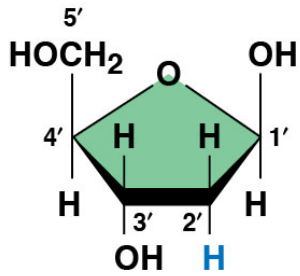


Deoxyribose (in DNA)

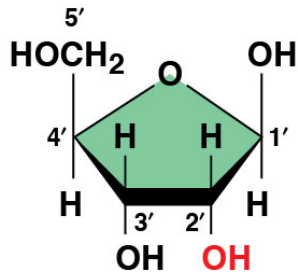


Ribose (in RNA)

SUGARS



Deoxyribose (in DNA)



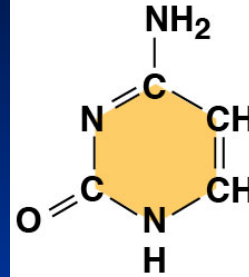
Ribose (in RNA)

(c) Nucleoside components

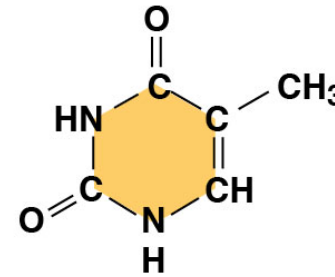
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NITROGENOUS BASES

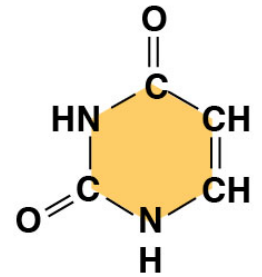
Pyrimidines



Cytosine (C)

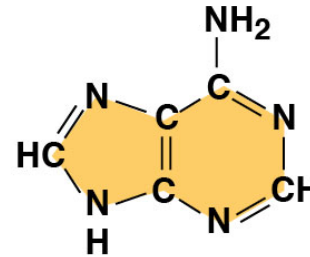


Thymine
(T, in DNA)

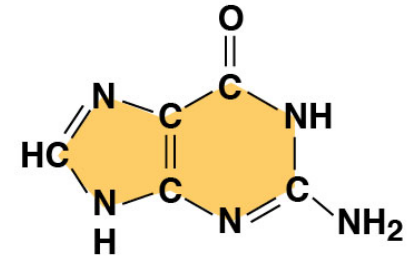


Uracil (U, in RNA)

Purines



Adenine (A)

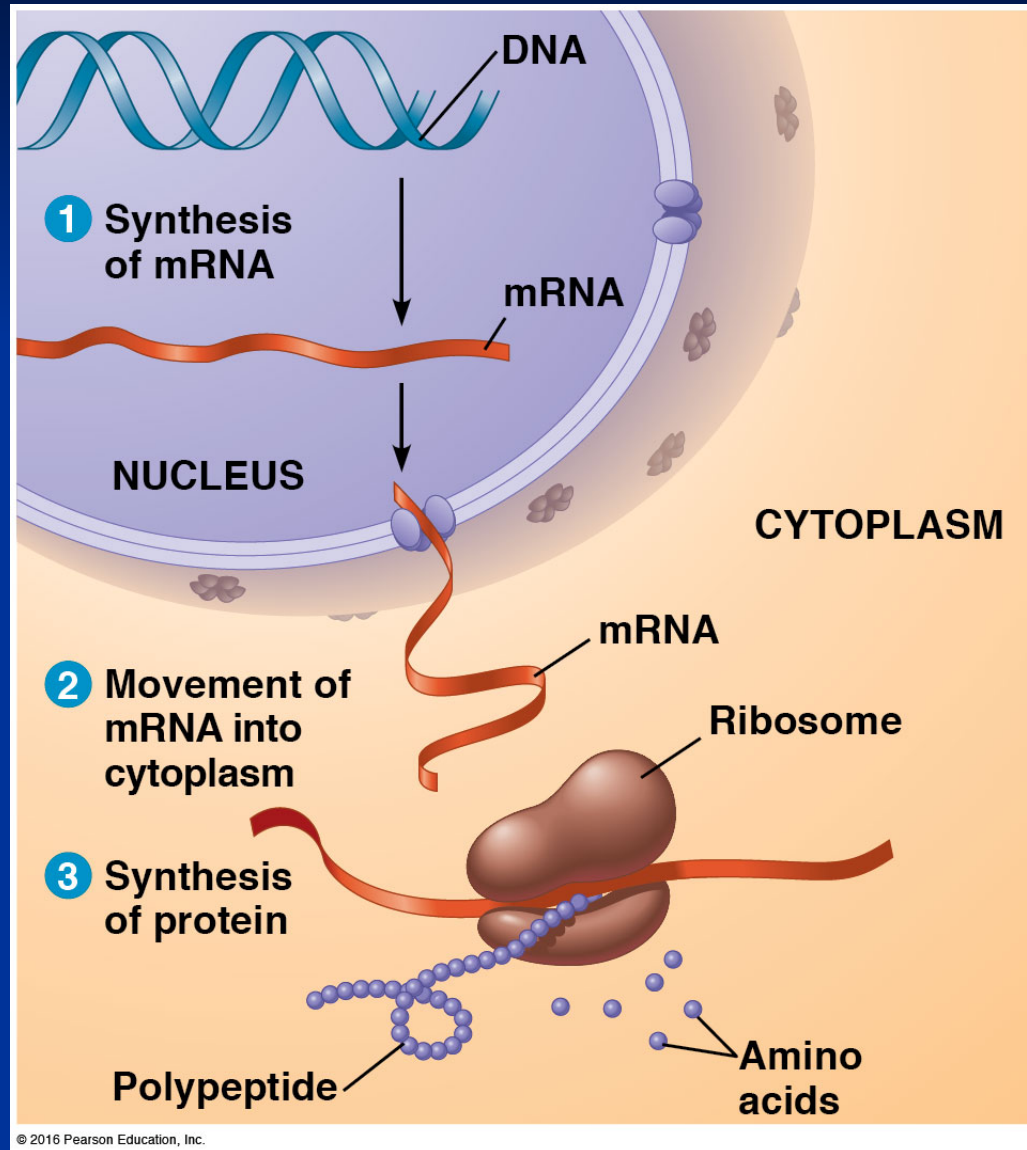


Guanine (G)

(c) Nucleoside components

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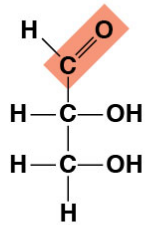
Information flow in a cell: DNA → RNA → protein



III. Carbohydrates

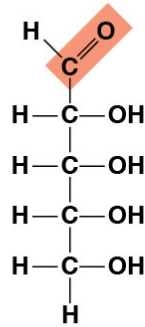
- Fuel and building material
 - Include simple sugars (fructose) and polymers (starch)
 - Ratio of 1 carbon: 2 hydrogen: 1 oxygen or CH_2O
 - monosaccharide \rightarrow disaccharide \rightarrow polysaccharide
 - Monosaccharides = monomers (eg. glucose, ribose)
 - Polysaccharides:
 - Storage (plants-starch, animals-glycogen)
 - Structure (plant-cellulose, arthropod-chitin)
- } Differ in position & orientation of glycosidic linkage

Triose: three-carbon sugar ($C_3H_6O_3$)



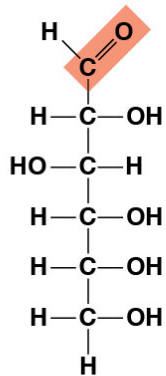
Glyceraldehyde
An initial breakdown
product of glucose in cells

Pentose: five-carbon sugar ($C_5H_{10}O_5$)

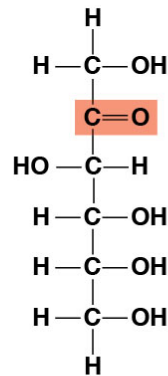


Ribose
A component of RNA

Hexoses: six-carbon sugars ($C_6H_{12}O_6$)

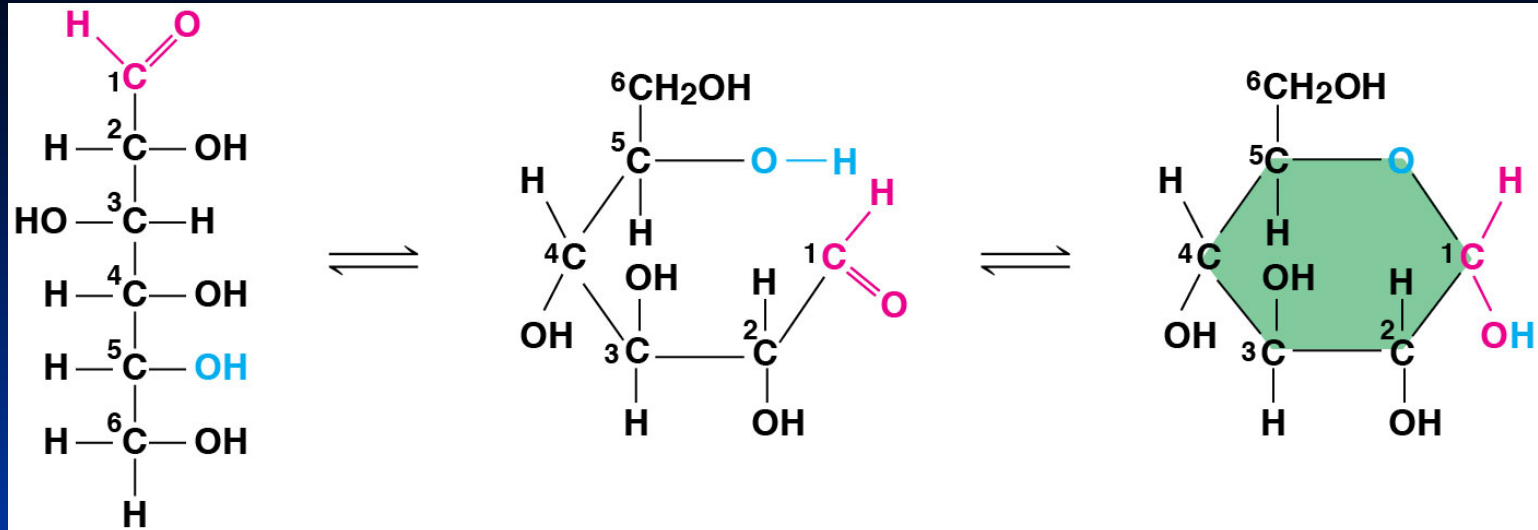


Glucose
Energy sources for organisms

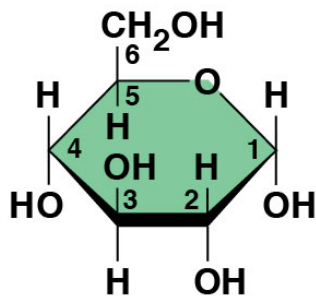


Fructose

The structure and
classification of
some
monosaccharides



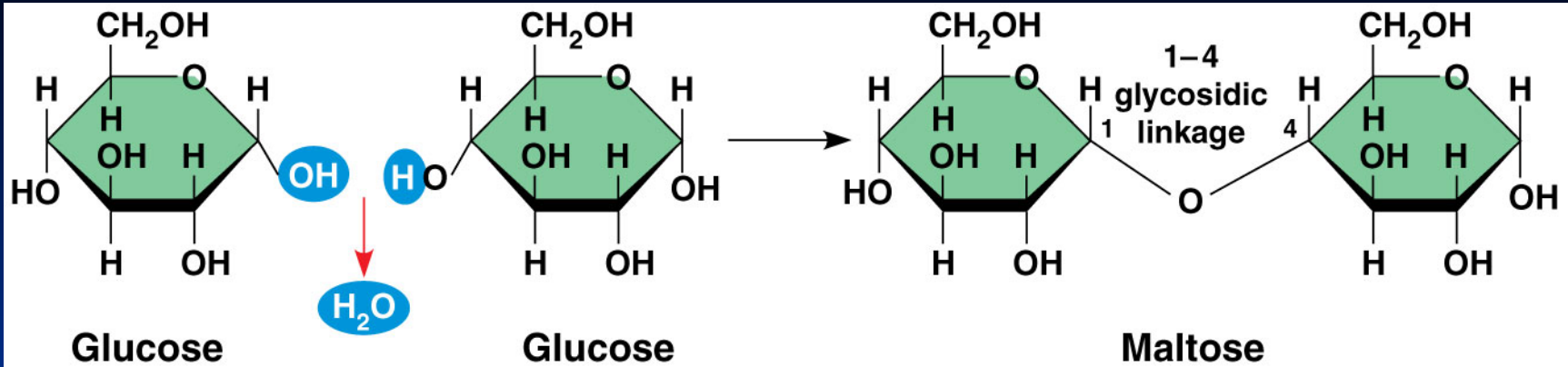
(a) Linear and ring forms



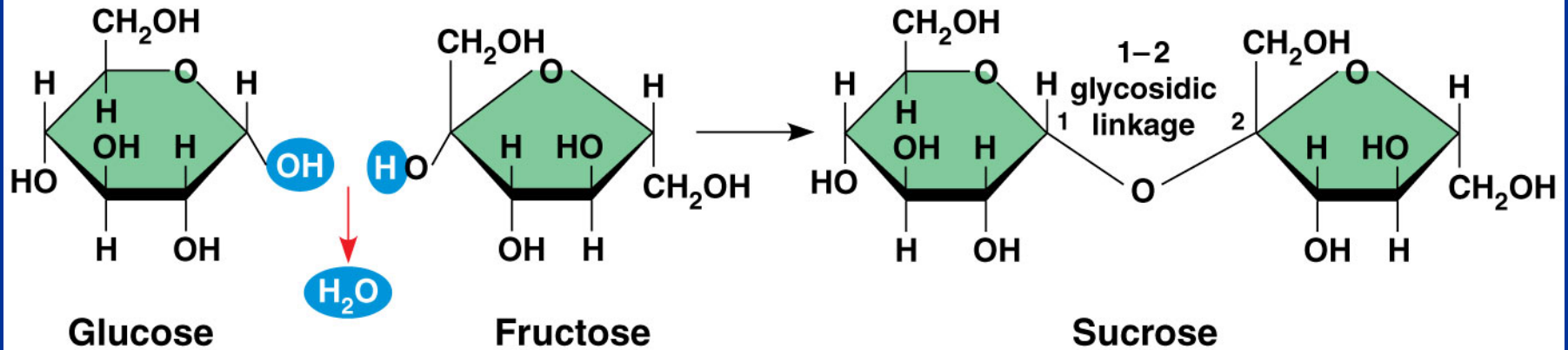
(b) Abbreviated ring structure

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Linear and ring forms of glucose



(a) Dehydration reaction in the synthesis of maltose



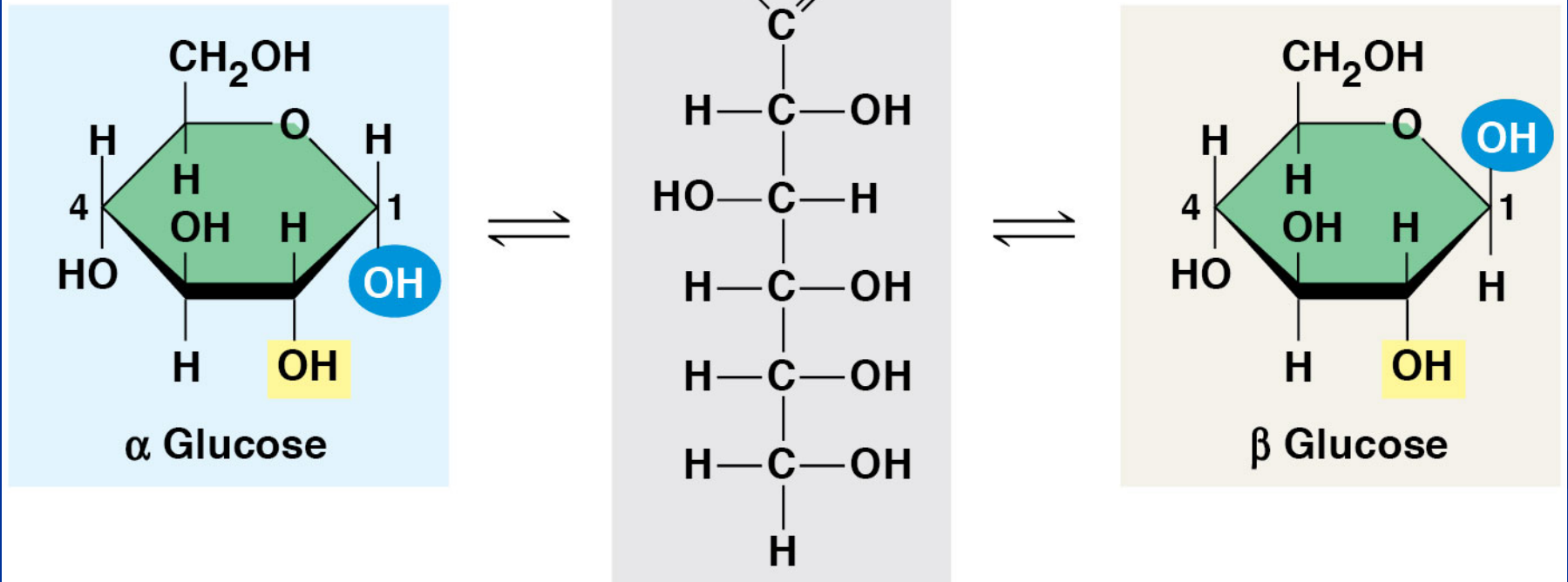
(b) Dehydration reaction in the synthesis of sucrose

Carbohydrate synthesis

Cellulose vs. Starch

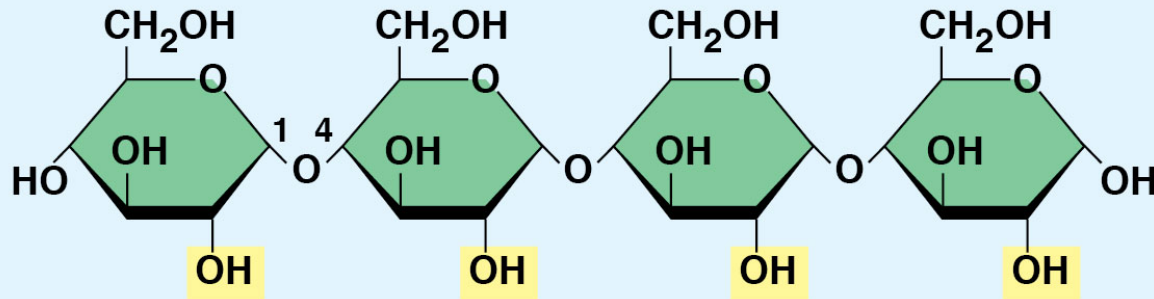
Two Forms of Glucose: α glucose & β glucose

(a) α and β glucose ring structures



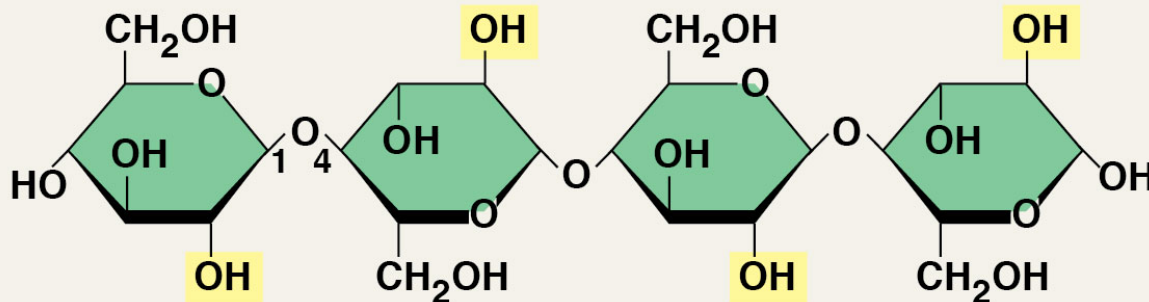
Cellulose vs. Starch

- Starch = α glucose monomers
- Cellulose = β glucose monomers



(b) Starch: 1–4 linkage of α glucose monomers

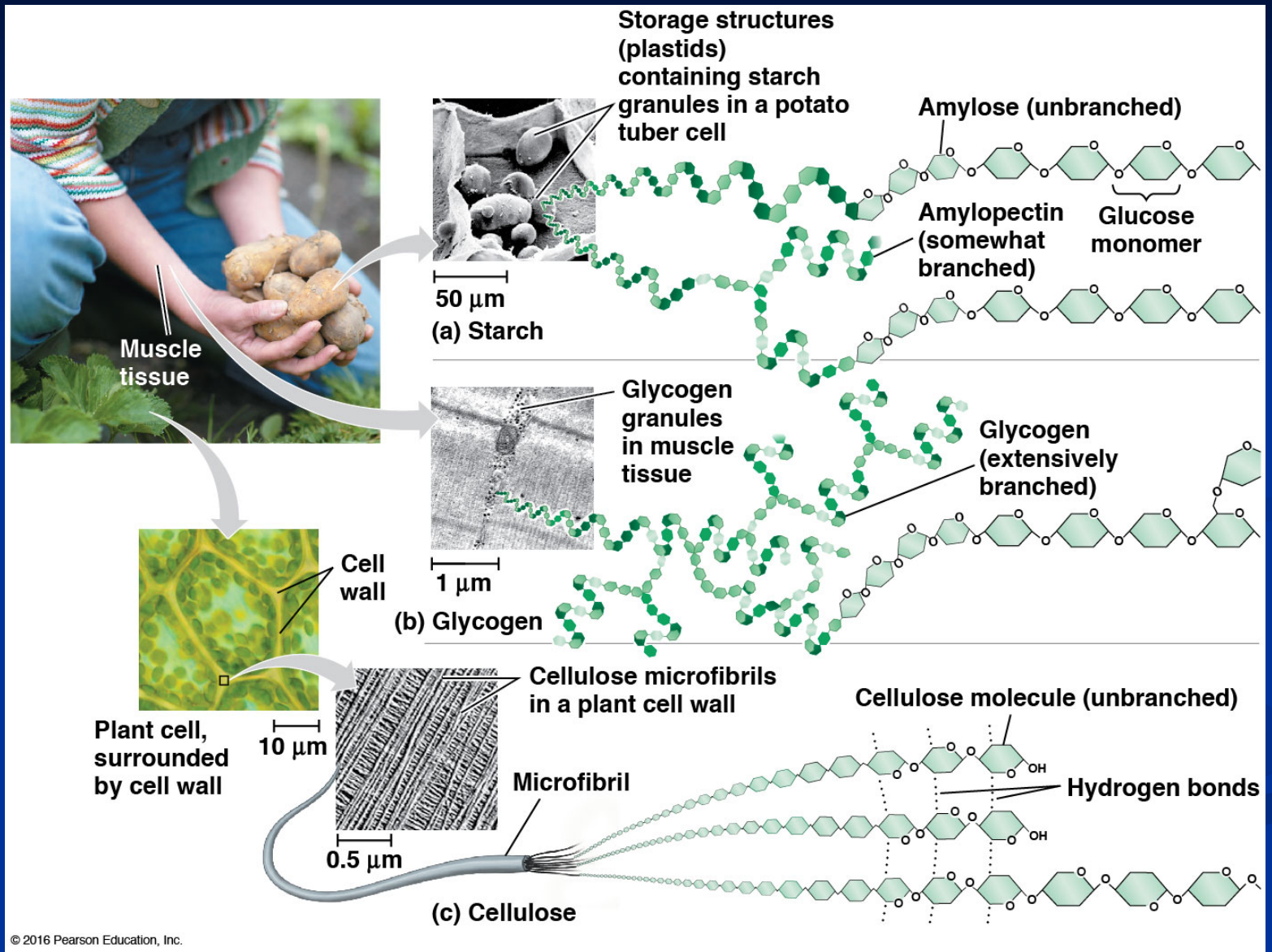
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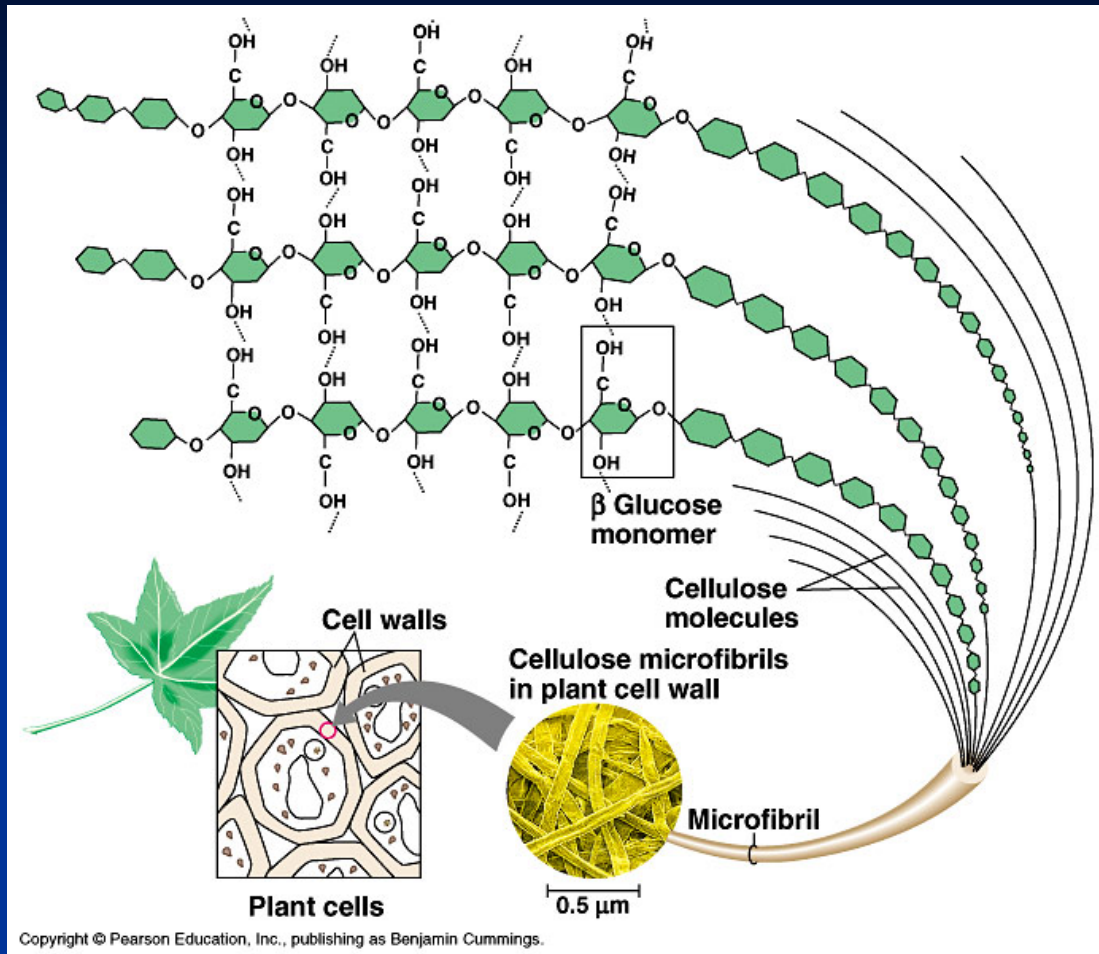


(c) Cellulose: 1–4 linkage of β glucose monomers

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Storage polysaccharides of plants (**starch**) and animals (**glycogen**)





▲ **Chitin forms the exoskeleton of arthropods.**

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Structural polysaccharides: cellulose & chitin (exoskeleton)

IV. Lipids

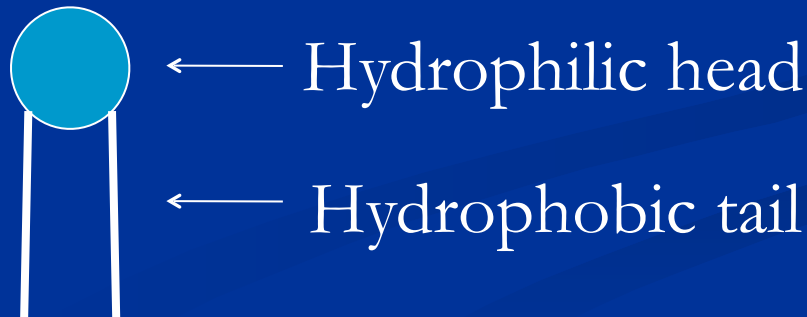
A. Fats (triglyceride): store energy

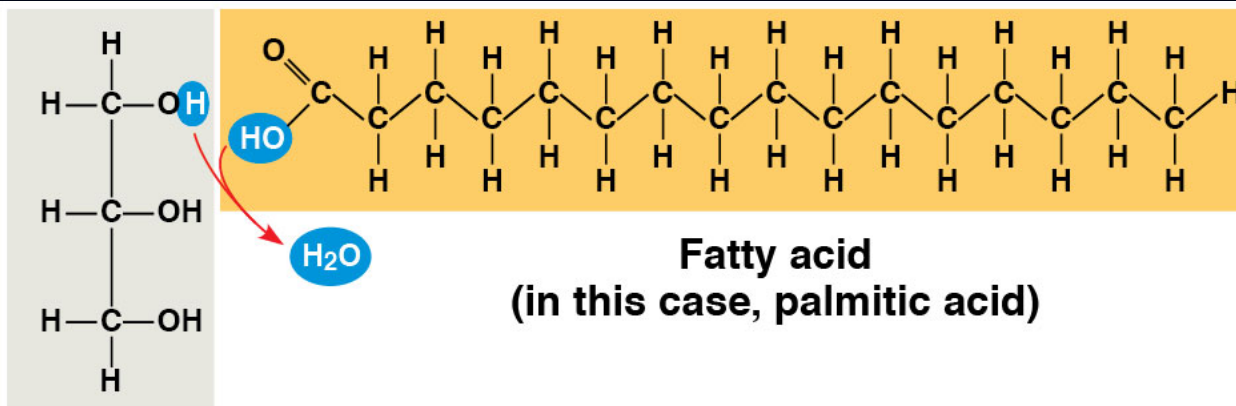
- Glycerol + 3 Fatty Acids
- saturated, unsaturated, polyunsaturated

B. Steroids: cholesterol and hormones

C. Phospholipids: lipid bilayer of cell membrane

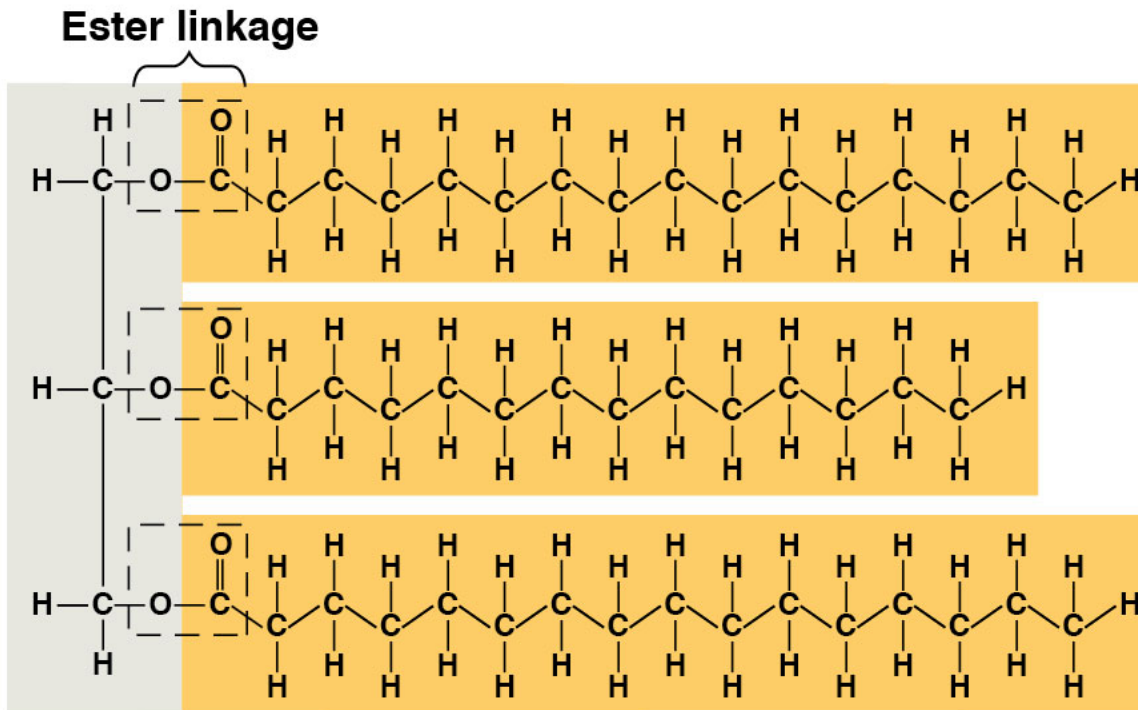
- hydrophilic head, hydrophobic tails





Glycerol

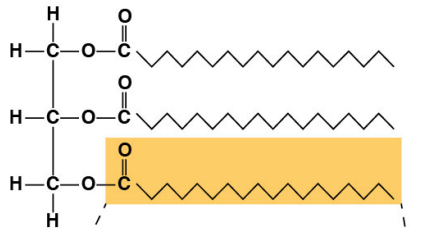
(a) One of three dehydration reactions in the synthesis of a fat



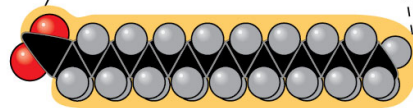
(b) Fat molecule (triacylglycerol)

(a) Saturated fat

Structural formula of a saturated fat molecule



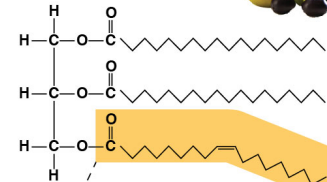
Space-filling model of stearic acid, a saturated fatty acid



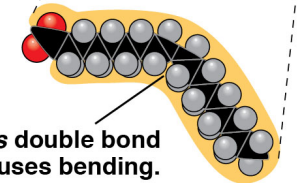
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(b) Unsaturated fat

Structural formula of an unsaturated fat molecule



Space-filling model of oleic acid, an unsaturated fatty acid



Cis double bond causes bending.

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Saturated

Unsaturated

Polyunsaturated

“saturated” with H

Have some C=C, result in kinks

In animals

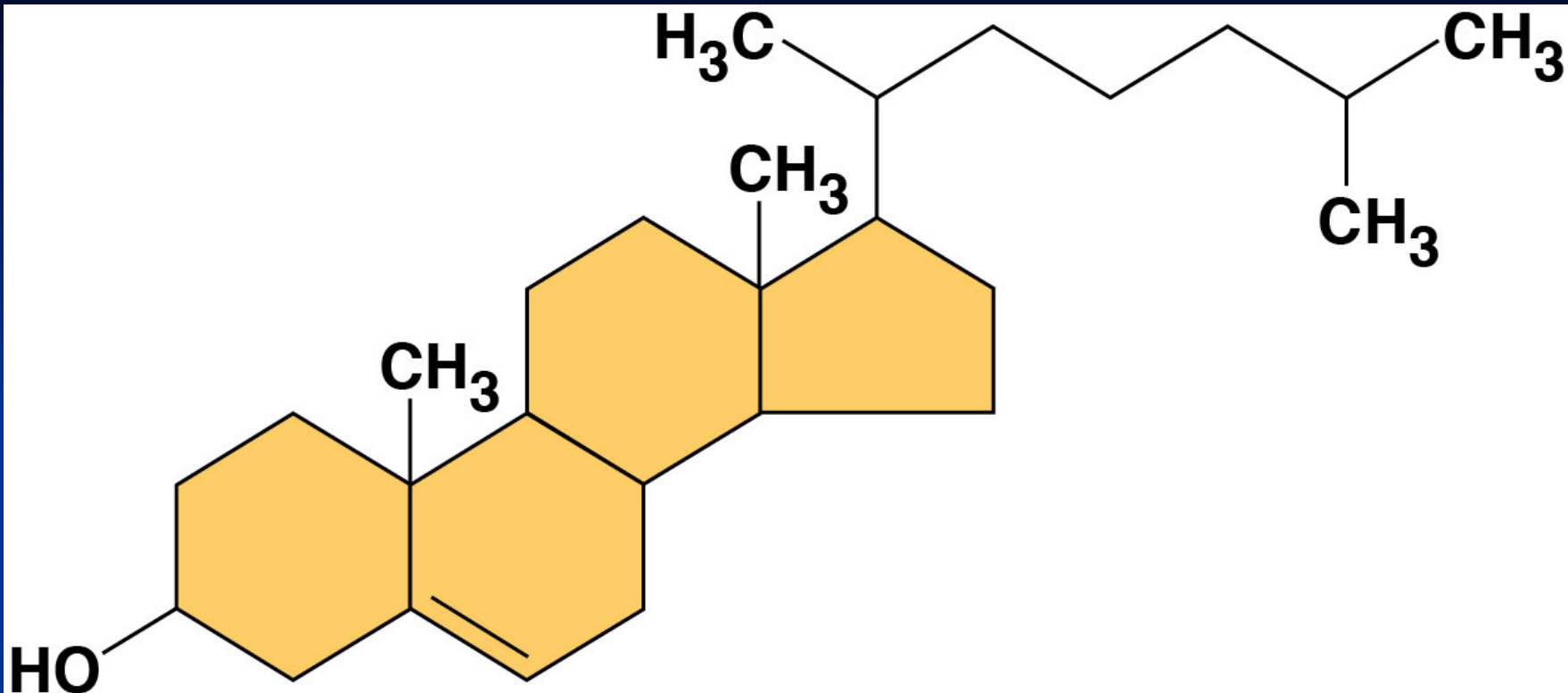
In plants

Solid at room temp.

Liquid at room temp.

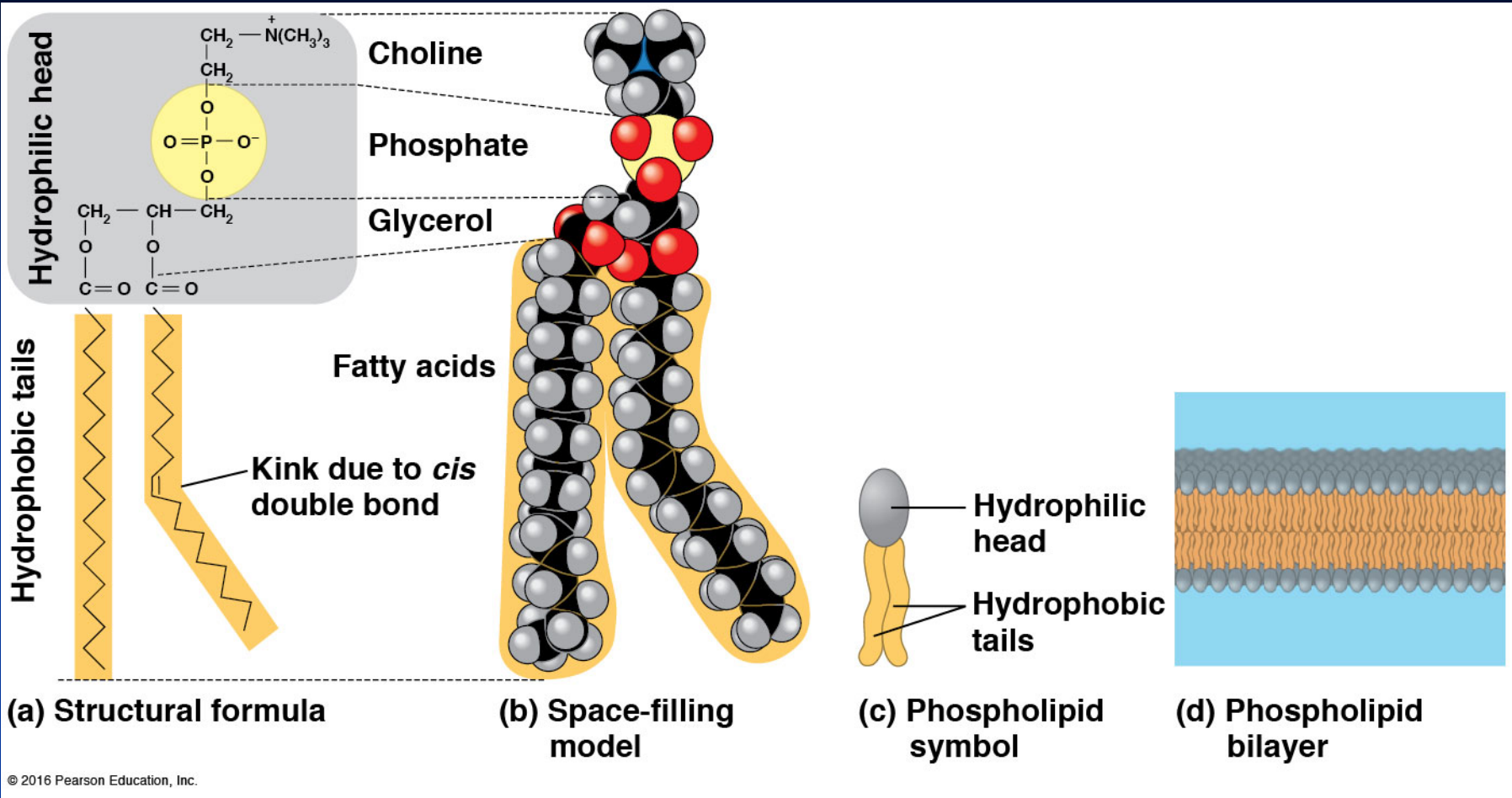
Eg. butter, lard

Eg. corn oil, olive oil



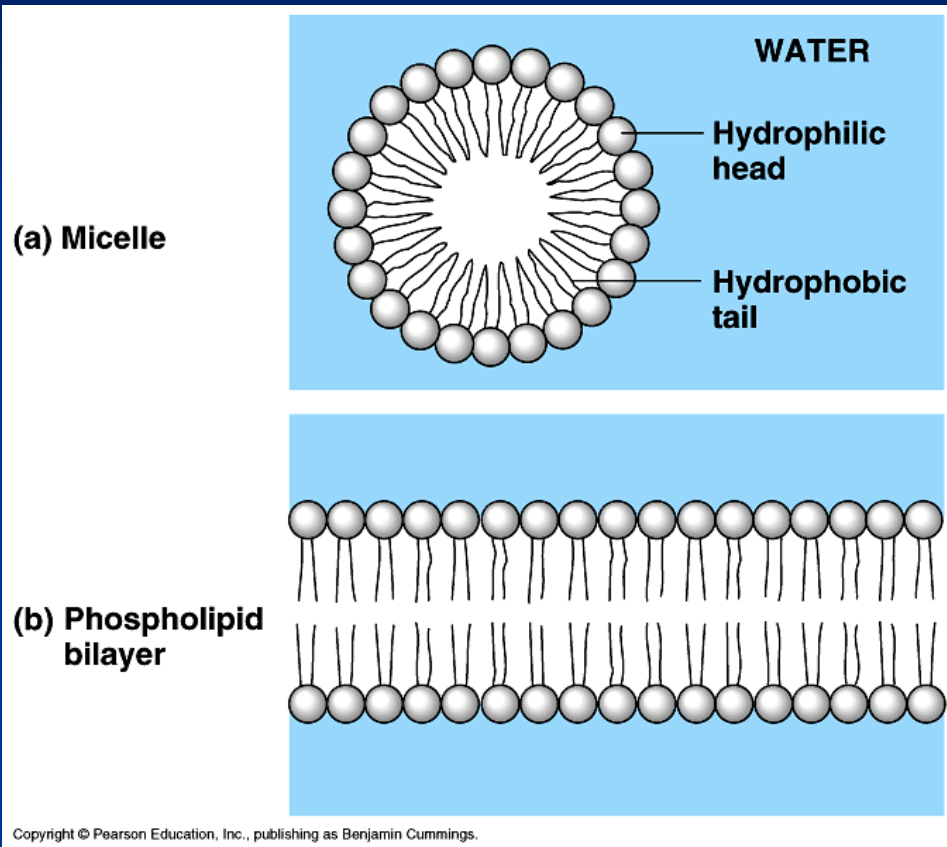
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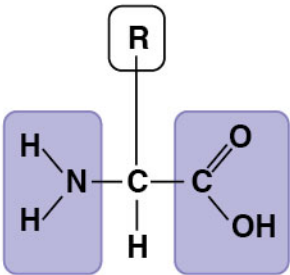
Cholesterol, a steroid



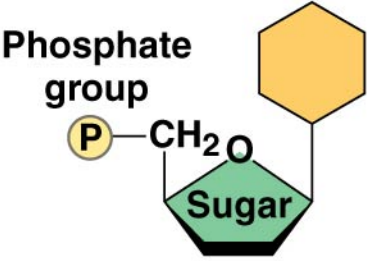


The structure of a phospholipid

Hydrophobic/hydrophilic interactions make a **phospholipid bilayer**

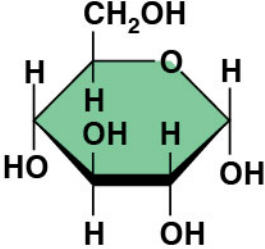


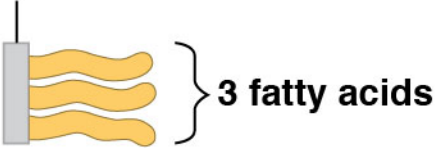

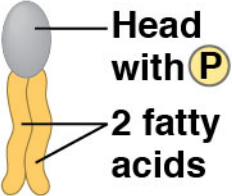
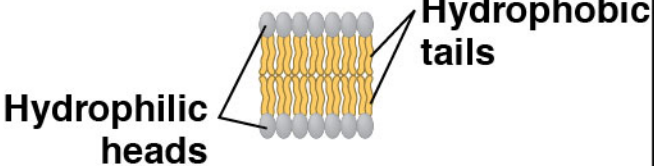
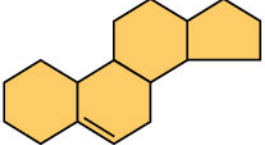
Components	Examples	Functions
 <p data-bbox="144 514 531 592">Amino acid monomer (20 types)</p>	<ul data-bbox="627 207 994 592" style="list-style-type: none"> • Enzymes • Structural proteins • Storage proteins • Transport proteins • Hormones • Receptor proteins • Motor proteins • Defensive proteins 	<ul data-bbox="1207 207 1845 592" style="list-style-type: none"> • Catalyze chemical reactions • Provide structural support • Store amino acids • Transport substances • Coordinate organismal responses • Receive signals from outside cell • Function in cell movement • Protect against disease

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Components	Examples	Functions
<p data-bbox="222 856 540 899">Nitrogenous base</p>  <p data-bbox="86 935 280 1021">Phosphate group</p> <p data-bbox="251 1106 386 1149">Sugar</p> <p data-bbox="135 1199 511 1235">Nucleotide monomer</p>	<p data-bbox="569 849 1091 906">DNA: </p> <ul data-bbox="569 906 1149 1042" style="list-style-type: none"> • Sugar = deoxyribose • Nitrogenous bases = C, G, A, T • Usually double-stranded <p data-bbox="569 1063 927 1120">RNA: </p> <ul data-bbox="569 1120 1149 1263" style="list-style-type: none"> • Sugar = ribose • Nitrogenous bases = C, G, A, U • Usually single-stranded 	<p data-bbox="1168 849 1700 885">Stores hereditary information</p> <p data-bbox="1168 1063 1845 1192">Various functions in gene expression, including carrying instructions from DNA to ribosomes</p>

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Components	Examples	Functions
 <p data-bbox="193 863 492 942">Monosaccharide monomer</p>	<p data-bbox="627 506 1130 578">Monosaccharides: glucose, fructose</p>	<p data-bbox="1246 506 1845 628">Fuel; carbon sources that can be converted to other molecules or combined into polymers</p>
	<p data-bbox="627 614 1207 649">Disaccharides: lactose, sucrose</p>	
	<p data-bbox="627 678 937 714">Polysaccharides:</p> <ul data-bbox="627 735 1120 921" style="list-style-type: none"> • Cellulose (plants) • Starch (plants) • Glycogen (animals) • Chitin (animals and fungi) 	<ul data-bbox="1246 735 1825 963" style="list-style-type: none"> • Strengthens plant cell walls • Stores glucose for energy • Stores glucose for energy • Strengthens exoskeletons and fungal cell walls

Components	Examples	Functions
<p>Glycerol</p>  <p>3 fatty acids</p>	<p>Triacylglycerols (fats or oils): glycerol + three fatty acids</p>	<p>Important energy source</p> 
 <p>Head with P</p> <p>2 fatty acids</p>	<p>Phospholipids: glycerol + phosphate group + two fatty acids</p>	<p>Lipid bilayers of membranes</p>  <p>Hydrophilic heads</p> <p>Hydrophobic tails</p>
 <p>Steroid backbone</p>	<p>Steroids: four fused rings with attached chemical groups</p>	<ul style="list-style-type: none"> • Component of cell membranes (cholesterol) • Signaling molecules that travel through the body (hormones)