









Ingredients

Milk:

- Source influences the milk fat content, type of fats (saturated), protein content and small organic molecules
- Goat, Yak, Cow, Buffalo
 - Animals with higher fat and protein create rich cheese
 - Goat have low casein less curds and more crumbly finished cheese
 Fand Time of your and lasteting
 - Feed, Time of year and lactation
 - Alter protein / fat ratio and small flavored molecules
 - Lowest fat in August, highest in October
 - Homogenization disrupts the size and membrane coverage of fat globules – casein binds to fat and doesn't curd as well



Types of Cheese

Acid Coagulated Fresh Cheese (lactic acid from bacteria)

- no enzyme is used to finish the curd
- Cottage and Cream Cheese

Heat-Acid Precipitated Cheese (acid and heat precipitate/coagulate the protein and cause milk fat to curdle)

- Add low amounts of acid to 75-100°C temp milk
- High moisture and protein
- Ricotta (Italy) Channa and Paneer (India)



Types of Cheese

Semi-hard Washed Cheese (washing cheese removes acid and lactose)

- · Acid and enzyme induced curdling
- But removal of milk sugar and acid results in no fermentation results in a moist and less finished cheese
- Gouda, colby, muenster, mozzarella ...

Hard Cheese (Low and High Temp)

- · Low moister makes a more dense hard cheese
- Elevated temps and pressing drive off water
- Cheddar, Romano, Parmesan, Swiss



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Curds from the whey

Cheddaring – stacked and restacked at warm temps to encourage increased acid production

Pressing – squeeze curds together and remove water for hard, aged cheeses









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Aging – (Ripening or Affinage)

Aging is the process of allowing starter and finishing bacteria and their enzymes to alter composition of fresh cheese

- The French term for ripening is affinage , which means 'end' or 'ultimate point'. As such, at times this stage of cheese making is carried out by an affineur, a cheese tenderer or finisher.
- The affineur takes care of the cheeses in the cheese-ripening cellars until the cheese has ripened adequately for packing and sale





· Smaller break down products - ketones - highly fragrant



Macromolecules and flavor

Proteins (casein & whey) degrade to amino acids

- Glycine and alanine are sweet, Tryptophan is bitter
- Cysteine is eggy, Glutamate is MSG savory flavor enhancing
- Some amino acids are further metabolized to ammonia, putrecine and trimethylamine

Fats are highly modified

- lipases release fatty acids altering acid and sharpness
- Fatty acids are further oxidized to ketones, alcohols or lactones
- Produces buttery (diacetyl) taste, grassy and other flavors





Finishing Microbes

Smear Bacteria – smelly cheeses like munster and limburger cheese

- Live in high salt (most bacteria won't do well)
- Grow on surface of cheese need oxygen and can't grow in acidic conditions from starter culture
- The cultures are swiped or smeared
- on surface of pressed cheeses
- Responsible for protein breakdown

into... stinky molecules

Sulfur containing compounds – methanethiol And methylthioacetate



The Science of Cooking			
Mold actively modifies fats producing short modified fatty acids	o 3-Methylbutanal Malty	OH 1-Octen-3-ol Mushroom	O Ethyl-3-methylbutanoate Fresh Cheese
P. Camemberti - Lactic acid is further degraded by surface smear – higher pH results in precipitation of calcium phosphates of casein forming a hard shell and produces lactones, ketones and sulfur from fats and proteins	OH 2-Heptanol Herbaceus - Gorgonzola Contentional Methylanisole Anisole	Heptan-2-one Banana-Fruity - Gorgo ô-Decalactone Peach/Coconut	Capylic acid nzola Bunt / Way Butane-2.3-dione (Diacetyl) Buttery Flavor







Cheddar cheese

Aged cheddar flavor comes from production of savory amino acids and aromatic byproducts of fats, sugar and protein metabolism

- During aging enzymes released by starter and finishing enzymes create flavors
- Lactobacilli make keto and hydroxyl acids
- Lactococcus will convert these to carbocylic keto acids.
- Butyric acid give a cheesy sweaty flavor from short chain fatty acid metabolism



Cooking with cheese

Melting cheese – process of changing state of matter from solid to liquid

- Melting requires adding energy to defeat chemical bonds holding molecules in place (solid)
 - The more and stronger the bonds the higher the heat/energy it takes to break the bonds
- Cheese is a complex of many types of solids with different interactions
- Water, fat and protein content and type all alter ability of cheese to melt or cook well



Short chain faily acids – builtery of peppery taste
 Smaller break down products – ketones – highly fragrant



Cheese melting

Moisture content impacts meltability

- High protein, low water cheeses (parmesan) melt poorly as the protein sticks together well
- Acid only curdled cheeses have too inter-bonded proteins and calcium to melt well

Fat will melt first – oil drops forming in heated cheese Fat will break down and burn if not carefully handled and

heat is added too quickly

Stringy cheese is due to cross-linked proteins lubricated by melting fat – moderate acid, high fat and water

Mozzarella and cheddar work best for gooiness



Cooking with Cheese

Sauces and Soups

- These foods need to avoid stringy texture
- · Use hard cheese grated finely to avoid clumping
- Add cheese last and avoid excessive stirring
 This causes the proteins to further denature and bind to each other strings!
- Use molecules (starch) to coat and emulsify proteins and fats.
 This stops the interactions and separation of fat
- Acid (lemon juice and wine) can decrease interactions of proteins hydrates protein, removes calcium.
 Wine supplies tartaric acid it isn't about the alcohol



Cooking with Cheese

Toppings and Gratins

- Au Gratin French style of cooking with bread crumbs and butter to top of dish – add cheese and even better!
- Excessive heat browns protein (casein), evaporates water (dehydration) and melted fats create a tough oily cheese topping
- · Grating cheeses are good for this
- Try using leftovers with Cheese Au Gratin





Processed Cheese

Velveeta & Cheez Whiz – made from mixtures of young and old scraps of cheese

- Phosphate salts highly charged molecules bind well to water and casein keeping proteins in a loose protein form – soft cheese
- The reduction in protein interaction and low stringy cheese makes this great for melting

MILK, WATER, MILKFAT, WHEY, WHEY PROTEIN CONCENTRATE, SOOUM PHOSPHATE, MILK PROTEIN CONCENTRATE, ALGINATE (algae cell wall polysaccharide- emulsifier), SODIUM CITRATE, APOCAROTENAL (COLOR), ANNATTO (COLOR), ENZYMES, CHEESE CULTURE.