From Last Time:

Saute – to cook in a hot pan using very little fat or oil

Denature – to change the structure of a protein

Melt – to change from solid to liquid

Cilantro – a herb, the leaves of coriander

Protein – long chains of amino acids

Salt – sodium chloride; can describe any substance made of charged particles

Descriptions of Scale

Macroscale vs. Microscale

Chemistry & Molecular Biology bridge these worlds

http://www.scaleoftheuniverse.com/

What is food made of?

Organic vs. Inorganic

Organic = "from life", contains C-H bonds

Inorganic = no C-H bonds

What is food made of?

Water

Inorganic components

Salts, minerals

"Small" Organic Molecules

Vitamins, metabolites

Macromolecules

Lipids, proteins, carbohydrates

Water

H_2O!

Very small, simple

Essential to all life on Earth

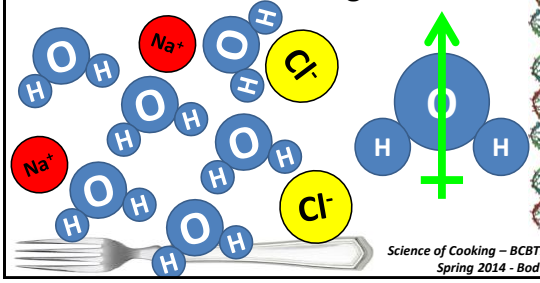
Search for Extraterrestrial Life

Most food is mostly water

Why is water liquid?

Water molecules are bent → polar

Polar molecules stick together



Water Content of Foods

Food	Water Content (%)
Meat	
Pork, raw, composite of lean cuts	53-60
Beef, raw, retail cuts	50-70
Chicken, raw meat without skin	74
Fish, muscle proteins	65-81
Fruits	
Berries, cherries, pears	80-85
Apples, peaches, oranges, grapefruit	85-90
Rhubarb, strawberries, tomatoes	90-95
Vegetables	
Peas (green)	74-80
Beets, broccoli, carrots, potatoes	80-90
Asparagus, beans, cabbage, cauliflower, lettuce	90-95

Source: http://class.fst.ohio-state.edu/fst605/605%20pdf/Water.pdf

Water in Foods

Water content of some foods

Food	Water content (%)
Beef	50 to 70
Chicken meat	74
Fish	65 to 81
Pears	80 to 85
Apples, peaches, oranges	85 to 90
Tomatoes, strawberries	90 to 95
Avocado, banana	74 to 80
Carrot, potato	80 to 90
Lettuce, lentils	90 to 95
Honey	20
Jam	28
Flour, rice	12
Milk powder	4

Source: http://www.azaquar.com/en/doc/water-in-food

Inorganic Components

"Salts" – charged particles

Sodium chloride → Na^+ and Cl^-

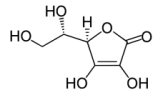
Other trace minerals

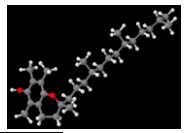
Iron, potassium, calcium, magnesium, etc

"Small" Organic Molecules

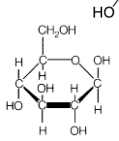
"Organic" = containing C and H

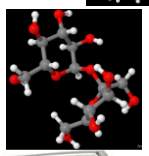
Vitamins





Sugars





Others

BIG Food Molecules

Lipids

Proteins

Carbohydrates

DNA/RNA

Lipids

Fats

Long chains of (mostly) C and H

Lipids are non-polar

Don't mix w/water = "hydrophobic"

"like dissolves like"

Molecule animations: http://www.biotopics.co.uk/JmolApplet/jcontentstable.html
Fatty acids Jmol:
http://www.mpcfaculty.net/mark_bishop/Bishop_Jmol_fatty_acids_triglyceride.htm

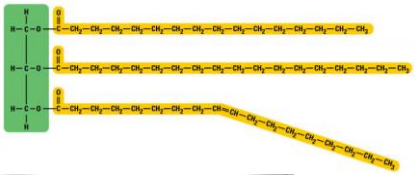
Fatty Acids/Triglycerides

Vinegar = 2 carbons

Water soluble

Stearic acid = 18 carbons

NOT water soluble



Types of Fats

Saturated vs. Unsaturated

Mono- vs Polyunsaturated

"Hydrogenated"

"Omega-3"

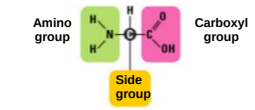
Macromolecules

Polymers –

poly="many", meros="parts"

Different "parts" result in different function/properties

Amino Acids

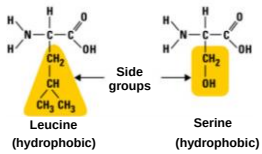


Central Carbon

Carboxyl group

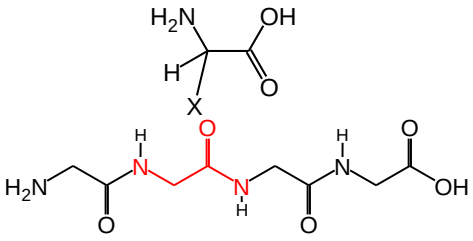
Amino group

Side chain - varies

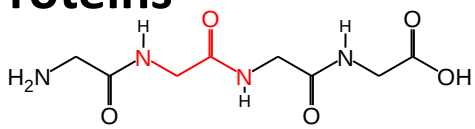


Proteins

Polymers made of amino acids



Proteins



Shape depends upon properties of side chains interacting with water

Shape = Function

20 "letters", many "words"

4 Levels of Protein Structure

Primary – aa order
Secondary – near aa interactions
Tertiary – long range in 1 protein
Quaternary – clusters of proteins

Denaturing disturbs structure

Protein structure: http://en.wikipedia.org/wiki/File:Main_protein_structure_levels_en.svg

Carbohydrates

"Carbo" → carbon
"hydrate" → water, O and H

Common Sugars

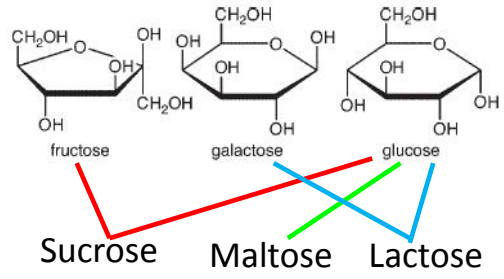


Image: http://en.wikipedia.org/wiki/File:Glycolysis2.svg

Common Sugars

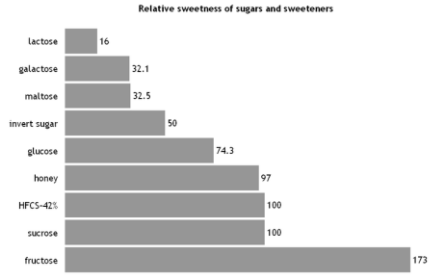
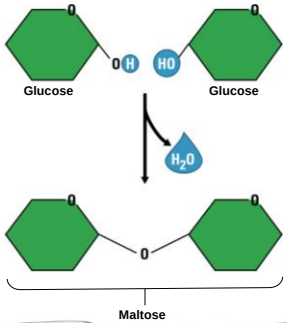


Image: http://en.wikipedia.org/wiki/File:Relativesweetness.png

Disaccharides



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

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