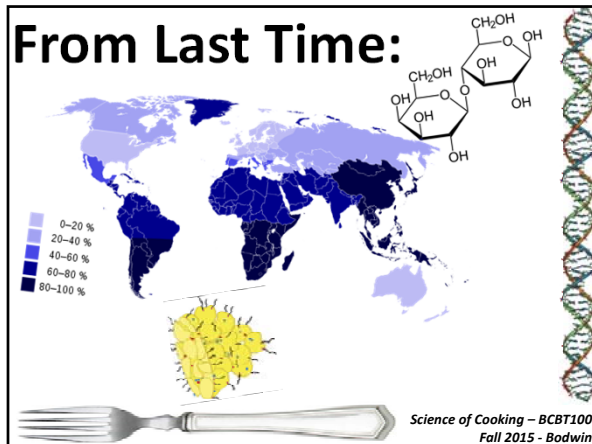


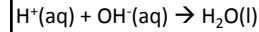
From Last Time:



Acids and Bases

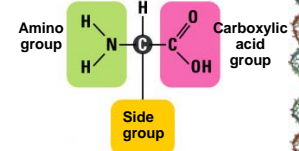
Acids = increase concentration of hydrogen ion (H^+) when dissolved in water

Bases = decrease concentration of hydrogen ion (H^+) when dissolved in water (increase OH^- concentration)



“Neutralization”

pH scale



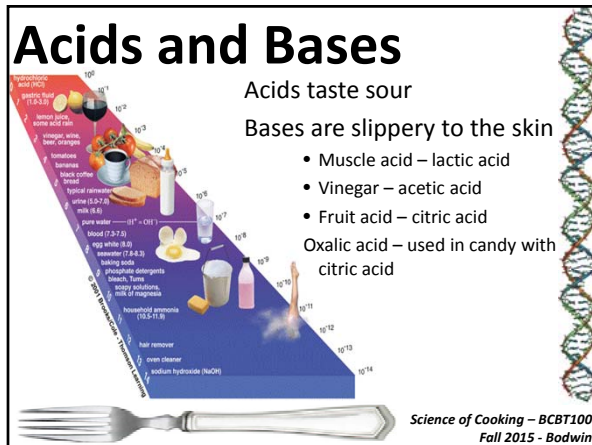
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Acids and Bases

Acids taste sour

Bases are slippery to the skin

- Muscle acid – lactic acid
- Vinegar – acetic acid
- Fruit acid – citric acid
- Oxalic acid – used in candy with citric acid



Milk Fat

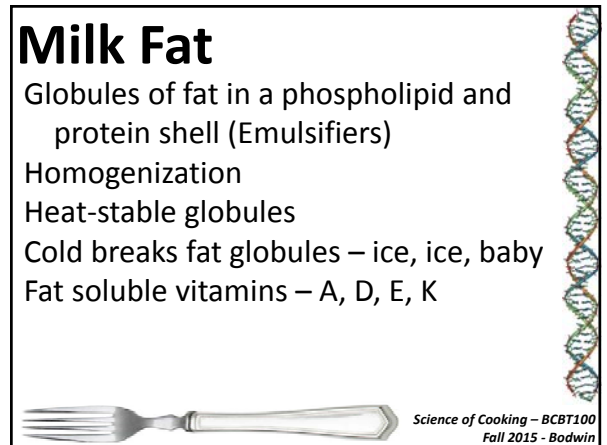
Globules of fat in a phospholipid and protein shell (Emulsifiers)

Homogenization

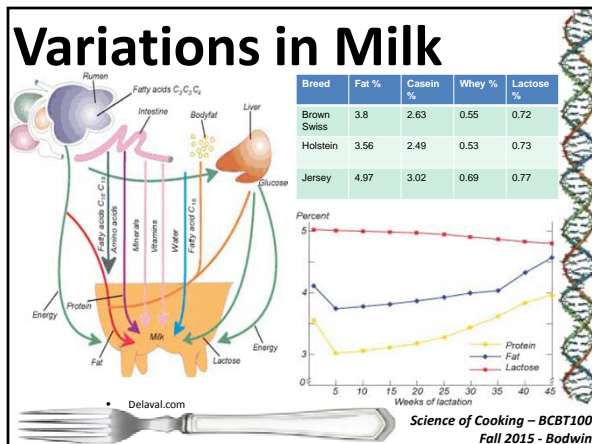
Heat-stable globules

Cold breaks fat globules – ice, ice, baby

Fat soluble vitamins – A, D, E, K



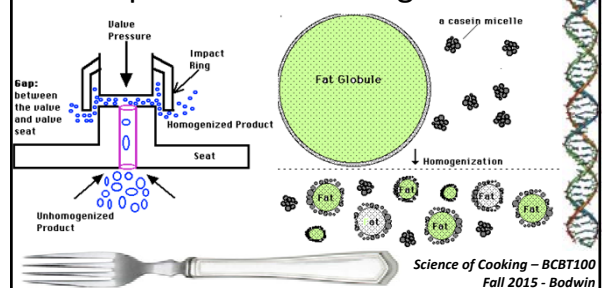
Variations in Milk



Homogenization

Increase surface area

Casein proteins coat – Negative



Sphere Math

$$\text{Volume} = \frac{4}{3} \pi r^3$$

$$\text{Surface area} = 4 \pi r^2$$

1 sphere, 2cm radius

$$\text{Volume} = \frac{4}{3} \pi (2\text{cm})^3 = 34\text{cm}^3$$

$$\text{Surface} = 4 \pi (2\text{cm})^2 = 50\text{cm}^2$$

Break into 2 spheres:

$$\text{Volume of each} = 17\text{cm}^3 = \frac{4}{3} \pi (x)^3 \rightarrow x = 1.6\text{cm}$$

$$\text{Surface of each} = 4 \pi (1.6\text{cm})^2 = 32\text{cm}^2$$

Total surface = $64\text{cm}^2 \rightarrow$ too much!

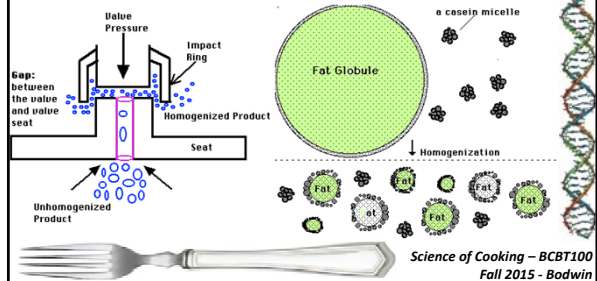


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Homogenization

Increase surface area

Casein proteins coat – Negative



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Pasteurization

Hot enough to sterilize, not cook

Batch = 145°F, 30 minutes

HTST = 162°F, 15 seconds

UHT = 265°F, 1-3 seconds

Cooked flavor due to sulfur cmpds



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Foams

Heterogeneous Mixtures

Air in solid or liquid

Milk foams

Protein and/or fat and/or sugar



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Milk Foams

Frothed Milk or “Espresso Foam”

Protein-based foam

Heat from steam denatures milk protein (whey)

Denatured proteins tangle, form net around air

Not stable – as water drains, bubbles collapse



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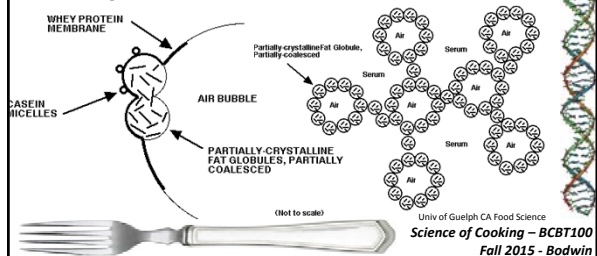
Milk Foams

Whipped Cream

Fat-based foam

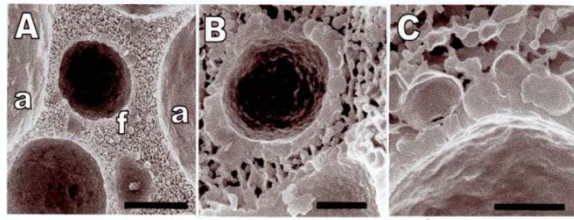
Mechanically shearing fat globules

Homogenization without the extra casein



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Whipped Cream



The structure of whipped cream as determined by scanning electron microscopy. A. Overview showing the relative size and prevalence of air bubbles (a) and fat globules (f); bar = 30 μ m. B. Internal structure of the air bubble, showing the layer of partially coalesced fat which has stabilized the bubble; bar = 5 μ m. C. Details of the partially coalesced fat layer, showing the interaction of the individual fat globules. Bar = 3 μ m.

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Whipped Cream

Cold, cold, cold – Keep fat solid
Don't over-whip

Let's whip!



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Over-whipped!

Fat globules combine = butter

Water and whey = buttermilk
"modern" buttermilk
Add protein and acid



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Butter

80% milkfat
21 pounds milk = 1 pound butter

"Churning" = mechanical shearing
of fat globules

Finishing



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Butter

Salted Butter

Reduces spoilage
Add salt or soak in brine

Sweet Cream Butter

No salt

Color?



Image: <http://finandmania-creatives.blogspot.com/2010/02/butter-sculptures.html>



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Butter

Cultured Butter

Bacteria added
Acidified

Diacetyl – "butter flavor"

Used in butter substitutes
Inhibits enzymes that protect against
oxidative damage
Exposure risk for workers and heavy
"fake butter" eaters (popcorn)

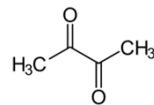


Image: <http://en.wikipedia.org/wiki/Diacetyl>



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Cooking with Butter

Lemon Butter

Add lemon and sugar

Restaurant trick

On steaks, and just about anything else

Clarified Butter

Heat to evaporate water (gently!)

Milk solids (proteins) separate

Used to flavor, fry or garnish – almost pure fat

Popcorn!

Ghee – south Asia



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Imitating Butter

Fake Butter

Emulsified vegetable oils

Added sugars and proteins – scorch easily

Not good for cooking

Margarines

“Partially hydrogenated” vegetable fat

Tallow from beef fat mixed with milk {traditional

“oleo margarine”}

Saturated fats



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