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

The Scientific Method

Observe something

Ask a question

Predict an answer

Test your prediction

Repeat, repeat, repeat

Doing "Good" Science

It's not random

Testable prediction

Statements not questions

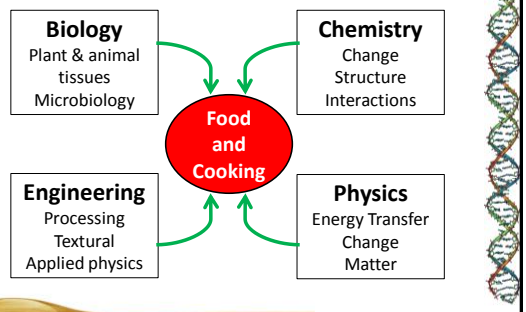
1 variable at a time

Reflective

What is "cooking"?

Preparing food & drink
Understanding flavors
Exploring combinations
Experiencing textures

Sciences of Cooking



Using recipes

More than a list of ingredients
Process matters
What's happening on a molecular level?
How can a recipe be changed?

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

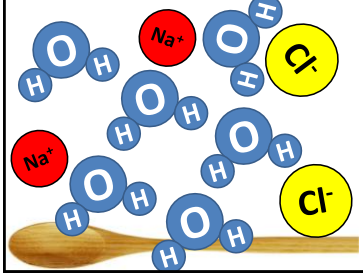
Search for Extraterrestrial Life

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^-

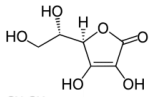
Other trace minerals

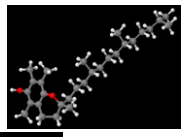
Iron, potassium, calcium, magnesium, etc

"Small" Organic Molecules

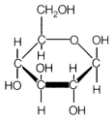
"Organic" = containing C and H

Vitamins

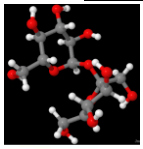




Sugars



Others



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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"

triglyceride animation: http://www.3dchem.com/3dmolecule.asp?ID=320
Fatty acids Jmol:
http://www.mpcfaculty.net/mark_bishop/Bishop_Jmol_fatty_acids_triglyceride.htm

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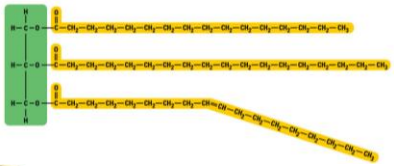
Fatty Acids/Triglycerides

Vinegar = 2 carbons

Water soluble

Stearic acid = 18 carbons

NOT water soluble



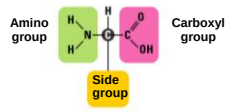
Macromolecules

Polymers –

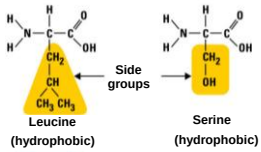
poly="many", meros="parts"

Different "parts" result in different function/properties

Amino Acids

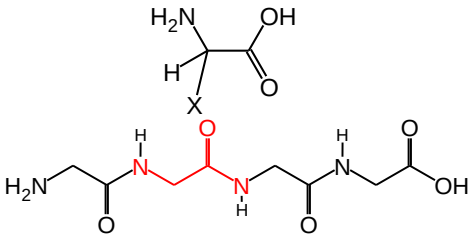


Central Carbon
Carboxyl group
Amino group
Side chain - varies

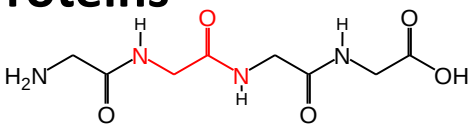


Proteins

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