

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



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Descriptions of Scale

Macroscale vs. Microscale

Chemistry & Molecular Biology
bridge these worlds

<http://htwins.net/scale2/>



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What is food made of?

Organic vs. Inorganic

Organic = “from life”, contains C-H bonds

Inorganic = no C-H bonds



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What is food made of?

Water

Inorganic components

Salts, minerals

“Small” Organic Molecules

Vitamins, metabolites

Macromolecules

Lipids, proteins, carbohydrates



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Water

H_2O !

Very small, simple

Essential to all life on Earth

Search for Extraterrestrial Life

Most food is mostly water

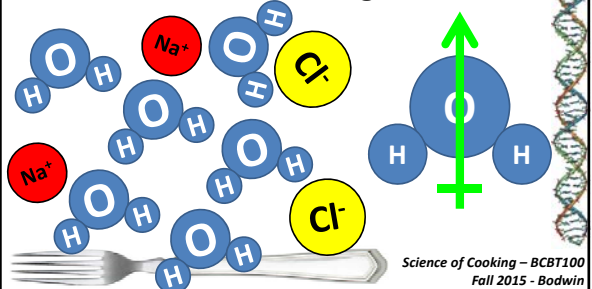


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Why is water liquid?

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>



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Water in 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.azqaqar.com/en/doc/water-in-food>



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Inorganic Components

“Salts” – charged particles

Sodium chloride → Na^+ and Cl^-

Other trace minerals

Iron, potassium, calcium, magnesium, etc

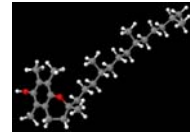
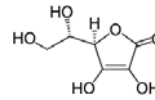


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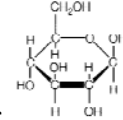
“Small” Organic Molecules

“Organic” = containing C and H

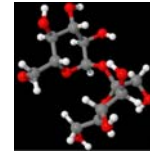
Vitamins



Sugars



Others



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BIG Food Molecules

Lipids

Proteins

Carbohydrates

DNA/RNA



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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



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Fatty Acids/Triglycerides

Vinegar = 2 carbons

Water soluble

Stearic acid = 18 carbons

NOT water soluble



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Types of Fats

Saturated vs. Unsaturated

Mono- vs Polyunsaturated
“Hydrogenated”

“Omega-3”



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Macromolecules

Polymers –

poly=“many”, meros=“parts”

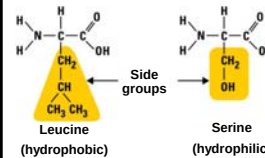
Different “parts” result in
different function/properties



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Amino Acids

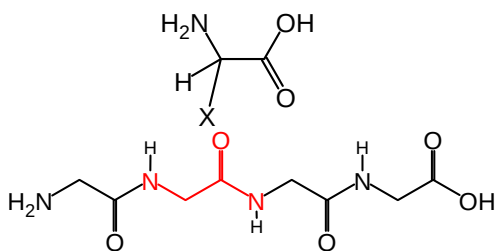
Amino group
Central Carbon
Carboxyl group
Side group
Amino group
Side chain - varies



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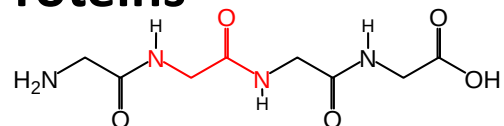
Proteins

Polymers made of amino acids



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Proteins



Shape depends upon properties of
side chains interacting with water
Shape = Function
20 “letters”, many “words”



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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



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Carbohydrates

“Carbo” → carbon
 “hydrate” → water, O and H



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Common Sugars

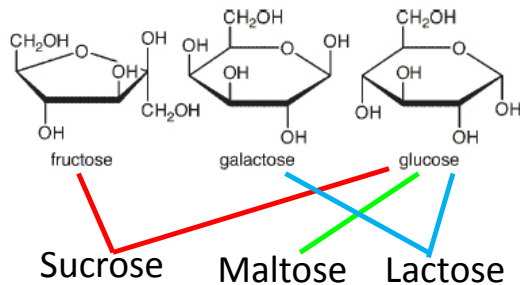


Image: <http://en.wikipedia.org/wiki/File:Glycolysis2.svg>



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Common Sugars

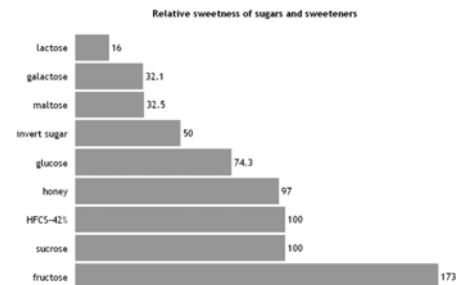


Image: <http://en.wikipedia.org/wiki/File:Relativesweetness.png>



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