

# Cheese

Curdled milk with most of the water removed

Add acid and salt

Discourages “spoilage microbes”

Enzymes hydrolyse fats and proteins

Smaller molecules = flavor, aroma



Image: <http://blog.fooducate.com/2011/06/26/if-milk-is-white-why-is-cheese-yellow/>

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# Storage & transport

Waterproof “bags”

Animal parts...

Stomach → Rennet (enzymes)

Makes cheese more cohesive, pliable

This is (was) SCIENCE!



Image: <http://blog.fooducate.com/2011/04/05/10-things-to-know-about-rennet-its-in-your-cheese/>

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# Rennet

The original Biotechnology!

Chymosin enzyme (digests milk) from the  
4<sup>th</sup> stomach of a milk-fed calf

Calf <30 days old

Once off milk, chymosin stops



Image: <http://www.peta2.com/blog/warning-babies-die-for-cheese/>



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# Rennet

Modern rennets – “vegetable rennet”

Chymosin from yeast, mold, bacteria

From “genetic engineering”

Is that good or bad?



Image: <http://www.cheesesupply.com/>



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# Rennet

What does it do?

Very specific activity

Attacks kappa-casein

Casein micelles merge/string together

Analogous to fat globules in whipping cream

Why not just use acid?

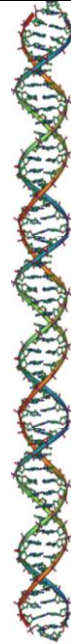
Destroys casein micelles too much

Lose some protein & calcium - nutrition

Tangy cheese?



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# Cheese Ingredients

Milk

Milk bacteria

Rennet

Salt

Time



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# Cheese Microbes

Bacteria are what make cheese

Lactococci (mesophilic, sour cream)

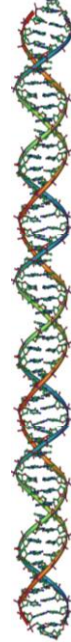
Lactobaccilli & streptococci (thermophilic, yogurt)

Propionibacteria (holes, variant causes acne)

Brevibacterium linens (stronger flavors, salty environment, seashore & skin, "smear bacteria")



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# Cheese Microbes

Molds

*Penicillium* – large family

Blue molds – *roqueforti*

Survive lower oxygen (inside cheese)

Breaks down fats – "peppery", aroma

White molds – *camemberti*

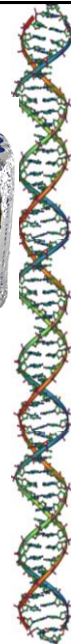
Surface ripening

Break down protein – creamy, flavor



Image: <http://www.gourmetsleuth.com/Dictionary/M/Maytag-blue-cheese-6166.aspx>

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# Making Cheese

## Acidify (bacterial)

Milk sugar to lactic acid

## Curdle casein (rennet) and drain whey

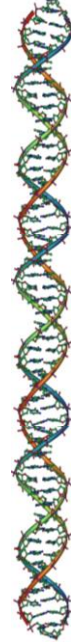
Stabilizes curd

## Ripening

bacteria + time = good



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# Curdling

## Acid

Fine, fragile gel  
Formed over hours  
Retains moisture



Image: <http://jamesranch.net/cheese/cheesemaking/>

## Rennet

Firm, rubbery curds  
Formed under an hour  
Cut to small grains,  
loses more water

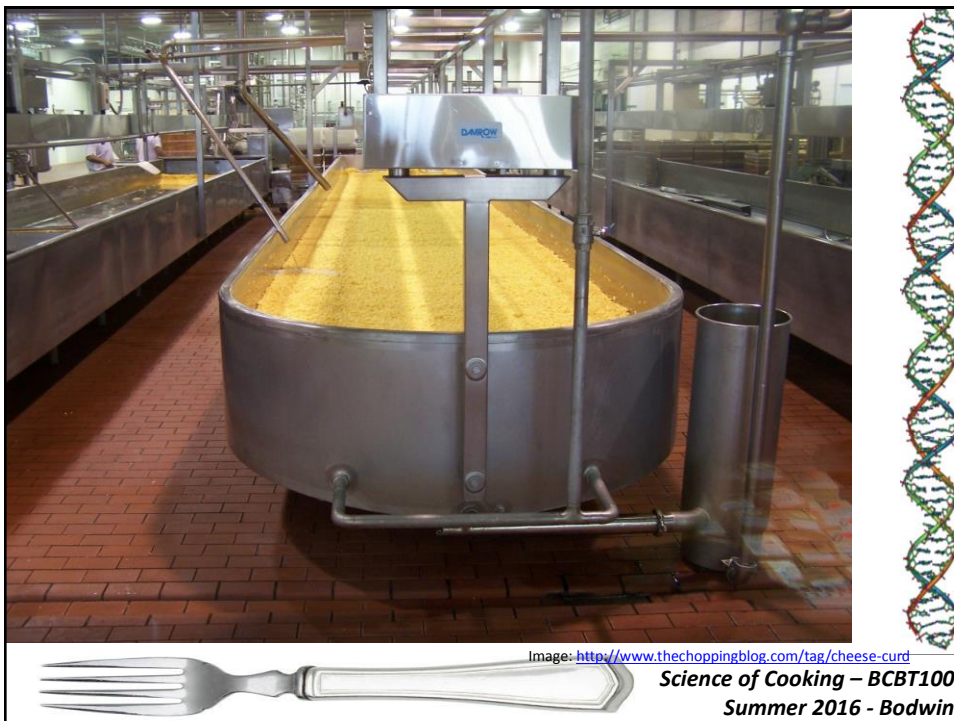


Image: <http://www.thekitchn.com/better-lunch-snacks-make-squeaky-cheese-at-home-167439>




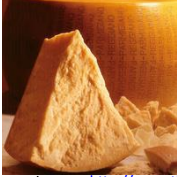
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# After the curd...

Draining – gravity, press, heat  
 Salting – mix or smear, inhibit spoilage  
 Shaping – Why wheels?  
 Ripening – Let the bacteria work!

Images: <http://www.theardentepicture.com/2010/04/food-of-day-parmigiano-reggiano.html>

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# Enjoying cheese...

Don't cut too soon

Aromatics lost

Oxygen attacks!

Let it warm a bit

Humid & 55-60°F ideal

Softens fats – Don't go too far!

Store loosely wrapped

Puddles of moisture are bad



Image: <http://www.khiewchanta.com/archives/snacks/chilli-cheese-experiment-1.html>

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# Cooking with cheese

Melting

~90°F – milk fats melt

~130-180°F – protein matrix breaks

Non-melting cheeses

Acid curdled – Why?

Stringiness

Casein strings stick together - crosslinking

Aging, acid, moisture, salt



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# Cooking with cheese

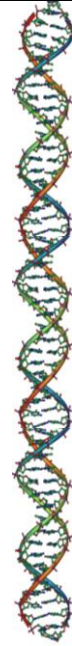
## Avoiding “stringiness”

Grate finely

Heat carefully

Minimize stirring

Add starch – coats protein and fat



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