Chemistry that you can eat!

The Science behind Food and Cooking

Magesh Nandagopal, NCL

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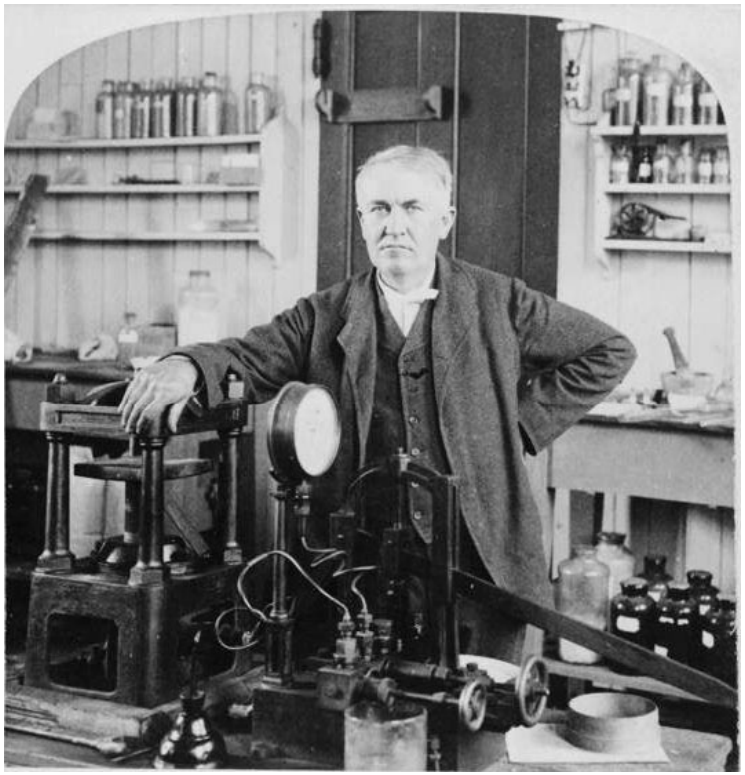
Why Science of Food?

Lab at Home



Equipment/Chemicals

+ couscous kettle

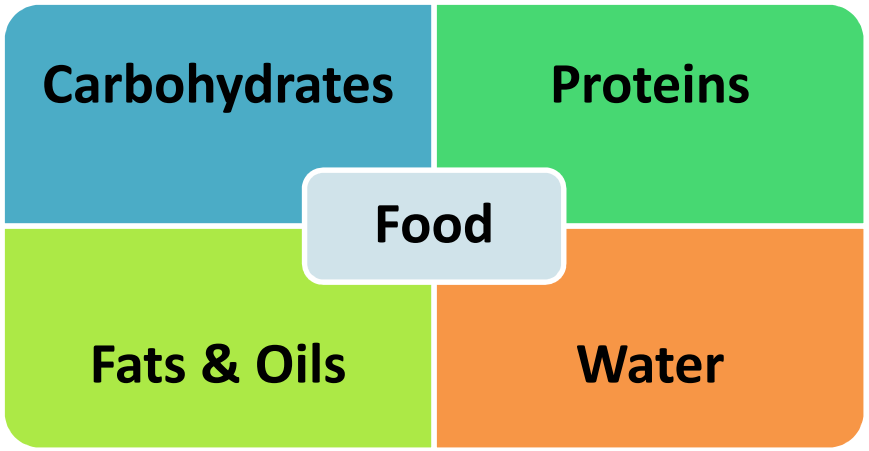
steamer basket

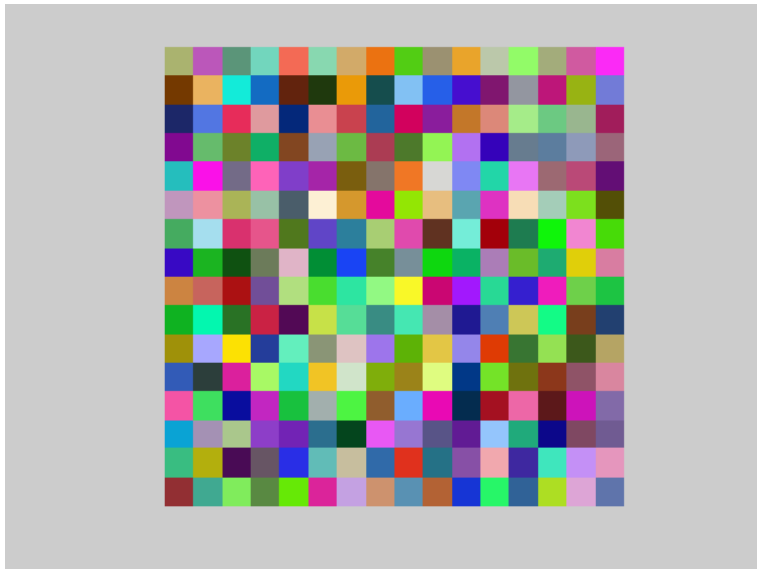
steamer

pressure cooker

Taste, Color, Texture etc.

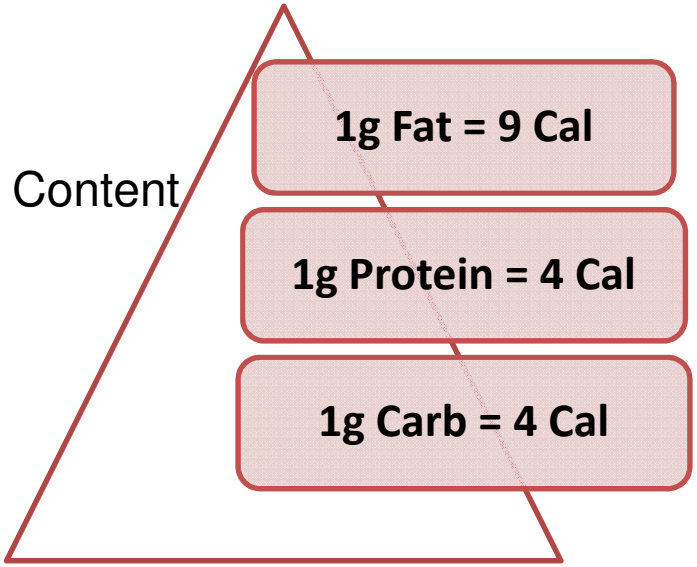
Classifying Food



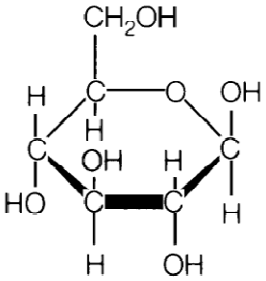


Thousands of compounds

Energy Content

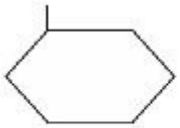


Carbohydrates

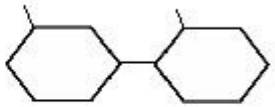


"saccharides"

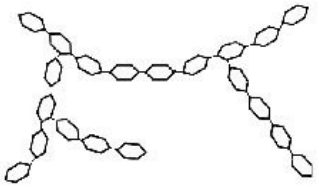
Mono	Di	Poly
• Glucose • Fructose	• Sugar/Sucrose • Lactose	• Starch



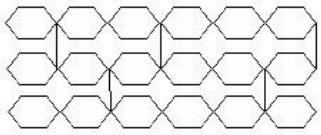
glucose



a disaccharide



glycogen



cellulose

(note that each ring is a monosaccharide)

Simple carbohydrates

Simple carbohydrates are found in foods such as fruits, milk, and vegetables

Cake, candy, and other refined sugar products are simple sugars which also provide energy but lack vitamins, minerals, and fiber

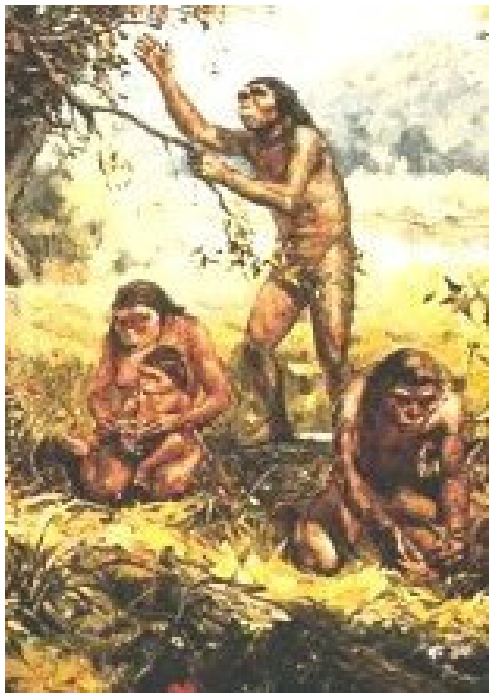
A.D.A.M.

Complex carbohydrates

Complex carbohydrates provide vitamins, minerals, and fiber

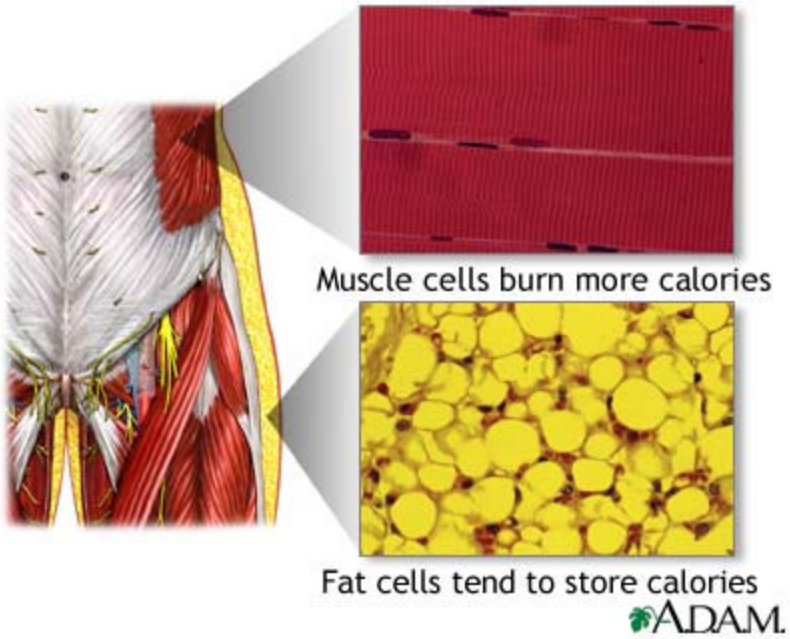
Foods such as breads, legumes, rice, pasta, and starchy vegetables contain complex carbohydrates

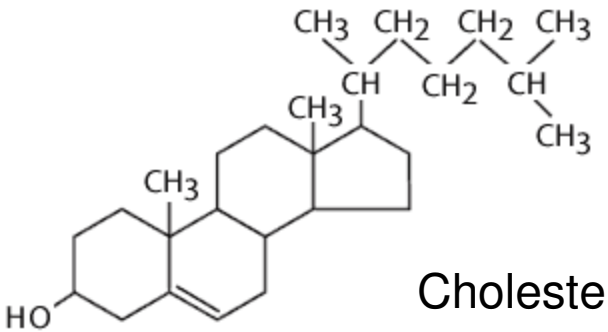
A.D.A.M.



Fats

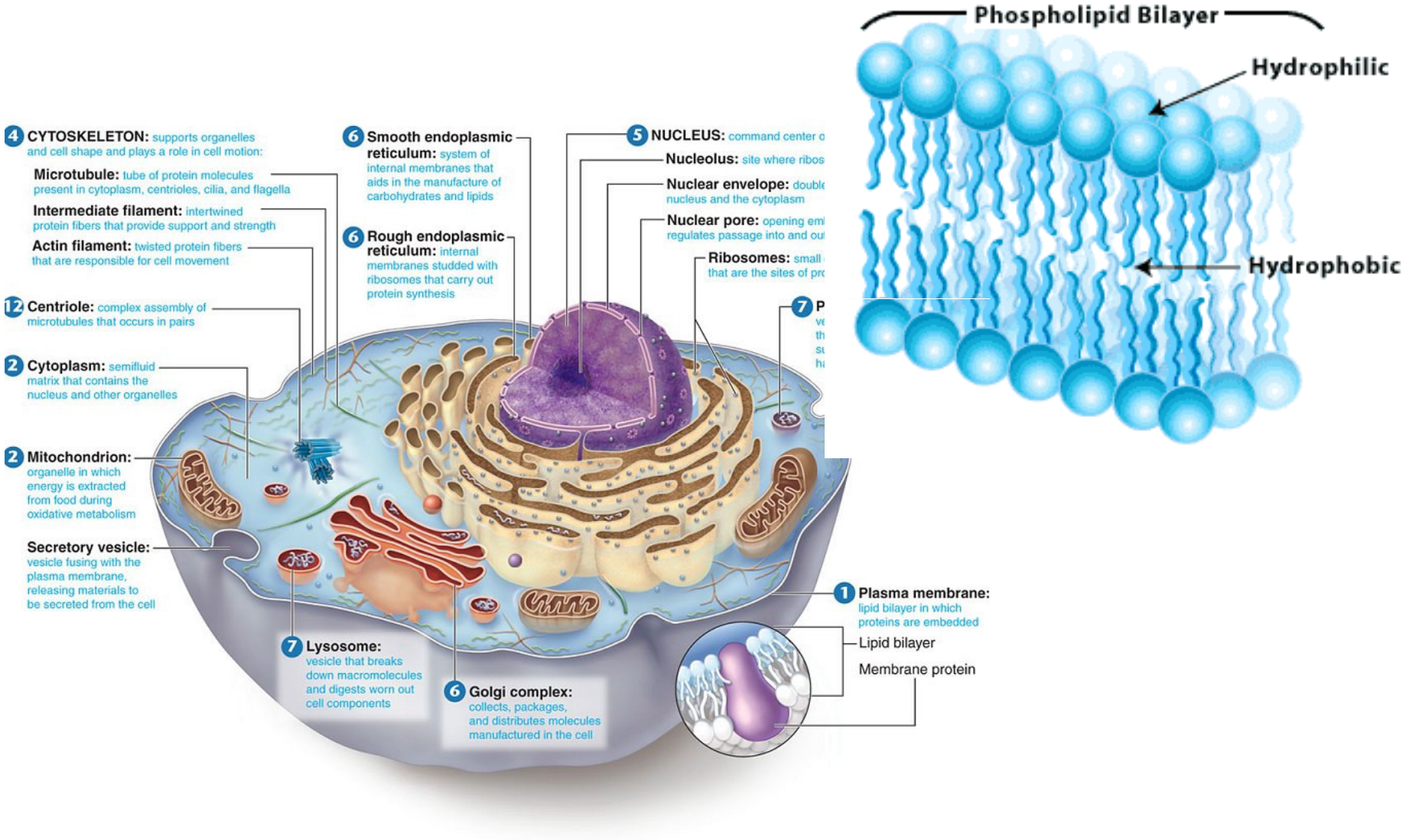
Energy Storage (450 g = 2 days)
Insulation
Other essential functions
- **Phospholipids**

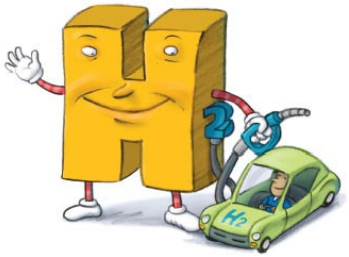




Cholesterol

Phospholipids





Energy

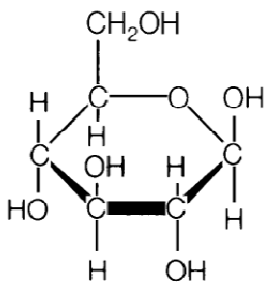
Bond	Bond Energy
C–O	358 kJ/mol
C–H	413 kJ/mol

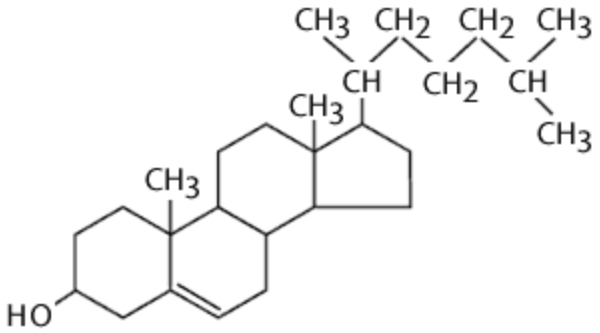
$$C_6H_{12}O_6 + 6O_2 \rightarrow 6H_20 + 6CO_2 + \text{energy}$$

(glucose + oxygen → water + carbon dioxide + energy)

Carbohydrates Vs. Fats

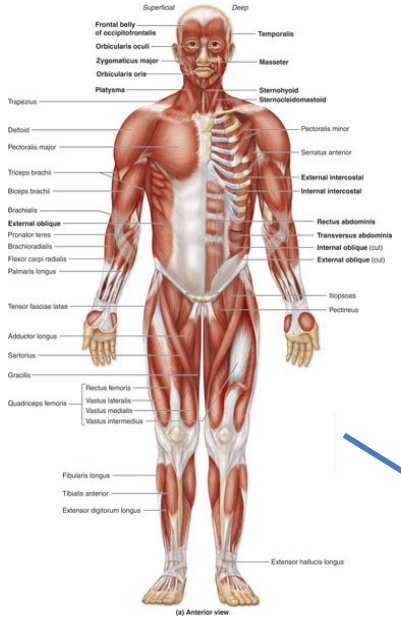
(4 Cal) **(9 Cal)**





Fewer bonds have been oxidized

Protein

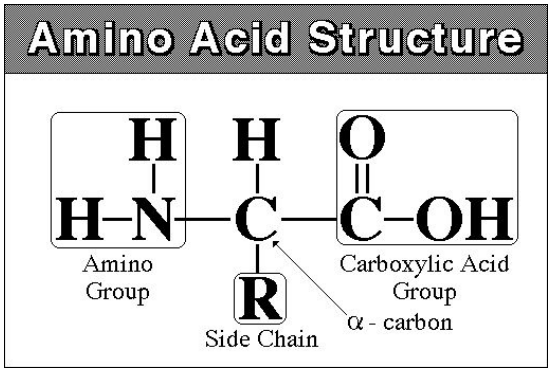


- H_2O =

Protein
- **Muscles**
- **Organs**
- **Blood Cells**
- **Skin**
- **Nails**
- **Hair**
- **Teeth**
- **Bones**
- **Antibodies**
- **Hemoglobin**
- **Insulin**

Synthesize 10-12 amino acids

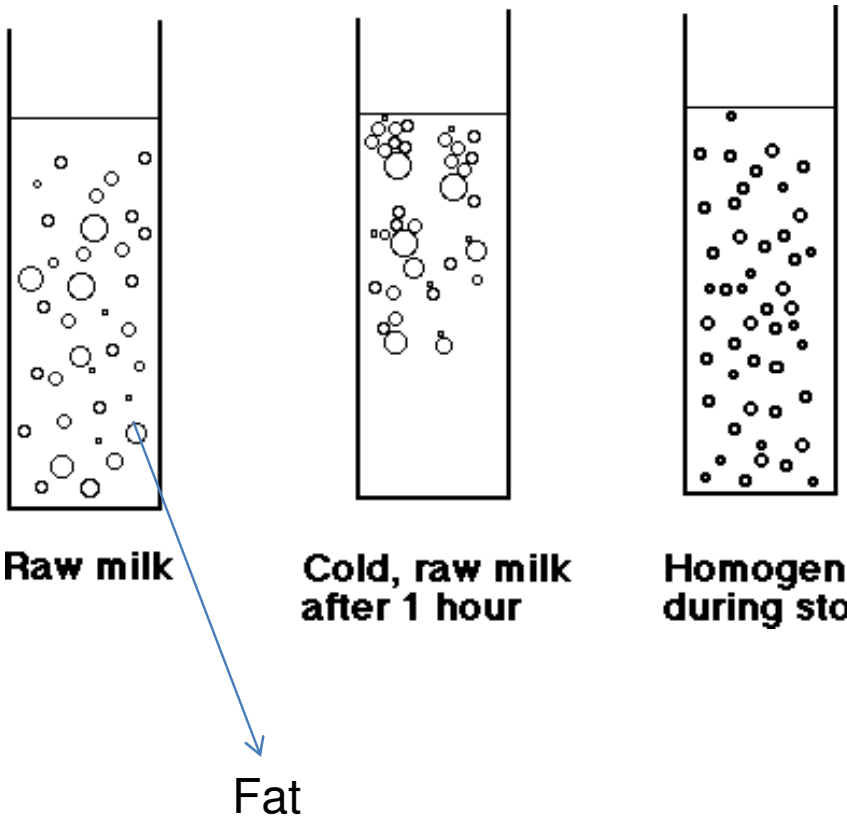
Dietary Protein → **Amino Acids 8-10**



Milk

Nutrient	How Much?
Water	87 %
Protein	3.5% (1.1%)
Fat	3.7%
Lactose	4.9%
Minerals	0.7%

Homogenisation



Pasteurisation

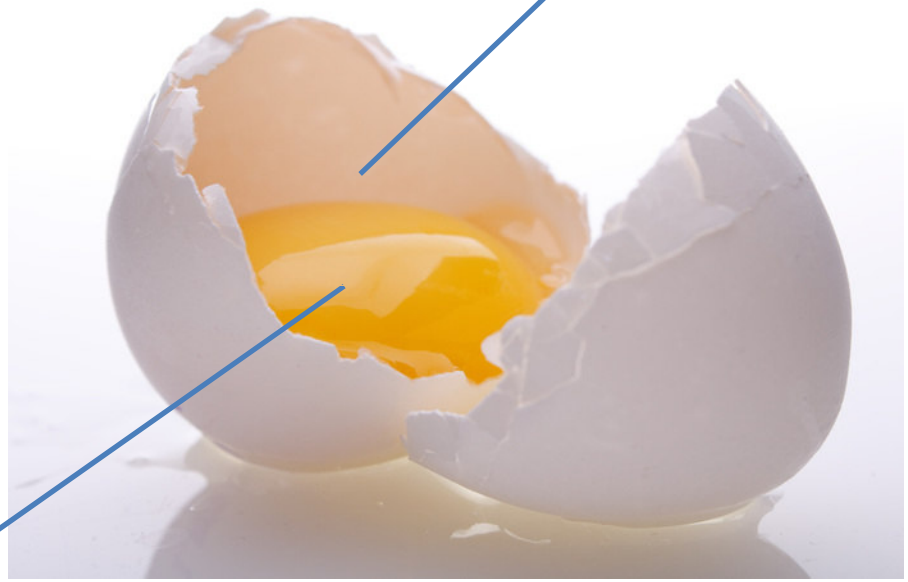
X	• To kill microbes
-	• Inactivate Enzymes

- 62°C/30 min
- 71°C/15 sec
- 138°C/1 sec

Egg

Nutrient	How Much?
Protein	10%
Water	Rest

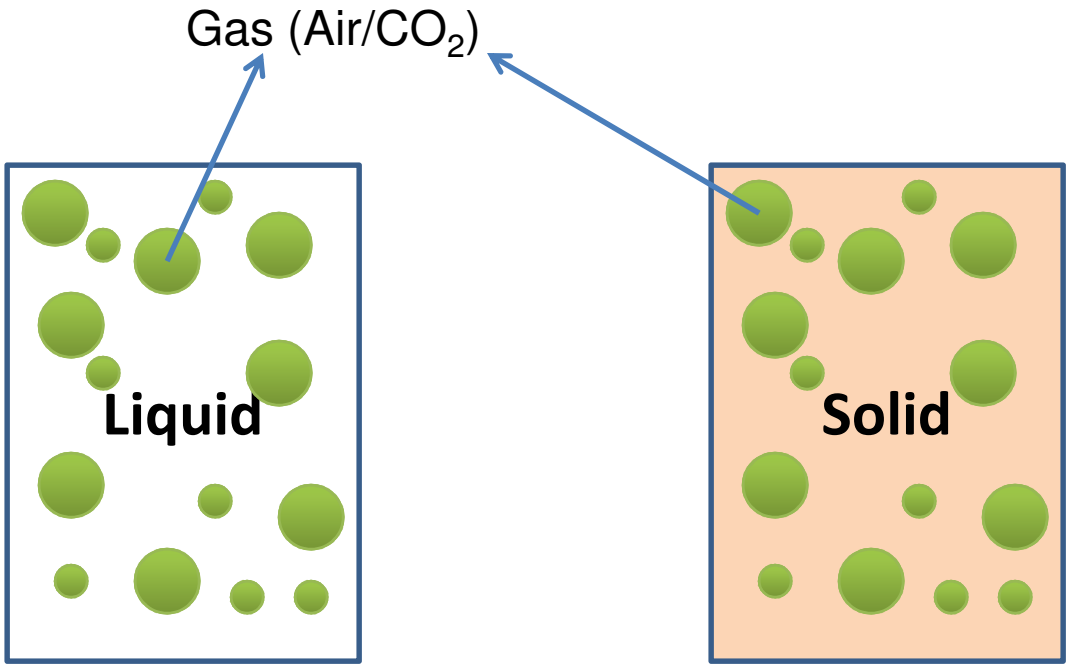
2/3rd by weight
1/4th of calories



Nutrient	How Much?
Water	50 %
Lipids/Fats (cholesterol)	34% (1/10th)
Protein	16%

1/3rd by weight
3/4th of calories

Foams

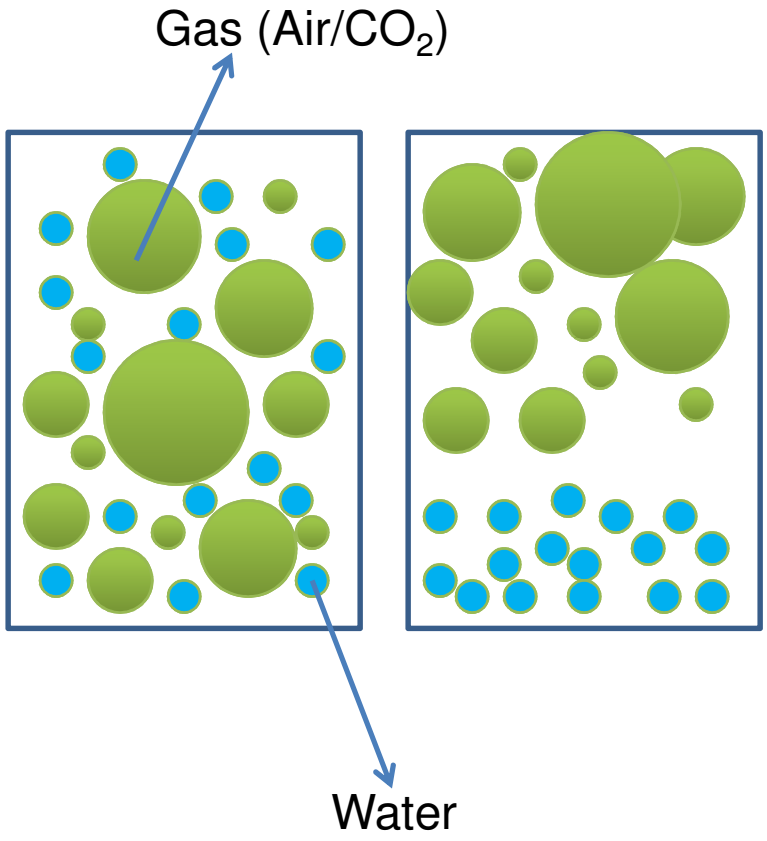


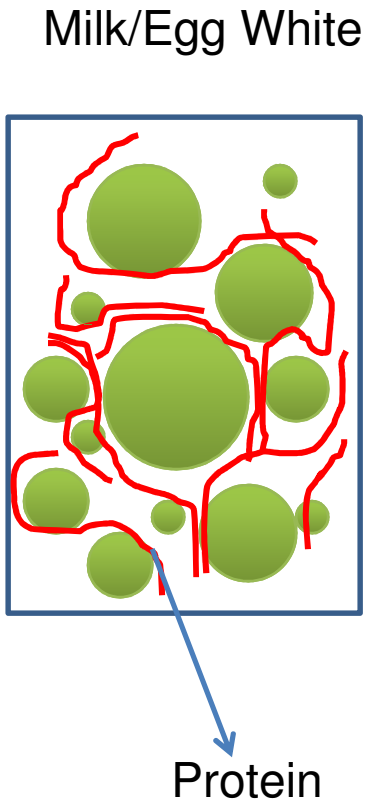
- **Soap bubble**
- **Milk Froth**

- **Cushion**
- **Marshmallow**

Foams that you can eat!

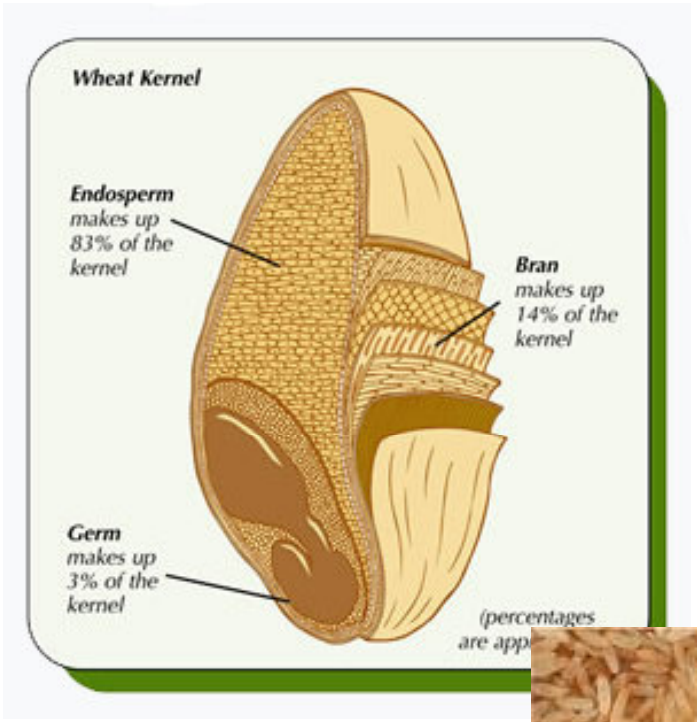
Why doesn’t water foam?





Rice/Wheat/Cereal

Whole grain vs. Refined Flour



Bread

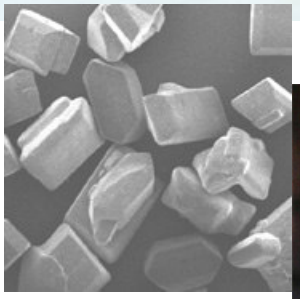
Gluten – A protein that complexes with water
Starch – Trapped in the protein-water complex
Water – Medium
Yeast – A fungus that eats sugars and spits out CO_2
Lipids – Flavor/consistency

http://www.exploratorium.com/cooking/bread/bread_science.html

Chocolate/Candy

Crystallization – how to prevent it?

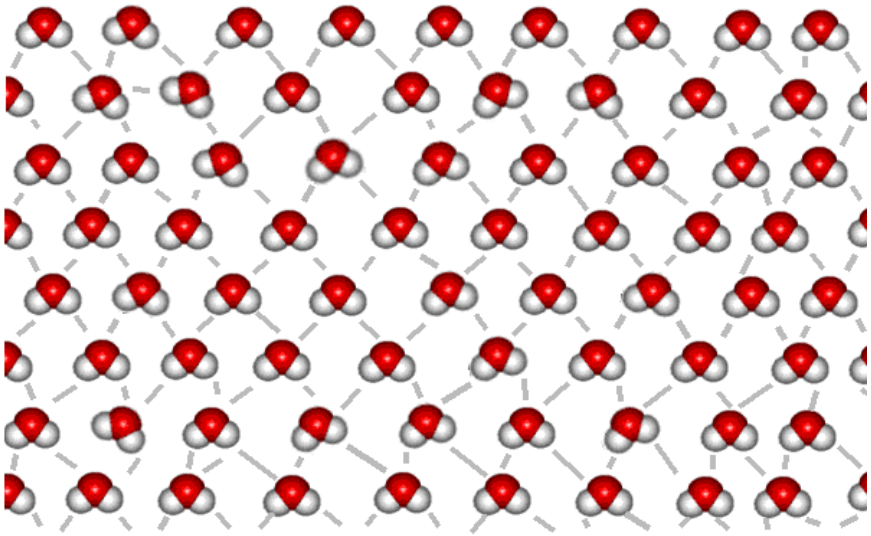
- Corn Syrup
- Lemon Juice
- Butter/Oil

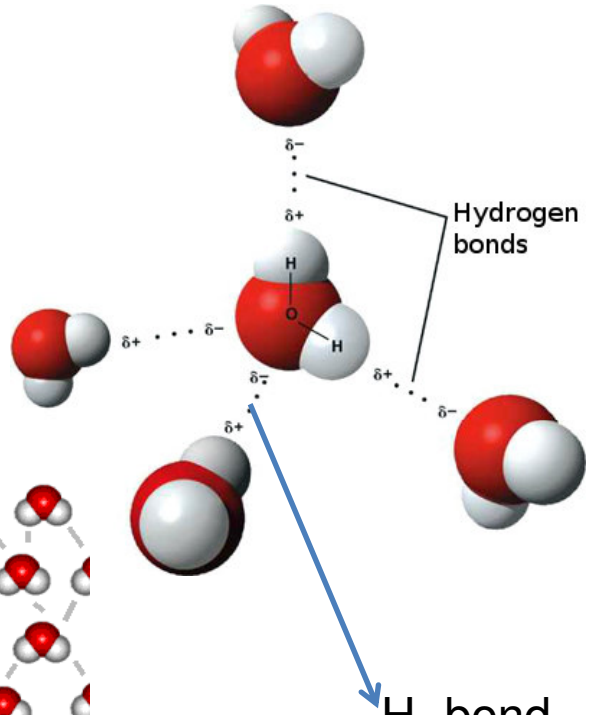



cooking

Water – What is so special?

	Water
Humans	60%
Raw Meat	75%
Fruits/Veg	95%





H- bond

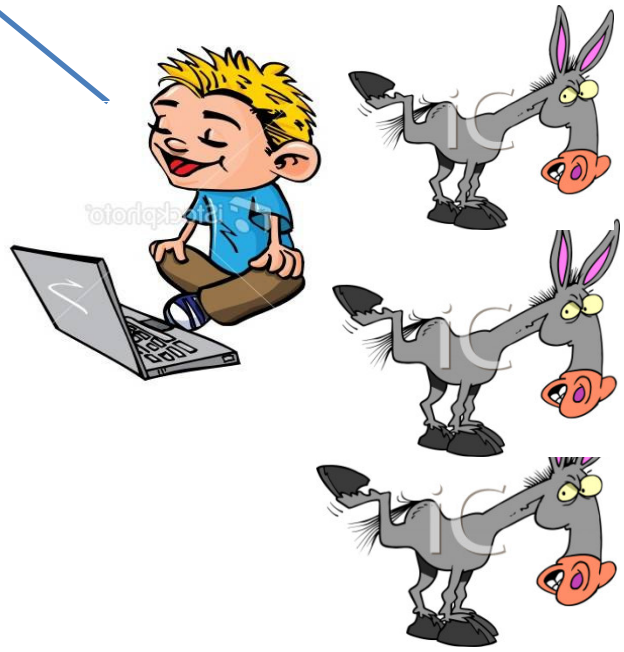
- Results in enormous heat capacity

Heat Capacity

Low kick-capacity

Heat Capacity

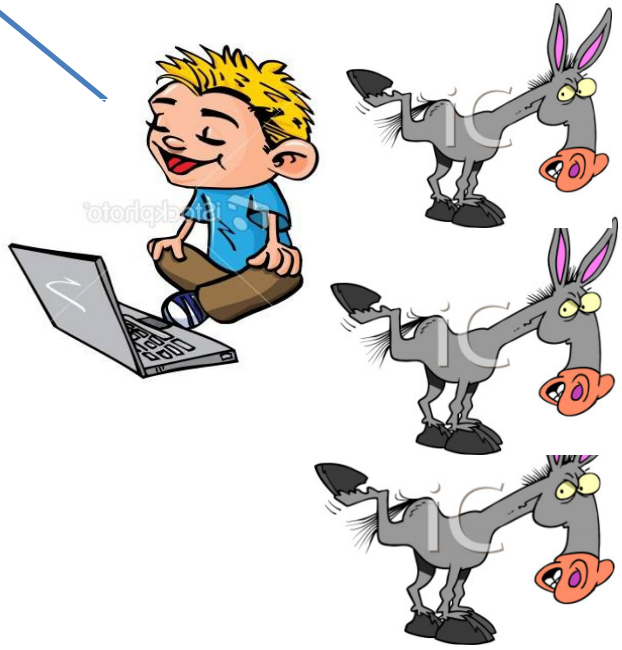
High kick-capacity



Heat Capacity

Low kick-capacity

High kick-capacity



High heat capacity- Why is it useful?

Keeps body temperature under control

As a medium to cook

Surface Area

?

How fast it cooks?

How spicy is it?

Browning

Why?

154ºC

→ Flavour

Water
100ºC

Cooking Oil
>200ºC

Ingredients – to make a Curry

- Vegetables (star of the curry)
- Dal?
- Herbs (for flavor, fragrance)
- Seasoning (for taste)
- Cooking medium (water)

The End

Have fun, cook and learn!!!