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Lecture 3:

Carbohydrates

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Carbohydrates:

- Known also as saccharides, carbohydrates are macronutrients.

- Approximately 2% of a person`s body weight is carbohydrates.

- They constitute about 50% - 55% of total daily calories intake.

- Carbohydrates are classified into three groups: monosaccharides, oligosaccharides, and polysaccharides.

Types of Carbs:

- Monosaccharides contain only one subunit of sugar and they represent the basic units of all carbohydrates.

- Oligosaccharides contain 2 – 10 monosaccharides, and their major group is disaccharides or double sugars. Monosaccharides and disaccharides are collectively called simple carbohydrates.

- Polysaccharides are composed of more than 10 monosaccharides.

Types of Carbohydrates:

Monosaccharides	Disaccharides	Polysaccharides
Glucose Fructose Galactose	Sucrose Lactose Maltose	Plants: - Starch - Fiber Animals: - Glycogen

Simple Carbohydrates.

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Complex Carbohydrates.

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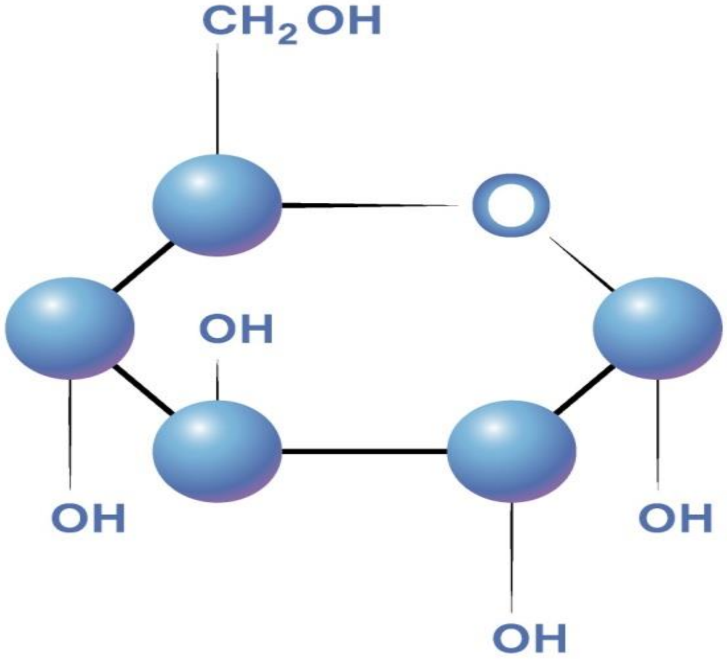
Glucose:

- Known also as dextrose, blood sugar, or grape sugar, glucose is the usual mechanism for transport of carbohydrates in the body.

- It can be naturally found in foods, especially grapes. Glucose can come from the breakdown of disaccharides or starch.

- A small amount is made from amino acids, lactate, pyruvate and glycerol in the liver through a process called gluconeogenesis.



Glucose

What happens to glucose after absorption?

a) **Is carried in the blood as blood sugar to be used as an energy source for the cells.**

All cells and tissues in the body need insulin to consume glucose, except nervous tissue, red blood cells, kidney tubules, intestinal cells, and beta cells of the pancreas.

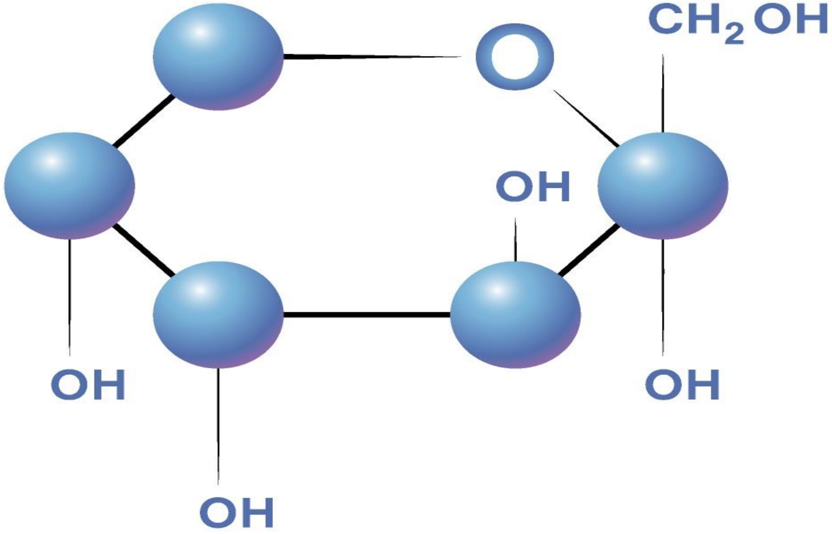
b) Forms glycogen through a process called glycogenesis, and then is stored in the liver and muscles.

c) Converts to fat to be stored for later use as energy.

Fructose:

- Known also as fruit sugar, and levulose, fructose is found in fruits and honey.

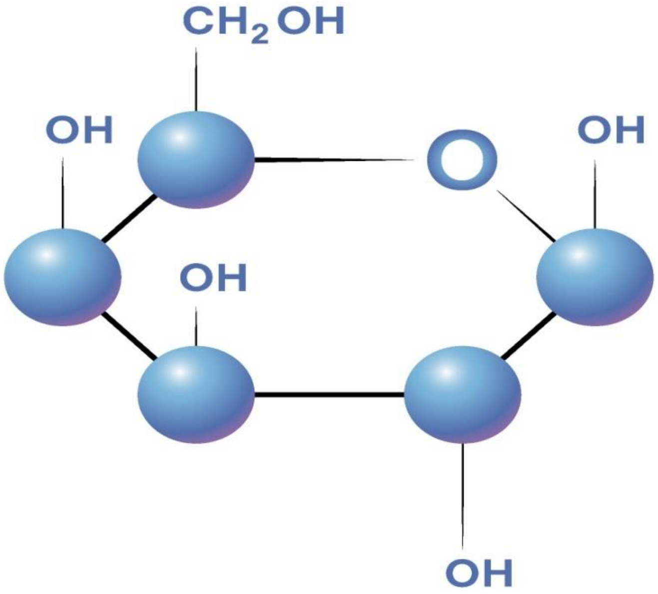
- It is the sweetest sugar, and after absorbing into the blood stream, it converts into glucose in the liver.



Fructose

Galactose:

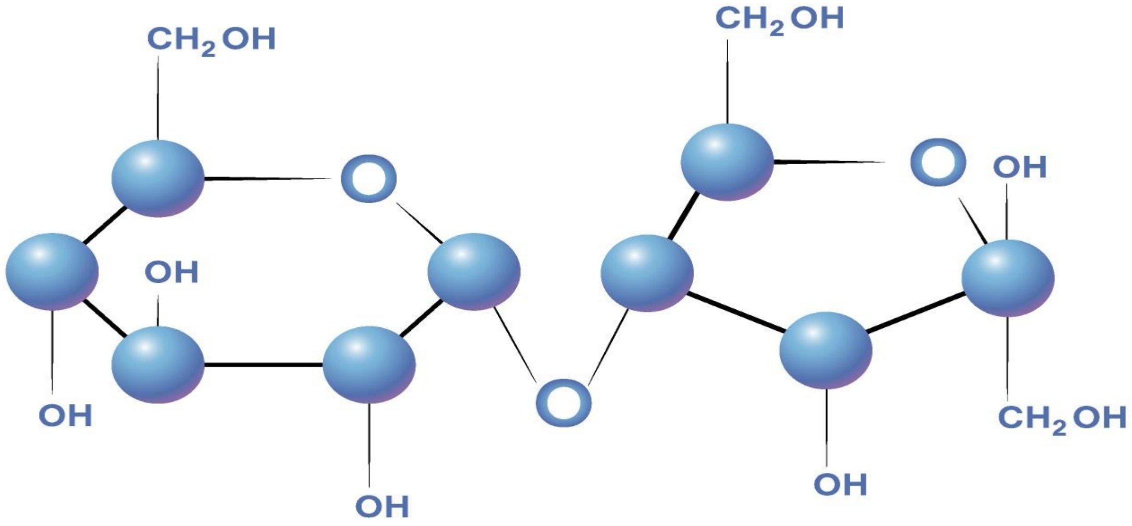
- **Galactose cannot be found in nature.**
- **It comes from the breakdown of lactose (milk sugar) and is converted into glucose in the liver.**



Galactose

Sucrose:

- Sucrose is a disaccharide made of one molecule of glucose and one molecule of fructose.
- It is the most common disaccharide in diet and can be found in sugar cane, beets, maple syrup, molasses, honey, and pineapple.
- It also called white sugar, brown sugar, table sugar, beet sugar, and cane sugar.

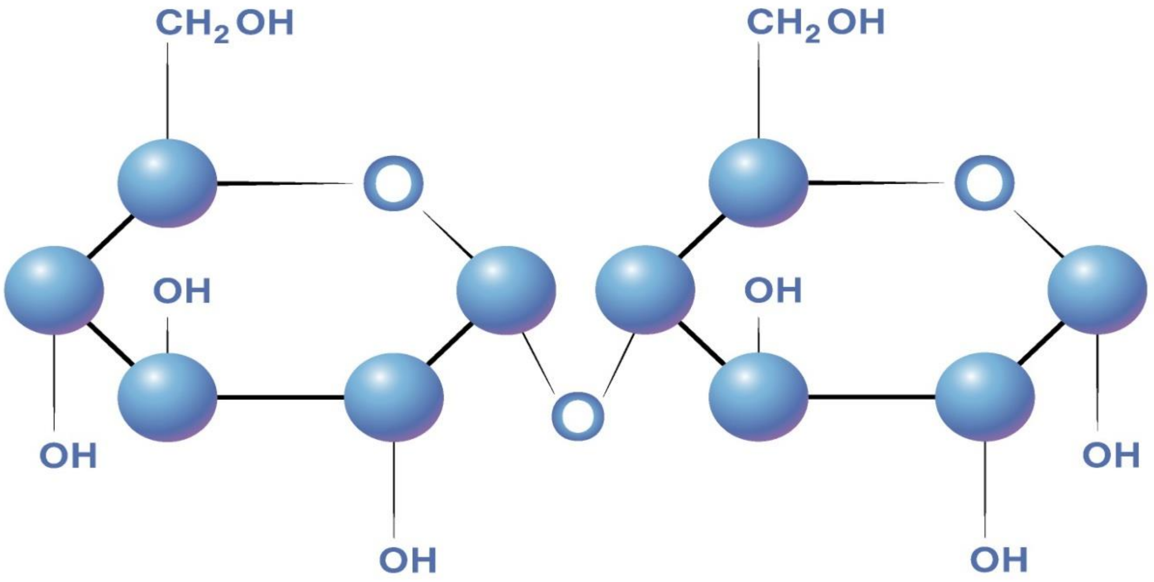


Sucrose

Maltose:

- **Maltose is a disaccharide composed of two unites of glucose.**

- **It is found in beer, breakfast cereals, malted snacks, and germinating seeds such as barley.**



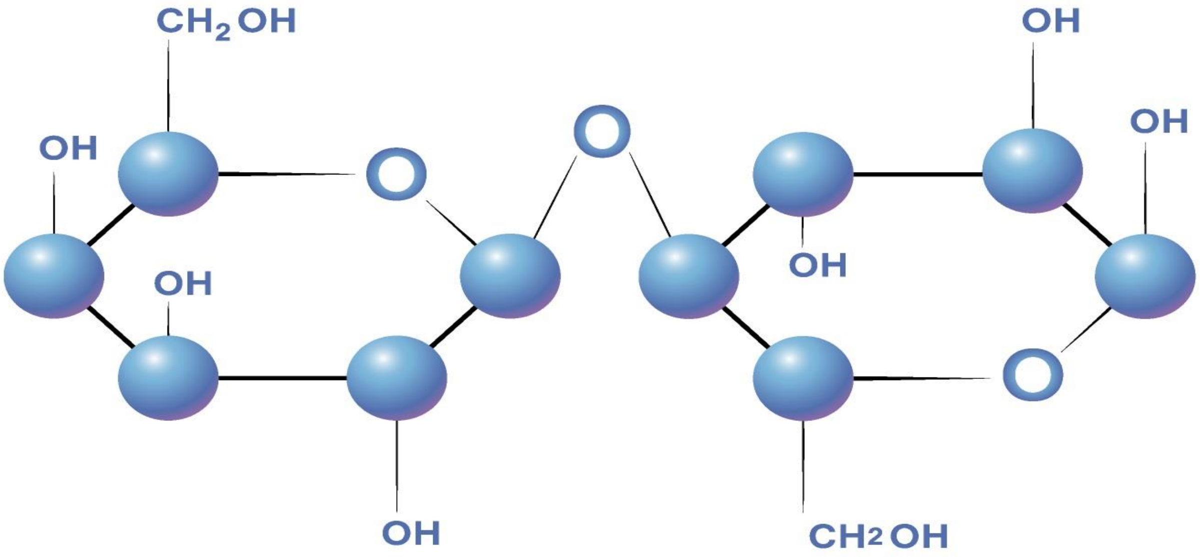
Maltose

Lactose:

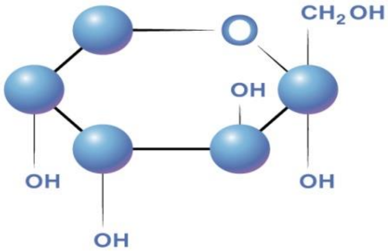
- It is a disaccharide made of one unit glucose and one unit galactose.

- Lactose is found only in milk (milk sugar). Among disaccharides, it is the least sweet one and is never found in plants.

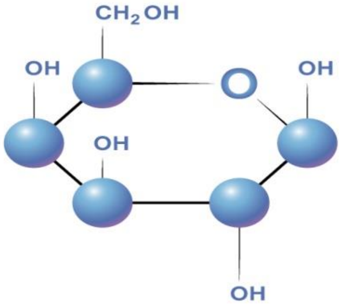
- Lactose is broken down by the enzyme lactase into glucose and galactose.



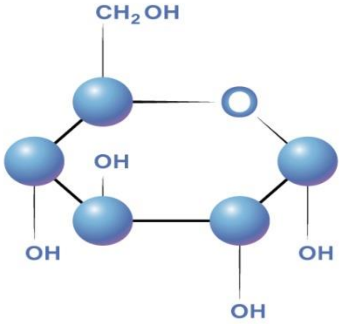
Lactose



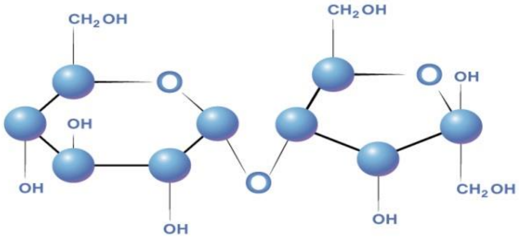
Fructose



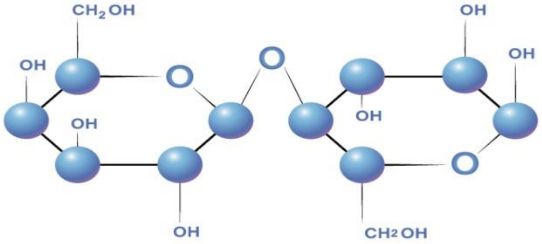
Galactose



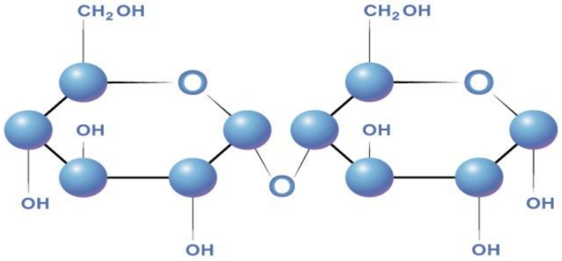
Glucose



Sucrose



Lactose



Maltose

Starch:

- Starch is a polysaccharide and is the stored form of carbohydrates in plants.
- It is found in rice, bread, grains, corn, potatoes, arrowroot, buckwheat, millet, oats, rye, yams, noodle, pasta, cassava, quinoa, and legumes.
- The starch in plants is also called ***complex carbohydrates.***

Forms of Starch:

- **Amylopectin:**

a) Is made of short and branched chains of glucose molecules.

b) Is the most common starch in foods.

c) Foods high in amylopectin digest and absorb rapidly.

- **Amylose:**

a) Is made of long and linear chains of glucose molecules.

b) Is the least common starch.

c) Foods high in amylose digest slowly.

Complex Carbohydrates:

Without Gluten	With Gluten
Amaranth	Barley
Arrowroot	Bulgur
Buckwheat	Couscous
Corn	Kamut
Millet	Muesli
Potatoes	Oats
Quinoa	Rye
Rice	Semolina
Teff	Spelt
Yams	Triticale
	Wheat

Gluten:

- **Gluten is a *protein complex* found in wheat and related grains.**

It contains many proteins in it, but two main proteins are:

- **Gliadin: water soluble**
- **Glutenin: water insoluble**
- **Gliadin and glutenin are storage proteins that store metal ions and amino acids.**

- **People with Celiac disease are intolerant to gliadin.**

Gluten-Free Carbohydrates


Amaranth


Corn


Quinoa

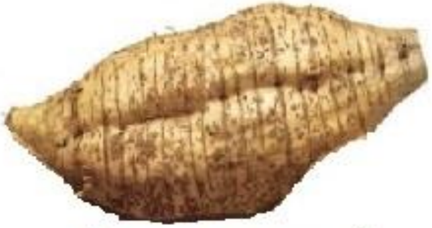

Rice


Millet


Teff


Buckwheat


Potato


Arrowroot

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Grains, Fruits, and Vegetables:

- The contents of carbohydrates in grains, fruits and vegetables will be emailed to you in PDF forms.
- See our websites.

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Glycogen:

- **Glycogen is the stored form of carbohydrates in humans and animals.**

- **It is a polysaccharide made of subunits of glucose through a process called "*glycogenesis*" in the liver.**

- **Glycogen is stored in the liver and muscles. An average person has about 350 grams of glycogens in the muscles and about 50 grams in the liver.**

How Much Carbohydrates Could Be Stored In The Body?

15 grams/kg of body weight

Liver

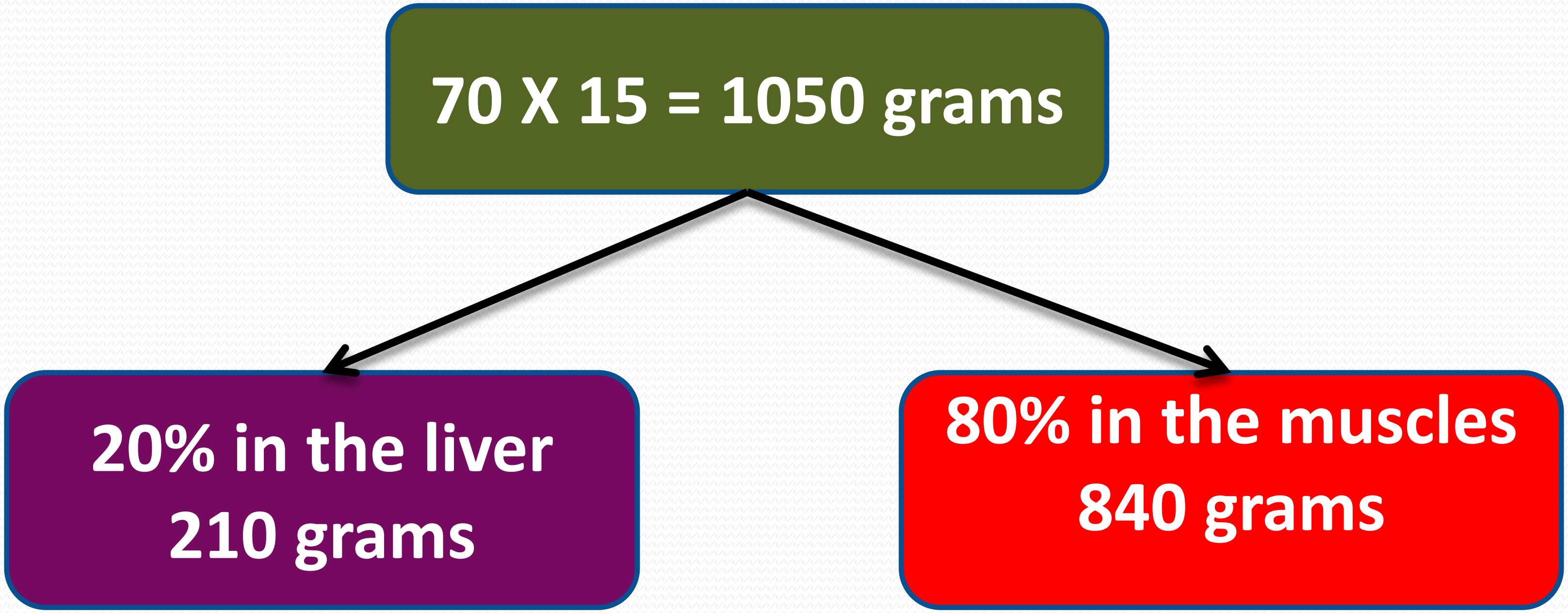
20%

Muscles

80%

Example:

- **If your client weighs about 70 kg. How much glycogen could his body store?**



70 X 15 = 1050 grams

20% in the liver
210 grams

80% in the muscles
840 grams

Homework:

- 1) Name the two forms of starch and the differences between them.
- 2) List the names of seven forms of grain and the amounts of carbohydrates in them per one serving size.