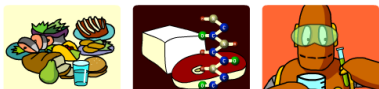


Biomolecules

BODY CHEMISTRY



What are Biomolecules?

- **Organic** compounds made by living things
- Also called biochemicals
- Some are very large
- There are thousands of different biomolecules, but are separated into 4 categories

Types of Biomolecules

1) Carbohydrates



2) Lipids



3) Protein



4) Nucleic Acids



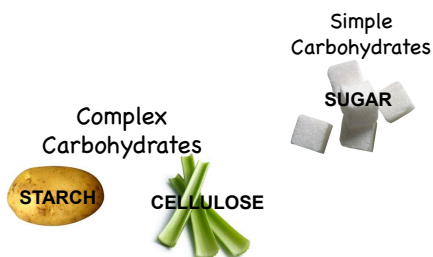
1) Carbohydrate Facts

- The **simplest** biomolecules
- Contain 3 elements:
 - **Carbon**
 - **Hydrogen**
 - **Oxygen**
- The word carbohydrate comes from the fact that these compounds have many carbon atoms bonded to hydroxide (OH) groups.

Carbohydrate Facts

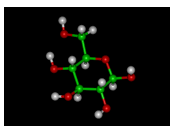
- Serve 2 main functions:
 1. Source of chemical **energy** for cells in many living things.
 2. Part of the **structural** material of plants
- Come in all sizes, from small rings to long chains.

Two Types of Carbohydrates



Sugar

- Break down **quickly** in the body
- Provide a quick burst of energy or a “sugar rush”
- **Glucose** is the most important & simplest sugar on Earth.
 - Used in cells & created by photosynthesis
 - It comes in many forms



Examples of Simple Sugars

Simple carbohydrates

Simple carbohydrates are found in foods such as fruits, milk, and vegetables

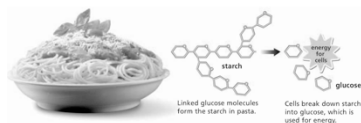
Cake, candy, and other refined sugar products are simple sugars which also provide energy but lack vitamins, minerals, and fiber



ADAM

Starch

- Long **chains** of simpler sugars joined together
- These big molecules are called **macromolecules**
- Also called polysaccharides or **polymers**
- **Slower** to break down in the body & provide energy for a longer period of time than regular sugars.



Did you know that?

Marathon runners, tri-athletes, cyclists like Lance Armstrong, and other endurance runners eat carbohydrates for weeks leading up to a big event.

They call it “carbo-loading”. Even high school athletes occasionally have “pasta feeds” the night before a big game. What’s the point?

As the athletes consume massive amounts of starch and pasta, the energy begins to store up in their body, saving itself for use during the event.

Starch Examples

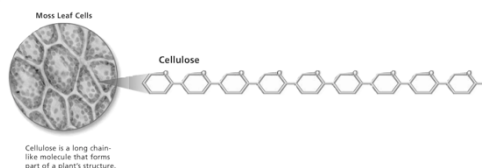
Starchy foods



ADAM

Cellulose

- Unlike animal cells, **plant** cells have a cell wall made of cellulose.
- The cell wall is a large part of vegetables such as lettuce & celery. It also is what gives stems & wood strength.
- Made from chains of thousands of glucose molecules, but the difference is in how they’re linked.
- Because of this small difference, your body **cannot** digest cellulose the same way it can starches & sugars.



Brainpop: Carbohydrate

Click to watch then answer the questions.



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2) Lipids

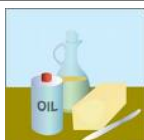
FACTS

STRUCTURE

SATURATED &
UNSATURATED

CHOLESTEROL

Lipid Facts



- Lipids include:
 - **Fats**
 - **Oils**
- Most lipids are made of just carbon, hydrogen, and oxygen.
- But unlike carbohydrates, fats are more complex & take much longer to break down.
- So, fats are **high-energy** molecules that plants and animals use to store energy in reserves for longer periods.

Lipid Facts

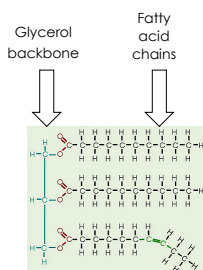


- Plants store energy in **oils**, like olive oil, corn oil, or peanut oil.
- An oil is a fat that is **liquid** at room temperature.



Lipid Structure

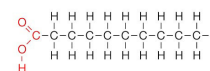
- Fats & oils store energy super-efficiently, 1 gram of fat contains about **twice** the energy as 1 gram of carbohydrate.
- A fat molecule has a 2-part structure.
- The first part is called **glycerol**.
- Attached to the glycerol are 3 long chains called **fatty acids**.



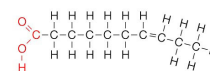
Saturated and Unsaturated

- **Saturated fats**
 - only **single** bonds in the carbon chain
 - Most **animal** fats
 - "bad" fats
 - Diets high in saturated fat are linked to heart disease
- **Unsaturated fats**
 - one or more **double** bonds in the carbon chain
 - Most oils from **plants**
 - "good" fats

Saturated




Unsaturated




Fat Examples

Unsaturated Fats



Saturated fats

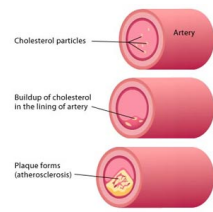
Saturated fats are found in animal products such as butter, cheese, whole milk, ice cream, cream, and fatty meats, and oils such as coconut, palm, and palm kernel oil.



ADAM

Cholesterol

- Cholesterol is another lipid in cell membranes
- It is also needed to make **hormones** like adrenaline
- Your body makes the cholesterol that it needs, but it is also found in many foods that come from animals, like meat and eggs.
- Although you need cholesterol, eating too much of it can block arteries and lead to heart disease.



Cholesterol particles

Artery

Buildup of cholesterol in the lining of artery

Plaque forms (atherosclerosis)

Brainpop: Fats

FATS

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Fueling the Body: Carbohydrates & Fats

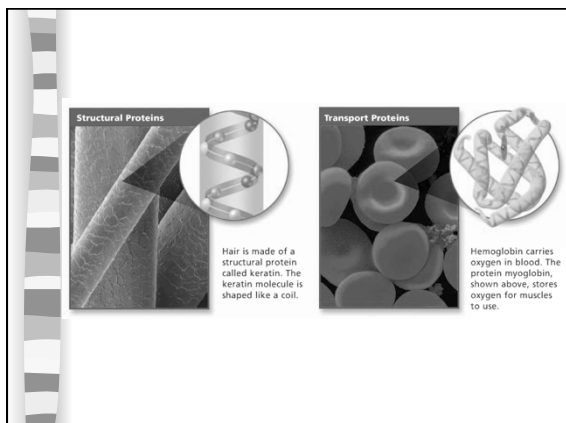
Click to watch then answer the questions.

3) Proteins

FACTS	AMINO ACIDS
ENZYMES	PROTEINS IN THE DIET
VITAMINS	

Protein Facts

- Proteins are big molecules called **macromolecules**
- Made of smaller molecules called **amino acids**
- Made of carbon, hydrogen, oxygen, nitrogen, sulfur, & some other elements
- There are at least **100,000** proteins in your body
- Each has a different **structure** that gives it a specific **job**.
- There are **4** types of structure, including coils & curls.



Amino Acids

- Think of proteins as being like a word. Amino acids are the letters in that word. Rearranging the letters makes words with different meanings.
- There are **20** amino acids required for human life to exist.
- **12** amino acids are made in our bodies, but the other **8** must be obtained by eating **foods** that contain them.

Enzymes

- Some proteins curl up into a shape like a ball of enzymes.
- An enzyme is a special protein & a **catalyst** for a chemical reaction in living things.
- Catalysts speed up the rate of a reaction.
- Enzymes are needed for many chemical reactions in your body.
- Without them, these reactions would occur too slowly to keep you alive.

Proteins in the Diet

- It's important to have lots of protein in your diet!
- Proteins in foods such as **meats**, **soybeans**, & **nuts** are broken down into amino acids.
- Without protein, your body can't function perfectly..
- This is why it's important for vegetarians to find protein from non-animal sources.

ANIMAL SOURCES

PLANT SOURCES

Vitamins

- Most of the chemical needed for life can be made by your own body, like proteins.
- However, there are certain chemicals that your body does not automatically make.
- We call these vitamins & **minerals**.
- Important daily vitamins & minerals include calcium, Vitamin A, Vitamin C, Vitamin D, and a whole bunch of B vitamins.
- The only place to get these: food!!

VITAMINS AND MINERALS

Both are essential for a healthy body and to prevent certain diseases.

Vitamin C


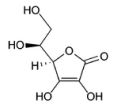
Ascorbic acid, or vitamin C, is needed for several important processes in your brain & nervous system.

Scurvy results from a lack of vitamin C in your diet.

It causes spotting on the skin, spongy gums, and bleeding membranes, and can eventually lead to death.

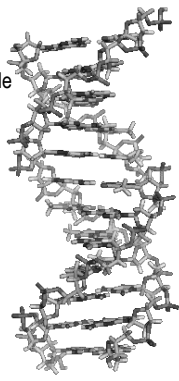
The British Royal Navy were among the first to discover this vitamin deficiency, when they noticed their sailors would get sick without fresh fruits & vegetables.

Citrus fruits, green peppers, strawberries, tomatoes, broccoli and sweet and white potatoes are all excellent food sources of vitamin C (ascorbic acid)

4) Nucleic Acids

- Largest & most complex biomolecule
- Includes:
 - **DNA**
 - **RNA**
- Contain information that cells use to make proteins
- Made of:
 - Carbon
 - Hydrogen
 - Oxygen
 - Nitrogen

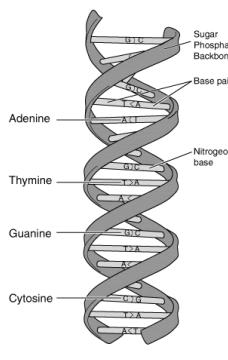


Protein Synthesis

- Every cell in your body has a complete set of nucleic acids.
- The process of making proteins from amino acids is called **protein synthesis**.
- How does protein synthesis work?
 - DNA!

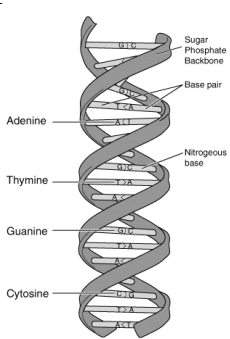
DNA Facts

- Deoxyribonucleic acid
- One of the largest molecules
- A single DNA molecule has more than **1 million** atoms.



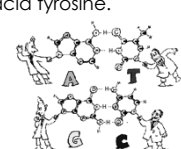
DNA Structure

- Twisted ladder or **double helix**
- The sides of the ladder are made of:
 - **sugar** molecules called deoxyribose
 - **phosphate** group
- The “rungs” of the ladder are made of:
 - **Nitrogen bases**



4 Nitrogen Bases

- Occur in matched sets:
 - **Adenine** (A) to **Cytosine** (C)
 - **Thymine** (T) to **Guanine** (G)
- The order of the bases in DNA is the way in which DNA stores instructions for making proteins.
- Each of the 20 amino acids is represented by a series of **3** DNA bases.
- For example, the sequence T-A-C is the code for the amino acid tyrosine.



Nucleic Acid Structure and Function

DNA contains the genetic code, which is the information needed to build proteins.

- The "backbone" of DNA is made of alternating sugar molecules and phosphate groups.
 - 5-carbon sugar
 - phosphate group
- The "rungs" of DNA are made of four molecules called bases.
 - Cytosine (C) always pairs with Guanine (G).
 - Adenine (A) always pairs with Thymine (T).
- A sequence of three bases codes for a specific amino acid. T A C is a code for tyrosine. T C G is a code for serine.
- The amino acids coded for by DNA are linked together to make proteins.
 - linked amino acids
- The mouse's coloration, from the color to hair color to the shape of its ears, is the result of the proteins coded for by its DNA.

Why is DNA necessary to make protein molecules?

Brainpop: DNA

Click to watch then answer the questions.

DNA

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Brainpop: Body Chemistry

Click to watch then answer the questions.

BODY CHEMISTRY

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