

# From Last Time:

**Science of Cooking – BCBT100**  
*Spring 2014 - Bodwin*

# Disaccharides

Monosaccharides react to form disaccharides  
Liberate water  
Dehydration  
Condensation  
Reversible  
Hydrolysis  
"-ase" enzymes

**Science of Cooking – BCBT100**  
*Spring 2014 - Bodwin*

# Sugar Metabolism

## Glycolysis

**Science of Cooking – BCBT100**  
*Spring 2014 - Bodwin*

# ATP ⇌ ADP ⇌ ATP

The conversion of ATP to ADP as illustrated yields about 7.3 kcal/mol of ATP. This is the energy source for a wide variety of processes in both plants and animals.

**Science of Cooking – BCBT100**  
*Spring 2014 - Bodwin*

# Sugar Metabolism

## Glycolysis

**Science of Cooking – BCBT100**  
*Spring 2014 - Bodwin*

# Sugar Metabolism

## Glycolysis

**Science of Cooking – BCBT100**  
*Spring 2014 - Bodwin*

# Sugar Metabolism

**Legend**

- ATP Adenosine triphosphate
- ADP Adenosine diphosphate
- Irreversible reaction (highly exergonic)
- Reversible reaction

Image: <http://en.wikipedia.org/wiki/File:Glycolysis2.svg>  
 Science of Cooking – BCBT100 Spring 2014 - Bodwin

# Sugar Metabolism

Image: <http://en.wikipedia.org/wiki/File:Glycolysis2.svg>  
 Science of Cooking – BCBT100 Spring 2014 - Bodwin

# Sugar Metabolism

## Glycolysis

**Legend**

- Hydrogen
- Carbon
- Oxygen
- Phosphate group
- ATP Adenosine triphosphate
- ADP Adenosine diphosphate
- Irreversible reaction (highly exergonic)
- Reversible reaction

Image: <http://en.wikipedia.org/wiki/File:Glycolysis2.svg>  
 Science of Cooking – BCBT100 Spring 2014 - Bodwin

# Polysaccharides

## Storage and structure

### Sugar polymers

polysaccharide (amylose starch)  
 Image: <http://en.wikipedia.org/wiki/File:Amylose2.svg>  
 Science of Cooking – BCBT100 Spring 2014 - Bodwin

# Starch

## Glucose polymers

## Energy storage in plants

## Potatoes, rice, grains

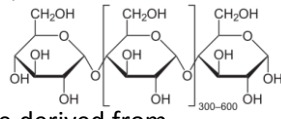
Image: [http://en.wikipedia.org/wiki/File:Amyleptin\\_Sessel.svg](http://en.wikipedia.org/wiki/File:Amyleptin_Sessel.svg)  
 Science of Cooking – BCBT100 Spring 2014 - Bodwin

# Starch - Structure

**STARCH**  
 Amylose Amylopectin  
 Straight chain Amylose  
 Branched chain Amylopectin  
 3/4  
 Image: <http://en.wikipedia.org/wiki/File:Amyleose2.svg>  
 Science of Cooking – BCBT100 Spring 2014 - Bodwin

## Starch – In foods

Thickener – binds a LOT of water  
Provides energy - amylase



**Industrially:**

Dextrose = glucose derived from hydrolyzed starch  
HFCS – dextrose treated with glucose isomerase

Image: <http://en.wikipedia.org/wiki/File:Amylose2.svg>

Science of Cooking – BCBT100  
Spring 2014 - Bodwin

## Glycogen – “animal starch”

Highly branched glucose polymer  
Energy storage  
**GLYCOGEN**

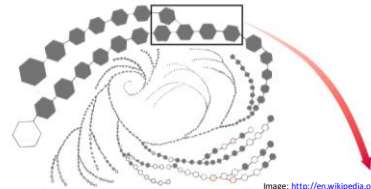
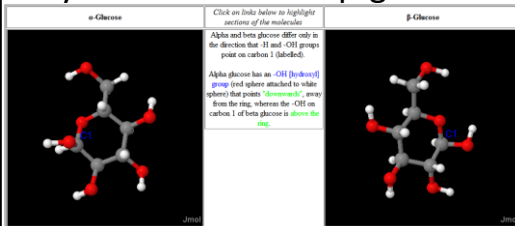


Image: <http://en.wikipedia.org/wiki/File:Amylose2.svg>

Science of Cooking – BCBT100  
Spring 2014 - Bodwin

## Cellulose

Polymers made from  $\beta$ -glucose



Side-by-side animations:

<http://www.biotopics.co.uk/JmolApplet/alphabetaajglucose2.html>

Science of Cooking – BCBT100  
Spring 2014 - Bodwin

## Cellulose

Enzymes that break amylose can't break cellulose  
Rigid, tough *fibers* that make plant cell walls and stalks  
Cross-linking



Science of Cooking – BCBT100  
Spring 2014 - Bodwin

## Cellulose - Dietary

Insoluble Fiber

Highly modified cellulose, up to ~1/2 the mass of a plant  
Binds water, “feel full”  
Draws water into gut  
Fruits, vegetables, whole grains



Science of Cooking – BCBT100  
Spring 2014 - Bodwin

## Cellulose - Dietary

Soluble Fiber

Highly modified cellulose  
Forms gel with high water content  
Water-soluble substances absorbed by gel – “intestine sweeper”



Science of Cooking – BCBT100  
Spring 2014 - Bodwin

# Cellulose - Dietary

## How Soluble Fiber May Lower Cholesterol

1 Soluble fiber and cholesterol from foods reach the stomach and travel to the small intestine

2 Soluble fiber forms a gel which binds some cholesterol in the small intestines and takes it out of the body

3 Cholesterol is also packaged by the liver and reaches the small intestine

Science of Cooking – BCBT100  
Spring 2014 - Bodwin

# Cellulose – Food source?

Cellulosic fiber is indigestible

Most animals lack enzymes to break down cellulose

Ruminants have bacteria in the gut that {partially} digest cellulose to glucose

Image: [http://www.publicdomainpictures.net/view\\_image.php?i=627&picture=black-cow](http://www.publicdomainpictures.net/view_image.php?i=627&picture=black-cow), <http://www.com.ncsu.edu/vhc/lefac/rm/>

Science of Cooking – BCBT100  
Spring 2014 - Bodwin

# Interactions

Fats and water

Amphiphiles

Micelles

Emulsifiers

Science of Cooking – BCBT100  
Spring 2014 - Bodwin

# Working with Data

Table → organize related info

Graphs → show trends

Science of Cooking – BCBT100  
Spring 2014 - Bodwin

# Making graphs

Science of Cooking – BCBT100  
Spring 2014 - Bodwin

# Making graphs

Science of Cooking – BCBT100  
Spring 2014 - Bodwin

## “Good” Graphs

Choose “x” & “y”

Scatter plot – no connectors

Fill the area

Label axes clearly

Use meaningful fit lines/trends



Science of Cooking – BCBT100  
Spring 2014 - Bodwin

## Graphing

You’ve gone for a walk and recorded the distance travelled at a number of times.

5 minutes = 296meters; 10min = 608m;

15min = 882m; 20min = 1207m;

25min = 1562m; 30min = 1803m

What was your average speed?



Science of Cooking – BCBT100  
Spring 2014 - Bodwin