

From Last Time:

Science of Cooking – BCBT100
Fall 2015 - Bodwin

Disaccharides

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

Maltose

Image: <http://en.wikipedia.org/wiki/File:Glycolysis2.svg>

Science of Cooking – BCBT100
Fall 2015 - Bodwin

Sugar Metabolism

Glycolysis

Legend

- Hydrogen
- Carbon
- Oxygen
- Phosphate group
- ADP
- ATP
- Magnesium ion (Mg⁺⁺)
- NAD⁺
- NADH
- Water
- Enzyme

Image: <http://en.wikipedia.org/wiki/File:Glycolysis2.svg>

Science of Cooking – BCBT100
Fall 2015 - Bodwin

ATP ↔ ADP ↔ ATP

The conversion of ATP to ADP as illustrated yields about 7.2 kcal/mol of ATP. This is the energy source for a wide variety of processes in both plants and animals.

Image: <http://en.wikipedia.org/wiki/File:Glycolysis2.svg>

Science of Cooking – BCBT100
Fall 2015 - Bodwin

Sugar Metabolism

Glycolysis

Image: <http://en.wikipedia.org/wiki/File:Glycolysis2.svg>

Science of Cooking – BCBT100
Fall 2015 - Bodwin

Sugar Metabolism

Glycolysis

Image: <http://en.wikipedia.org/wiki/File:Glycolysis2.svg>

Science of Cooking – BCBT100
Fall 2015 - Bodwin

Sugar Metabolism

Fructose 6-phosphate

Fructose 1,6-bisphosphate

Glyceraldehyde 3-phosphate

1,3-bisphosphoglycerate

Enolase

Phosphofruktokinase

Glyceraldehyde 3-phosphate dehydrogenase

ATP

ADP

NAD⁺

NADH

H⁺

H₂O

Legend

- ATP: Adenosine triphosphate
- ADP: Adenosine diphosphate
- Orange arrow: Irreversible reaction (highly exergonic)
- Black arrow: Reversible reaction

Image: <http://en.wikipedia.org/wiki/File:Glycolysis2.svg>

Science of Cooking – BCBT100
Fall 2015 - Bodwin

Sugar Metabolism

Pyruvate

Glucose

Phosphoenolpyruvate

2-phosphoglycerate

Pyruvate kinase

Enolase

ATP

ADP

H⁺

Mg⁺⁺

Mg⁺⁺

H₂O

Image: <http://en.wikipedia.org/wiki/File:Glycolysis2.svg>

Science of Cooking – BCBT100
Fall 2015 - Bodwin

Sugar Metabolism

Glycolysis

Glucose

Glucose 6-phosphate

Fructose 6-phosphate

Fructose 1,6-bisphosphate

Dihydroxyacetone phosphate

Glyceraldehyde 3-phosphate

Hexokinase

Phosphofruktokinase

Aldolase

Glyceraldehyde 3-phosphate dehydrogenase

ATP

ADP

NAD⁺

NADH

H⁺

H₂O

Legend

- Hydrogen
- Carbon
- Oxygen
- Phosphate group
- ATP
- ADP
- Magnesium ion (Mg⁺⁺)
- NAD⁺
- NADH
- Hydrogen ion (H⁺)
- Water (H₂O)
- Enzyme

Image: <http://en.wikipedia.org/wiki/File:Glycolysis2.svg>

Science of Cooking – BCBT100
Fall 2015 - Bodwin

Polysaccharides

Storage and structure

Starch, Glycogen, Cellulose

Sugar polymers

polysaccharide (amylose starch)

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

Science of Cooking – BCBT100
Fall 2015 - Bodwin

Starch

Glucose polymers

Energy storage in plants

Potatoes, rice, grains

Image: http://en.wikipedia.org/wiki/File:Amylopectin_Sessel.svg

Science of Cooking – BCBT100
Fall 2015 - Bodwin

Starch - Structure

STARCH

Amylose Amylopectin

3/4

Straight chain Amylose

Branched chain Amylopectin

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

Science of Cooking – BCBT100
Fall 2015 - 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

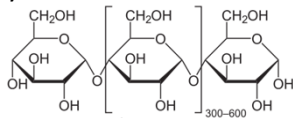


Image: <http://en.wikipedia.org/wiki/File:Amylose2.svg>



Science of Cooking – BCBT100
Fall 2015 - Bodwin

Glycogen – “animal starch”

Highly branched glucose polymer
Energy storage

GLYCOGEN

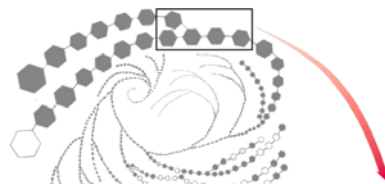


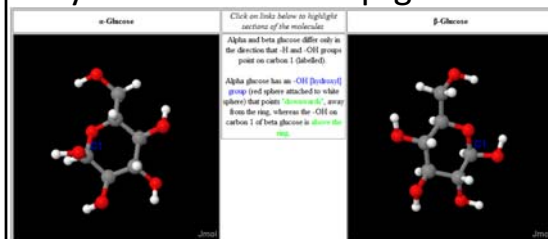
Image: <http://en.wikipedia.org/wiki/File:Amylose2.svg>



Science of Cooking – BCBT100
Fall 2015 - Bodwin

Cellulose

Polymers made from β -glucose



Side-by-side animations:

<http://www.biotopics.co.uk/1molApplet/alphabetajglucose2.html>



Science of Cooking – BCBT100
Fall 2015 - 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
Fall 2015 - 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
Fall 2015 - Bodwin

Cellulose - Dietary

Soluble Fiber

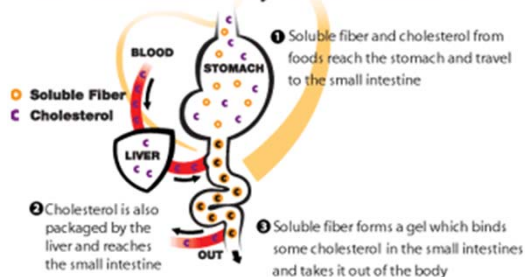
Highly modified cellulose
Forms gel with high water content
Water-soluble substances absorbed by gel – “intestine sweeper”



Science of Cooking – BCBT100
Fall 2015 - Bodwin

Cellulose - Dietary

How Soluble Fiber May Lower Cholesterol



Science of Cooking – BCBT100
Fall 2015 - 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?image=627&picture=black-cow> <http://www.cvm.ncsu.edu/vhc/efar/rhm/>



Science of Cooking – BCBT100
Fall 2015 - Bodwin

Interactions

Fats and water
Amphiphiles
Micelles
Emulsifiers



Science of Cooking – BCBT100
Fall 2015 - Bodwin

Working with Data

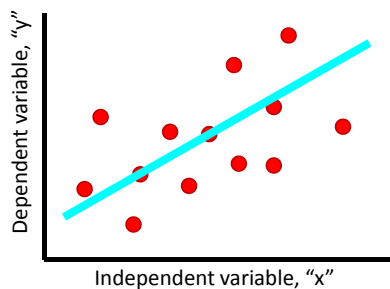
Table → organize related info

Graphs → show trends



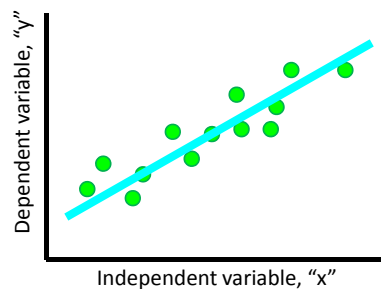
Science of Cooking – BCBT100
Fall 2015 - Bodwin

Making graphs



Science of Cooking – BCBT100
Fall 2015 - Bodwin

Making graphs



Science of Cooking – BCBT100
Fall 2015 - 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
Fall 2015 - 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
Fall 2015 - Bodwin