CANADA
4-H Saskatchewan

# Fun With Foods

Reference Guide

## 4-H Motto

'Learn To Do By Doing'

## 4-H Pledge

**'I pledge**
**My Head to clearer thinking,**
**My Heart to greater loyalty,**
**My Hands to larger service,**
**My Health to better living,**
**For my Club, my community and my country'**

## 4-H Grace

(Tune of Auld Lang Syne)

We thank thee, Lord, for blessings great
On this, our own fair land.
Teach us to serve thee joyfully,
With head, heart, health and hand

CANADA
4-H Saskatchewan

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Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

AGRICULTURE COUNCIL OF SASKATCHEWAN INC.

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# Introduction

## Objectives

Upon successful completion of this project, members should be able to:

- Recognize and apply safety measures while cooking.
- Know more about four basic ingredients.
- Understand the reasons behind the methods suggested.
- Read a recipe and create new ones.
- Be able to recognize the food systems at play in different recipes.
- Recognize the role of ingredients and be able to substitute appropriate healthier ingredients.
- Make some interesting foods.
- Have fun and be creative while cooking.
- Work with others.
- Clean up when done.

## Requirements

Here is a review of the equipment you will need to do the projects given in the activity guide. You probably have most of it in your kitchen already.

1. You will need the use of a stove, oven and fridge as you will be cooking, baking and refrigerating.
2. You will also need some basic cooking utensils consisting of:
    a. Mixing bowls of different sizes: You'll need a few smaller one and at least one large one. Stainless steel or glass bowls are a good choice.
    b. A set of measuring spoons, a set of measuring cups for dry ingredients and a measuring cup with a spout for wet ingredients. Dry ingredients are measured by scooping up and levelling off with a knife. Wet ingredients are measured using a cup with a spout which will prevent spilling. Pour the liquid in the cup until it reaches the correct line of the measuring cup. Read at eye level. The bottom of the arc at the liquid surface should touch the measuring line.
    c. Spatulas, wooden spoon, forks, spoons, strainer and chopping knife
    d. Wire whisk, blender and rotary mixer. The simplest rotary mixer is the hand- held, hand-powered one, which you can use for most of the recipes in the activity guide, except for the marshmallows recipe which should be done with a free-standing mixer, as you will be pouring a hot syrup solution while beating the egg whites. There are also hand-held electric mixers and free-standing electric mixers. Any one of those should work for most of the recipes requiring mixing.

e. Small and large saucepans, skillet and double-boiler. Stainless steel cookware with heavy bottoms works well. (For more detailed information on cookware and coatings, their use and possible effects on your health, please see Health Canada's website: http://hc.sc.gc.ca/hl-vs/iyh-vsv/prod/cook-cuisinier-eng.php)

f. Baking pans:
   - Square 8" x 8" pan
   - Spring pan or cake pan (8" round pan)
   - Chiffon cake pan
   - Bread pan: rectangular shape
   - Cookie sheet
   - Muffin tins
   - Casserole dish

g. Candy thermometer: important when making bread, yogurt, crème fraiche and candy.

h. Pastry bag and tips: not strictly needed, but fun to use and helps with food presentation.

i. Parchment paper


3. Lastly, there are a few more various items you will need:
   - Mason-type jars (½ litre and 1 litre)
   - Clean cork or marble (to make butter)
   - Small freezer container
   - Cheesecloth
   - Cooling rack
   - Small cooler wrapped in blankets or sleeping bags (to make yogurt)

## Getting the Most from this Project

- Attend club activities regularly.
- Listen and ask questions.
- Try explaining what you learn to a younger brother or sister. Explaining it clearly to somebody else helps *you* to understand better.
- Learn by watching experienced cooks, in person or on YouTube.
- If you don't succeed at first, try again.
- Keep track of your attempts in your journal.

## Suggestions for Achievement Day Requirements for this Project

As a club, decide in which area(s) you will demonstrate or display your accomplishments on Achievement Day. Examples may include:

- A poster explaining basic food safety tips.
- Have a journal.
- Made from scratch at least one dish from each category (Unit 3): emulsion, foam, leavened baked product, fermented food, crystalline food, sprouted food.
- Made from scratch at least two dishes from Combining Food (Unit 4).
- Made a meal for your family that includes at least a salad, entrée and dessert made from scratch and incorporating all the categories: foam, emulsion, leavened baked product, fermented food, crystalline food and sprouted food.
- Created a new dish and given it a tantalizing name.
- Done one volunteer project in the community.

## Safety While Online

The Internet is a great resource when you start learning about cooking. There are many helpful YouTube videos explaining how to make various recipes and showing you in detail the results you want to achieve. It's like having a chef in your own kitchen. There are also interesting forums where people share their joys and troubles about making new foods. These places can be very helpful in learning to cook. Use the following guidelines at all times when online:

- Never attach any personal information (names, addresses, phone numbers, date of birth, what school you attend, etc.) to the questions you post online. Always remember the person you are talking to in a forum may not be the person they claim to be.
- When using social networking sites like Facebook or MySpace, set your online profile to private. That way, the only people able to see your profile will be those that you approve. Don't give out your passwords to anyone but your parents or guardian and never meet anyone in person by yourself that you just met on these sites.
- If anything happens online that makes you feel scared, uncomfortable or creeped out, always tell your parents or guardian. Report any inappropriate comments or messages that violate the terms of service for that site.

## Resources for Learning

### People

Asking questions to knowledgeable people, watching them in action and receiving feedback from them can help you become a better cook. These people might be able to help you in that way:

- Your parents or guardians, grandparents or any cooking enthusiasts from your extended family
- Your Home Economics teacher
- Continuing Education Faculty at a local University
- Other 4-H members or leaders
- Local restaurant chef

### Resources

- Cookbooks or magazines about food and cooking
- Television shows about cooking
- Websites and YouTube videos explaining methods of cooking.
- Library books, DVDs
- Government publications

### Places, Events, Organizations

- Cooking classes in your community. Sometimes chefs from well-known restaurants give classes using high school home economics facilities.
- Colleges or universities that offer nutrition, dietetics, human ecology or home economics programs.
- Organizations such as Slow Food Canada.

### Websites

There are many websites where you can find information on making just about any kind of food. Many YouTube video are also helpful in showing you how to go about making a recipe you may be unfamiliar with and can give you a visual image as well as detailed information. *A picture is worth a thousand words* and so is a video. The web can also give you information on cooking classes that may be available in your community or give you information on other organisations that maybe interested in food in general. For example, some volunteer organisations in urban centres collect unwanted fruits and vegetables in people's yards, cook with them and distribute parts of the proceeds to the owners, volunteers, shelters and the food bank in the community.

## Fun with Foods: An Introduction

*In France, pastry shops are works of art!* I was told that, shortly before leaving for Europe. I dismissed it as an exaggeration. Works of art, well… works of art are great symphonies that bring tears to your eyes, amazing paintings from past centuries**,** breath taking sculptures so full of life you think they'll start talking . But a pastry shop?

Yet, when I walked into my first pastry shop in Paris, there they were: rows of delicate, tiny pastry, exquisitely beautiful with little puffs of artistically arranged whipped cream, surmounted by a jumble of fruits fresh from the fields. The shop was orderly, yet vibrant and full of colour! And when I bit into one of those little morsels of pure culinary artistry, I thought I had died and gone to heaven. The cream was so fresh, the fruits so juicy, the pastry shells so light and airy! I smiled to myself and thought, *in France, at least, pastry shops are works of art*.

But *before* you write a symphony you need to learn the notes and the sound of different instruments. Before you paint an art piece of the century you need to learn how to hold your brush, mix your paint and observe details. And before you open your work- of- art pastry shop,

you need to learn about ingredients, basic cooking techniques, their application and food safety. Now you can let your creativity soar, or just make a tasty dish and that is fine too.

Making food from scratch is fun and it will help you make friends. Show up with a warm loaf of bread or a freshly made batch of cookies and you'll be a food hero. There are some foods you simply can't buy in your local grocery store. (Ever seen a ready-made soufflé?) You can choose healthier ingredients and avoid some unnecessary food additives. Homemade food often tastes better and you can turnout an amazing variety of dishes, from entrees to desserts, with just a few basic ingredients such as eggs, flour, milk and butter. It's more environmentally friendly since you cut down on the packaging and the transport involved with readymade foods. And finally, preparing food from scratch will give you a sense of pride and accomplishment. Imagine presenting your family with a baked Alaska, fresh out of the oven. The *ooh*s! and aahs! you'll get will be music to your ears and worth every minute spent beating those egg whites into an amazing meringue. Now, on to the magic of cooking!

# Unit 1: Safety in Cooking

Cooking – a high risk activity? Nothing like mountain climbing or paragliding! Yet in Canada 1,000 outbreaks of food poisoning involving 5,000-6,000 cases are reported every year. And that's just the tip of the iceberg as many cases are never reported. Food poisoning can make you sick and often it can be avoided with a few simple precautions, which we'll talk about. Fires, burns, cuts, slips, falls, chemical contamination and electrocutions are a few more potential hazards in an active kitchen. This is not to discourage you from cooking but rather to encourage you to pay attention to some basic safety rules *while* cooking. So take a few minutes to review the following important safety tips for the kitchen.

## Food Poisoning

Safety means that the food you serve to your friends is safe to eat and doesn't send them to the hospital with a case of food poisoning.

Health Canada Fight BAC's 4 steps are:

1. Wash your hands before cooking and after a trip to the bathroom, and clean cooking surfaces often.
2. Separate foods that could contaminate each other such as raw meat and vegetables.
3. Promptly chill, by refrigerating, groceries from the store or leftovers.
4. Cook to the proper temperature fish, chicken and meat, since they are the foods most prone to bacterial contamination.

Can you think of some more safety measures? We know from long experience that respecting expiry dates, keeping cold food cold and warm food warm and thawing frozen foods in your fridge or in cold water changed often, are three more ways you can keep food safe to eat. Food-poisoning bacteria have two allies, temperature and time. Room temperature is the ideal temperature for most disease-causing bacteria to thrive and reproduce. So the longer potentially contaminated food items such as raw meat and fish are left at room temperature, the more time it gives to the bacteria, who might be present, to reproduce and cause sickness.

## Food Spoilage

Generally speaking, there are six main factors responsible for food spoilage:

1. Microorganisms such as yeasts, molds and bacteria spoil food by causing unwanted changes in texture, flavour and colour.
2. Enzymes responsible for the ripening of fruits and vegetables will cause food to spoil if the enzymatic action is not slowed down or stopped once ripening is achieved. This enzymatic action will cause undesirable changes in colour, texture and flavour.
3. Oxidation is the reaction of food items with the oxygen present in the air. It is responsible for the browning in cut fruits and vegetables for example.
4. Excessive moisture causes food to spoil as microorganisms use the unbound water to grow.
5. Temperature affects both the action of microorganisms and the action of enzymes. Microorganisms are more active at room temperature and less so in colder temperature. Enzymes activity is also higher at room temperature but slower at fridge or freezer temperature. However at a very high temperature, the temperature of boiling water for example, enzymes are denatured. That is why immersing fresh vegetables in a boiling water bath for just a few minutes before freezing them will improve their keeping quality. It will denature the enzymes responsible for unwanted changes in colour and flavour.
6. Lastly, rodents and insects may also cause food spoilage.

So what can you do to prevent spoilage? Keep meat, dairy, eggs, ripe fruits and vegetables in the fridge or the freezer as microorganisms and enzyme activity are slower at those lower temperatures. Keep food in the fridge or the freezer properly wrapped to prevent oxidation. Store food at the right temperature for that particular food item; ice cream goes in the freezer and fruits and vegetables in the crisper at the bottom of your fridge. When storing dry foods such as flour, grains and beans make sure your container is dry. If you go camping or go to your cottage, store food in hard plastic, metal, wood containers or glass jars to keep the food dry and away from rodents or insects. Mice are particularly good at gnawing on plastic bags and cardboard to get to bread, crackers and other dry items. So again, prevention is the best cure.

## Knives and Other Sharp Edges

Keep knives sharpened. When a knife is dull, it does not cut well and tends to slip off and cause accidents, while a sharp knife will slice through easily. Of course, handle all knives carefully. Use them with a cutting board, and put them away when done. Store your knives close to your working areas to avoid walking any distance with them. If you must walk with a knife, make sure it is pointing down, to avoid slipping and having the sharp point aimed at you. And never use any utensil to pry food out of a plugged-in toaster or electrical appliance as it could cause electrocution. Before slicing and dicing a vegetable or fruit, make one cut through centre to

produce two flat surfaces. Then, place the food on its flat surface and slice from that stable configuration. When opening a can, always wash the top, in case it falls in. And again be careful with the sharp edge of the lid.

Food processors, blender and other appliances that have sharp attachments or blade-like parts should also be handled carefully to avoid serious cuts. Use them, wash them and put them away. As a general rule, be on the lookout for sharp edges, use them carefully and put them away as soon as you are done.

## Fire and Electrocution

What can you do to avoid having to call firefighters or ambulance to your rescue while cooking?

1. When cooking on the stove, begin by using back burners first.
2. Make sure that handles are turned towards the interior.
3. Keep baking soda handy to extinguish fires.
4. Watch out for dangling electrical cords, long loose sleeves or anything else that can catch on pots or ignite on hot burners.
5. Whenever using an electrical appliance, make sure it is on firm surface, away from any water source with the cord safely plugged in away from busy walkways. Check cords periodically to make sure they are not frayed and if they are, ask a knowledgeable person to fix them. Frayed electrical cords can cause electric shock so be careful. And it goes without saying never, ever stick a finger, a knife or a spatula into any running appliance.

Other ways that help lower risk of injury are**:**

1. Using dry, thick oven mitts when handling warm pots or casseroles.
2. When lifting a lid, tilt it away from you to avoid a blast of steam, which is extremely hot and can burn quickly.
3. If you have long hair, tie it so it doesn't burn or fall into the food you're preparing. That, in fact, is the reason that chefs traditionally wear those high white puffy hats.

## Slips and Falls

By wearing sturdy non-slippery shoes and wiping counters to avoid water dripping on the floor, you'll help prevent slips and falls. Ideally, your floor has a non-slippery surface. If you use throw rugs in your kitchen, it should have a non-slippery rubber-type backing to avoid sliding and slipping.

## Chemical Contamination

Chemical contamination is mixing a toxic substance with a food item. Since soaps and cleaners are often stored in kitchen cupboards, they should be clearly labeled and stored safely in sturdy

containers. It will prevent them from contaminating your food supply and cause you or your family to become sick.

If you need to store a food item in a different container than its original one, label it clearly. Never taste an unknown product to find out what it is. It could be toxic and make you sick even if you only ingest a small amount.

## Cleaning Up

The cooking is not done till the cleaning's done. Keeping your cooking space clean and free of clutter, washing while waiting for dishes to cool and putting ingredients away after you use them are three ways to do this. Can you think of others?

Nobody likes facing a dirty kitchen and more so if someone else left it dirty. It's perfectly fair to enlist the help of others if they're going to eat your creations! So trade away… I cook; you clean… but just make sure it's not all left to your parents or guardians.

## References and Other Resources


- Health Canada establishes regulations and standards relating to food safety and nutritional quality of foods sold in Canada. Their website is http://www.hc-sc.ca
- http://healthycanadians.gc.ca/eating-nutrition/safety-salubrite/in
- Public Health Agency of Canada: www.phac-aspc.gc.ca/fs-sa/index-eng.php
- Canadian Food Inspection Agency: www.inspection.gc.ca
- http://www.befoodsafe.ca/en-home.asp
- http://www.canfightbac.org/cpcfse/en/about
- http://www.thecanadianencyclopedia.com/articles/food poisoning
- http://www.premiersystems.com/recipes/kitchen-safety/cooking
- http://food.unl.edu/web/safety/poisoning. from Julie Albrecht. PhD., R.D. UNL Extension Food Specialist)

# Unit 2: Ingredients

## Introduction

Before you write a symphony you learn notes and before you cook an amazing meal you learn about ingredients, your tools of the trade. When you're a Chef, your pots are your canvas, your utensils are your brushes and your ingredients are your paints. So let's take a closer look at four main food items, flour, eggs, milk and fats. Other ingredients such as sugar, salt, lemon juice, fruits, vegetables, etc., will be needed to make the recipes as you go through the activity guide. However we will not cover them here. Make sure to read the ingredients needed before you attempt the recipes to make sure you have everything that's required on hand.

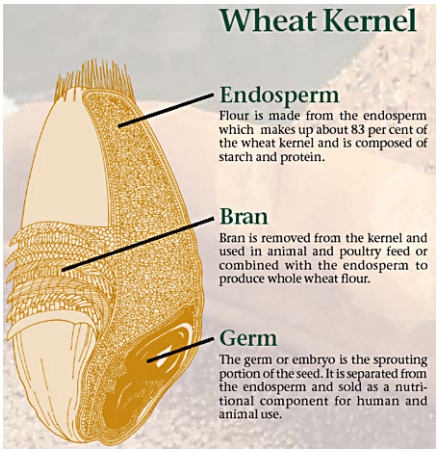
## Flour

### Wheat

Wheat is the most important cereal in the world. It's in the grass family, *Gramineae,* and its Latin genus name is *Triticum.* Worldwide Canada is sixth in production of wheat but one of the largest exporters. We export roughly four-fifths of the wheat we produce all over the world. The top export markets are the United States, Indonesia, Iraq and Japan.

Wheat, like all other grains or cereals, has three parts:

1. The **bran**, the hard outer layer of the seed or the kernel's skin, is valued for its dietary fibre.
2. The **endosperm**, the centre and biggest part of the kernel, is mostly starch with some protein.
3. The **germ**, comprising only two to three per cent of the kernel is the part of the seed that grows into the new plant and is rich in fat, protein and vitamins.



## Types and Uses of Wheat

If you live in Alberta, Saskatchewan or Manitoba, you probably see a lot of wheat fields as 90% of the wheat grown in Canada is grown in those three provinces. Roughly one-fifth of the wheat grown is Durum wheat, which is ground into a grainy powder consisting almost entirely of endosperm particles called semolina and used chiefly to make pasta. Durum wheat is mostly grown in Saskatchewan. The common wheat that we know better as hard and soft wheat, depending on the hardness of the kernel, is usually milled to make bread, pastries, cookies, pie crusts and other products. Wheat's also classified by colour – red, white or amber. It's further divided into winter or spring wheat, depending on when it's sown.

## Milling

Imagine for a moment that you live in a world with no electricity, gas, television, iPod, radio, cell phone or any other electric or electronic gadget you take for granted. And then imagine I give you a few grains of wheat and ask you to make flour. What would you do? What do you think your ancestors a few thousand years back would have done?

Our ancestors might have used two stones: one as quern stone, a flat stationary stone where the grain would be deposited and a hand stone, an upper mobile one which would be used to grind the grain.

Later on mills became two large circular stones powered by slaves and animals. Eventually, water and wind replaced slaves and animals. Now mills are run by electric motors. Even though the methods have changed, the basic principle is still the same: cracking the grain to make it into a fine powder used in many ways.

Commercial grain mills have operated in Canada for over 200 years. The grandfather of all Canadian milling wheats was introduced in Canada in 1851. Some of Canada's largest modern grain mills are operating at or near locations where mills have operated for more than 100 years. There are approximately 55 commercial wheat and oat mills from coast to coast. Commercial scale wheat and oat mills operate in 8 out of 13 provinces and territories. The majority of wheat milling capacity is in the east in close proximity to urban centres. The majority of oat milling is done in the Prairie Provinces. Canadian mills grind over 3.5 million tonnes of wheat, oats and barley each year. They export wheat flour, semolina and other milled grain products to over 30 countries, with the United States being the largest export market.

There are also small facilities that will make specialty flours. And families interested in making their own very fresh flour with no additives added can buy small electric grinders for home use.

## Types and Uses of Flour

Flour can be made with different kinds of grains, legumes or even starchy vegetables such as potatoes**.** Wheat is often preferred in baked product where gluten development is important such as yeast-raised breads. Of all the grains, wheat has the most gluten. Some people are celiac or gluten resistant and they need to avoid any grains containing gluten which means they need to avoid wheat, rye, barley, kamut, spelt and triticale. Flours made with amaranth, rice, corn, teff, quinoa, buckwheat, pure uncontaminated oats, potato and any legumes are okay for them to eat. The *Canadian Celiac Association* and *Health Canada's* websites can give you further information if you have these conditions.

Hard wheat flour typically has higher protein content and is more suitable to make bread. Soft wheat flour has lower protein content and is used for soft pastry, biscuits, and pie crusts. Durum wheat flour is mostly ground into semolina to make pasta.

There are different types of wheat flour. Here is an overview of the most common ones:

1. **Whole wheat flour**: The bran, germ and endosperm of the grain have been ground. Nothing has been removed and nothing has been added. Sometimes the bran may be partially removed and then it is called 90% or 80% whole wheat. Whole wheat flour is more nutritious but may go rancid more quickly, if not kept in the freezer. The germ, which is rich in oils, is prone to rancidity. This type also includes fresh homemade flour ground in small mills sold for home use.
2. **White flour**: The germ and the bran have been removed, leaving the endosperm to be ground. It is refined and is usually enriched to add back some of the important nutrients that are lost when the bran and germ are removed. If it is marked *unbleached* flour, it means that no bleaching agent has been added to it. If *unbleached* is not marked on the bag, then the white flour has been bleached, which means a compound has been added to whiten it.
3. **Bread flour**: Because it is made from hard wheat and has high gluten content, it is the best flour to make yeast-leavened bread. It comes in white, whole wheat, organic, bleached and unbleached.
4. **Cake flour**: It is made from soft wheat, so it is low in protein content. It is chlorinated to further break down the gluten. It is a good flour to use when a tender and delicate texture product is desired. It is used to make cake, especially white cake, biscuits and cookies with a tender crumb.
5. **Pastry flour**: It is also made from soft wheat and is low in protein content, but slightly higher than cake flour. It is non-chlorinated and is good to make pastry, pies and cookies.

6. **All-purpose flour**: It is white flour made of a blend of hard and soft wheat so it has a medium amount of protein. It can be bleached or unbleached and is good for making cakes, cookies, breads and pastries.
7. **Organic flour** is made from grains grown organically and processed according to organic standards. For wheat or grains to be labeled *organic* they need to be grown without artificial fertilizers, herbicides or pesticides and to have been inspected by an organic certification body.

## Agriculture Methods of Grain Production in Canada

The trend for the last 70 years has been towards fewer but larger farms with an increase in mechanization. Most of the wheat, oats, barley, flaxseed and canola grown in Canada are grown in Alberta, Saskatchewan and Manitoba. Conventional agriculture methods tend to rely on chemical fertilization and chemical control of weeds and pests. However the organic sector has seen a dramatic growth in the last few years due to increased expectations from consumers regarding their food and their environment. *Organic* means that the grains have been grown without chemical fertilizers, herbicides or pesticides and are certified by a recognized Organic Certification body. The industry analysts recognize the organic food market as the most dynamic and rapidly growing sector.

## Quality Control from Producers to Consumers

The **Canadian Grain Commission** provides quality control for the grain industry by defining grading standards and ensuring that these standards are applied consistently. Their website provides information on sampling program, food safety, harvesting and export quality, grain inspection and testing, grain safety assurance, grain sanitation and storage and quality standards for Canadian grain grades.

## Laws and Policies Affecting Grain and Flour Production in Canada

The Canadian Grain Commission is a department of **Agriculture and Agri-food Canada**. Subject to the *Canada Grain Act*, an Act of Parliament passed in 1912 and revised in 1995, the Canadian Grain Commission "*shall in the interest of grain producers, establish and maintain standards of quality for Canadian grains and regulate grain handling in Canada to ensure a dependable commodity for domestic and exports markets*." Under the Canada Grain Act, 21 of the grains grown in Canada are considered official grains. All other grains are not regulated by the *Canada Grain Act.*

There are 5 categories of grains protected by the *Canada Grain Act:*

1. Cereals which includes barley, oats, rye, triticale and wheat.
2. Oilseeds which includes canola, flaxseed, mustard, rapeseed, safflower, solin, soybeans and sunflower seeds;

3. Pulses which includes beans, chickpeas, fababeans, lentils and peas;
4. Mixed grains which include mixture of wheat, rye, barley, oats, triticale, wild oats, domestic or wild oat groats;
5. Other crops which includes buckwheat and corn.

There are many uses for each of these grains. In terms of food, in general they are sold as grains, beans and seeds to be used in soups, casseroles, salads and a great variety of dishes; cereals and pulses can also be ground into flours, while the oilseeds can be crushed into oils; they are also used in the production of foods such as breads, baked products, breakfast cereals, snacks, cookies, noodles, sweetener, syrup and alcoholic beverages. In terms of non-food item, they can be used in the production of cosmetics, plastics and fabrics. And they can also be used in the production of livestock feed and fodder. For a more detailed list of the end uses for each grain, consult the Canadian Grain Commission website: http://www.grainscanada.gc.ca.

# Eggs

## Egg Industry in Canada

There are 1,015 registered egg farms in Canada. The average flock size is 19,000 hens but ranges from a few hundred to 400,000. An average laying hen produces three hundred eggs a year. The most popular breeds are White Leghorn and Rhode Island Red. In 2007, Ontario led with almost 40% of the Canadian egg production, followed by Quebec, with close to 20%. The Prairie Provinces together produced 23%, British Columbia, 12% and the four Eastern Provinces produced roughly 8% of Canadian eggs.

In Canada in 2009, there were 261 federally registered egg grading stations and 14 federally registered processing eggs establishments. Canada's egg industry operates under an orderly marketing policy framework called supply management, designed to encourage the production of a sufficient volume of egg to meet market needs.

## Grading and Use of Eggs

All eggs available for consumers in Canadian grocery stores have to be **Canada grade A** eggs. Grade A eggs have a normal shape with a clean, uncracked shell, round well-centred yolk, firm white and small air cell. There are two more grades, **Grade B** and **Grade C**. Grade B eggs have an uncracked shell but may be slightly soiled or stained, might have a rough texture and have a slightly flattened yolk and a watery white. They are sold for commercial baking or for further processing into foods such as mayonnaise, noodles and baked goods. They may also be sold to restaurants or hospitals. Grade C eggs are the lowest grade. The shell may be cracked, the yolk is loose and the white thin and watery. If they are pasteurized they may be used in the production of processed eggs. Egg processing includes the production of whole eggs, albumen and egg yolks in frozen, dried or liquid form. Grade C eggs may also be used in specialty items such as shampoo, pet food and adhesives.

In 2009 Canada exported for $24.6 million of processed eggs but only a little less than $400,000 of fresh/preserved/cooked shell eggs. Canada also imported for $46.4 million dollars of eggs and egg products.

## Quality Control from Producers to Consumers

If you have your own chickens, then you gather their eggs, wash them, put them in the fridge and eat them soon after. And that's the way to get the freshest eggs possible. But if you don't have chickens and you buy them at the grocery store, what happens?

In federally-registered egg grading stations, eggs are received in a sanitary and refrigerated area, washed and sanitized to remove dirt and bacteria adhering to their shells. Then they are candled, which means they are passed over a strong light to determine internal defects such as blood spots, meat spots, rot, or poor quality. Candling also make cracks visible. Then they're weighed. Each size has a weight requirement and includes jumbo, extra large, large, medium, small, and peewee size. Once the eggs have been graded, they're packed according to their grade and size, stored in coolers till they're loaded for transport in refrigerated trucks and delivered to a grocery store near you.

The **Canadian Food Inspection Agency (CFIA)** inspectors across Canada monitor operations and take food samples from egg grading and egg processing stations for laboratory analysis to verify compliance with food safety regulations and product standards. In addition, the Canadian Egg Marketing Agency and its provincial/territorial partners have put in place a Hazard Analysis Critical Control Points, HACCP-based *Start Clean-Stay Clean*$^{TM}$ program which is a code of farm management practice designed for production of high quality, clean eggs that complies with internationally recognized safety standards.

## Laws and Policies Affecting Egg Production in Canada

The egg industry is regulated by the *Canada Agricultural Products Act*, which controls grading, health and safety, egg station registration, packing, marking, size and inspection requirements. The egg industry may also be affected by the following Acts:

1. *Health of Animal Act*: an act respecting diseases and toxic substances that may affect animals or that may be transmitted by animals to persons and respecting the protection of animals.
2. *Safe Food for Canadian Act*: an act to make food as safe as possible for Canadian families. It protects consumers by targeting unsafe practices; implements tougher penalties for activities that put health and safety at risk; provides better control over imports; institutes a more consistent inspection regime across all food commodities; and strengthens food traceability.
3. *Feed Act*: an act to control and regulate the sale of feeds.

4. *Consumer Packaging and Labelling Act*: an act to protect consumers from misrepresentation in packaging and labelling and to assist consumers in differentiating between products. A *product* is defined to mean any article that is or may be the subject of trade or commerce including both food and non-food items.

If you want to find more detailed information on the subject, you can consult the following websites:

- http://www.agr.ca/pol/mad-dam/index_e.php?s1=pubs&s2=r
- http://www.inspection.gc.ca/about-the-cfia/acts-and-regulations
- http://laws-lois.justice.gc.ca/eng/regulations/C.R.C,_c_284/index


# Milk

## Dairy Industry in Canada

The Canadian dairy industry is the third largest agricultural sector in Canada, after grain, oilseeds, and red meat. 82% of the dairy farms in Canada are in Ontario and Quebec, 13% in the Western provinces and the remaining 5% in the Atlantic Provinces.

There are 1.4 million dairy cattle in Canada and a typical farm would have 77 cows. The vast majority, 94% to be exact, of dairy herds are **Holstein**. Holstein cows are popular milking cows due to their good conversion ratio, which is their ability to turn feed into milk, their highest average milk production (30 litres/day of milk per cow) and the greatest content of protein in their milk compared to other breeds of cows. The other 6% of dairy cattle are **Ayrshire**, **Brown Swiss**, **Canadienne**, **Guernsey**, **Jersey** and **Milking Shorthorns**.

Ayrshire, as the name implies, is a breed of cow that originated in the county of Ayr in Scotland. Ayrshire cows are vigorous, efficient milk producers (25 litres/day) and have a superior shape and quality udder. The Brown Swiss breed originated in Switzerland as the name implies. It is a large, robust, very gentle, strong and rugged breed, producing an average of 25 litres of milk/day. Its milk has a high fat content. Canadienne has been declared a rare breed by *Rare Breeds Canada*. It is the only dairy to have developed in North America. Canadienne cows of today are the descendants of the cows brought to Canada by Jacques Cartier in the early 1540 and Samuel de Champlain in 1608-1610. This breed adapted to survive the harsh conditions of the Canadian winters. Its milk is rich in fat and protein and is used to produce specialty cheeses. Guernsey, originated on the island of Guernsey in England. It is very adaptable and its milk has a high fat content. It has been declared an endangered breed by Rare Breeds Canada. Jersey produces the milk with the highest fat content of all breeds. It makes excellent cheeses, ice cream and whipping cream. It's the smallest of the dairy breeds and produces an average of 22 litres of milk/day. Lastly, Milking Shorthorns were brought to North America as a multipurpose animal in the early 1800s to provide meat, milk and a source of power for farmers. It is a hardy, good natured and efficient milk producer.

The three largest processors of dairy are Saputo, Agropur and Parmalat. They process close to 80% of the total raw milk production in the country. The fluid milk market, which provides the milk you drink, represents 38% of the milk production. The market for other dairy products such as butter, cheese, yogurt and ice cream accounts for 62% of the dairy production.

The production of organic milk is steadily increasing and has more than doubled in the last five years. Organic milk is pasteurized and homogenized and is held to the same standards as conventional milk. For a farm to become certified organic it can take up to four years of transition period. The land, the crops and the cattle must all be certified. In general, farmers may not use pesticides or commercial fertilizers on their land for three years prior to being officially recognized. The milking cows need to be fed organic feed for 12 months prior. Farmers may not use antibiotic or hormone treatments and when veterinary drugs other than those listed in the *Permitted substance list* are used, there is a withholding period. Organic farms generally require a 5-10% increase in labor but save on fertilizers, spray and medical expenses. Typically it also uses 20-50% less energy than conventional farming.

The majority of the organic milk production is concentrated in four provinces: Quebec, Ontario, British Columbia and Alberta. Milk, yogurt, ice cream and cheese are the most popular categories of finished organic dairy products in Canada. Organic milk and yogurt generate the highest revenues.

There are 700 varieties of cheese made from cow, goat or ewe's milk produced in Canada. However the dairy that is imported in Canada is mostly cheese and milk protein ingredients and is imported from the European Union, the United States and New Zealand.

In 2011, dairy production was 16.4% of the Canadian food and beverage sector. There are 453 milk processing plants (including 273 federally-inspected) and they contribute to more than 22,500 jobs across Canada. And finally, the Canadian dairy sector operates under what is called a **supply management system**. The benefits of this system are to have consistent and stable prices for producers, processors and consumers and ensure a constant and certain supply of milk. It was introduced in Canada as a way to address the problems of unstable markets, uncertain supplies and highly variable producers and processors income. This system is based on planned domestic production, administered pricing and dairy product imports control.

## Types of Milk

There are many types of milk available on the market. Here is an overview of the most common ones:

1. Whole milk: Contains 3.25% milk fat.
2. Skim milk or partly skimmed milk: When some of the fat is removed, it becomes 2% or 1%, depending on how much fat has been removed. Skim milk is virtually fat free and contains only 0.1% milk fat.
3. Buttermilk: Fresh milk with a bacterial culture added. Buttermilk is also the liquid left over from making butter. But the buttermilk available on the market is cultured milk.
4. Filtered milk: Regular milk passed through filters to remove most microorganisms, making it seem creamier.
5. Ultra Heat Treatment milk (UHT): Sterilized milk that has been heat-treated at an ultra-high temperature (138-158° C). Once it has cooled down, the milk is poured into a sterilized package (tetra-type box usually) without air contact. When unopened, the UHT milk will keep for several months at room temperature. Once opened, it must be refrigerated and consumed within three days.
6. Evaporated milk: About 60% of the water is evaporated from fresh skim, 2% or whole milk. It is sealed in cans and is heat tolerant making it excellent for baked goods and slow-cooker recipes.
7. Lactose-free milk: Regular milk that has been processed to break down lactose, the sugar in milk. It helps people with lactose-intolerance to easily digest milk.
8. DHA milk: Milk that comes from cows fed a conventional diet enriched with DHA, docosahexaenoic fatty acid, a type of omega-3 fat, from natural sources. The enriched diet allows cows to produce milk that is naturally higher in DHA, which supports the normal development of brain, eyes and nerves.
9. Organic milk: Milk from cows fed crops that are organically grown.

## Quality Control from Production to Consumers

From the milking of the cow to the serving of the milk in your glass, there are steps to make sure that the milk is always kept warm enough not to freeze and cold enough to keep bacteria growth in check. There are steps to make sure that milk is free from any kind of contamination.

Dairy farmers in Canada are implementing a food safety program on their farms called the **Canadian Quality Milk Program (CQM)**. This program is based on best management Practices (BMPs) which are recommended and proven management procedures that help prevent on – farm safety problems from occurring.

These practices deal with:

1. Dairy facilities, pesticides and nutrient management.
2. Feed.
3. Animal health and biosecurity.
4. Medicines and chemicals used on livestock.
5. Milking management.
6. Facility and equipment sanitation.
7. Use of water for cleaning milk contact surfaces.
8. Staff training and communication.

These Best Management Practices are the foundation of any **Hazards Analysis Critical Control Points (HACCP)**. Critical Control Points are a point, a step or a procedure at which control can be applied and a food safety hazard will be prevented, eliminated or reduced to acceptable level. Safety hazards can be biological. Pathogenic (disease-carrying) bacteria, fungi, viruses are biological hazards. They can be chemical. Pesticides, toxins, allergens are chemical hazards. And they can be physical. Broken needles, glass, metal, wood would be physical hazards.

The following website will give you more details on the subject:

- http://dairyinfo.gc.ca/pdf/workbookpdf

## Laws and Policies Affecting Milk Production in Canada

Laws and Policies exist to ensure that all dairy products produced, transported, processed, sold in Canada, imported or exported are safe to eat and meet standards of quality. The *Canadian Dairy Regulations and Codes of Practices* is comprised of the *National Dairy Code* and *Code of Practice (Animal Care).* And here's a list of other relevant acts and regulations*:*

1. *Canadian Dairy Commission Act:* This act regulates the actions of the Canadian Dairy Commission. The Commission seeks to provide the producers of milk and cream with a

fair return for their labor and also seeks to ensure that consumers will have an adequate supply of high quality dairy products.

In addition each province also has regulations affecting milk production and safety of dairy products.

2. *Canada Agricultural Products Act – Dairy Products Regulations:* This act regulates the marketing of agricultural products in import, export and interprovincial trade. It also provides national standards and grades of agricultural products, for inspection and grading, for registration of establishments and for the standards governing the establishments.
3. *Dairy Products Marketing Regulations:* Under the Canadian Dairy Commission Act; regulations about all aspects of marketing of dairy products in Canada.
4. *Food and Drug Regulations:* In general, it is an act that covers the advertising, selling, labelling, packaging, treating and processing of food, drugs, cosmetics and devices. It is enforced by Canadian Food Inspection Agency (CFIA) inspections. It is applicable to dairy products as this act seeks to ensure that the food eaten by Canadians contains no harmful or poisonous substances unfit for human consumption.
5. *Agricultural Products Marketing Act:* This act provides for the marketing of agricultural products in interprovincial and export trade.
6. *Organic Production Systems: General Principles and Management Standards/Permitted Substances List:* This document describes the principles and management standards of organic production systems. It also provides a list of substances that are allowed for use in organic agriculture.

You will find more information on Acts and Regulations on the following website:

- http://www.dairyinfo.gc.ca/index_e.php?s1=dr-rl&page=canada

## Butter and Fats

There are many types of fat available: butter, margarine, lard, shortening and a variety of oils. Since each one has specific characteristics, such as their smoking point or the temperature at which they are solid, one fat may not easily substitute for another in many recipes. For example, you would not use butter, margarine or lard to make oil and vinegar vinaigrette but you could certainly use different oils to make that vinaigrette. Similarly, canola, sunflower or soybean oil would be a poor choice for a butter cake.

To finish our section on ingredients, we will take a closer look at the production of two fats in Canada, butter and canola oil, since canola is now the major Canadian crop.

## Butter Industry in Canada

The production of butter increased by 15% from 2006-07 to 2010-11.It may be due in part to the debate between margarine or butter as being the healthiest choice swinging back towards butter. Proponents of margarine point to the fact that margarine is made with vegetable oils, which are lower in saturated fats and hence better at preventing cardio-vascular disease. Proponents of butter as the healthiest choice point to the fact that fats should be used in small amounts anyway and that the hydrogenation of oil to turn in into margarine is an artificial process producing trans-fats which can negatively affect people's health. Butter imparts a nice flavour to food. But it should be eaten in small amounts. Foods such as cakes and pastries with a high fat or butter content should be eaten sparingly.

In 2009, Ontario produced 37% of Canadian butter, Quebec, 28% and the other 8 provinces produced 34%.

## Canola Oil in Canada

Canola oil is the most important edible oilseed grown in Canada. In 2005, it surpassed wheat as the most valuable field crop in Canada. In 2008, it was the number one generator of crop receipts for all crops. Canola production is concentrated in the Prairie Provinces. Other vegetable oils such as sunflower, soybean, and corn are also grown in Canada. Sunflower seeds are grown in the southern part of the prairies and are used in the confectionary and baking sectors, in birdseeds and animal feed industry in addition to being crushed for oil. Corn is mostly grown in Ontario and Quebec with a small production in Manitoba. Corn is used in feed for livestock and is used in the ethanol industry. Soybeans are grown in Ontario and Quebec.

Other fats are margarine made by hydrogenating vegetable oils. Margarine is used as a butter substitute. Lard is the fat rendered from animal such as beef and pork. Shortening is a lard substitute and made from hydrogenating vegetable oils.

## Quality Control from Production to Consumers

Since butter is made from cream, it is a dairy product. The quality control that applies to dairy products also applies to butter.

Canola is one of the oilseeds protected under the *Canada Grain Act*. The Canadian Grain Commission (CGC) defines grading standards for all oilseed crops and ensures that they're applied to canola. Samples are analyzed in the CGC Grain Research Lab. It's also monitored by the Canadian Food Inspection Agency (CFIA). 85% of the canola crop is sold to markets around the world with the United States being the biggest buyer of canola oil and meal. For raw seeds, Japan and Mexico are the most important destinations. China and India are also two other important markets.

### Laws and Policies Affecting Butter and Fat Production in Canada

Since butter is a dairy product, all the Acts and Policies that apply to dairy products also apply to butter.

For oilseeds crops such as canola, flax seed, mustard, rapeseed, safflower, solin, soybeans and sunflower, the Canadian Grain Commission (CGC) define the grading standards and ensure they are applied. These oils are also monitored by the Canadian Food Inspection Agency.

## References and Other Resources


- Agriculture and Agri-Food Canada: http://agr.gc.ca/index_e.php, http://agr.ca/pol/mad-dam/index_e.php?s1=pubs&s2=r
- Canadian Grain Commission: http://www.grainscanada.gc.ca/research-recherche/dexter/cw-bc, http://grainscanada.gc.ca/wheat-ble/wbm-eng.htm
- Farm Credit Canada: http://www.fcc-fac.ca/en/learningcnetre/knowledge/doc/grains_facts
- United States Department of Agriculturehttp://www.fas.usda.gov/remote/canada/can-wha.htm
- Food and Agriculture Organisation: http://www.fao.org/docrep/006/y4011e/y4011e0w.htm, R.J. Pena
- http://infoplease.com/encyclopedia/science/wheat-wheat
- http://thecanadianencyclopedia.com/articles/wheat
- http://esask.uregina.ca/entry/wheat.html
- http:www.wheatbp.net/WheatBP/Documents/DOC.Milling.php
- www.canadianmillers.ca/english/millers
- Canadian Dairy Information Centre: Partners: Dairy Farmers of Canada, Dairy processors of Canada, Canadian Dairy Commission
- http://www.joyofbaking.com/flour.html, by Stephanie Jaworski
- http://www.dairyinfo.gc.ca/index_e.php
- http://www.dairygoodness.ca/milk/types-of-milk/other-types-of-milk
- http://www.dairygoodness.ca/100-percent-canadian-milk
- Canadian Quality Milk Program
- Canadian Food Inspection Agency (CFIA):
- http://www.agriculture.technomuses.ca/english/tour/breeds.cfm
- http://inspection.gc.ca/food/consumer-centre/foodsafety
- http://eggs.ab.ca/about-eggs/quality-grades-fromEggfarmersofAlberta
- http://agr.ca/poultry/prinde_eng.htm
- http://agr.gc.ca/misb/aisd/poultry/eggsnap.pdf
- http://agr.gc.ca/poultry/gleg_eng.htm
- http://www.inspection.gc.ca/about-the-cfia/acts-and-regulations
- http://www.cdc-cc/.gc.ca/CDC/index-eng.php?id-3805
- http://www.agr.gc.ca/resources/prod/doc/dairy/pdf/prof-butter-ep.

- http://www.dairyinfo.gc.ca/index_e.php?s1=cdi-ilc
- http://canola-council.merchantsecure.com/uploads/canada’s%2
- http://www.canolacouncil.org/markets-stats/industry-overview
- http://www.statcan.gc.ca/pub/96-325-x/2007000/article110778-e
- http://laws-lois.justice.gc.ca/eng/regulations/C.R.C.,_c_284/index

# Unit 3: The Science Behind Food

## Introduction

Now that we have an idea about ingredients, let's go on to see how we can turn them into creamy sauces, savory soups, tasty entrees and scrumptious desserts. To do so, you'll learn the facts about emulsions, foams, leavening agents, microorganisms, crystallisation and sprouting and how we can combine these systems to create tasty dishes. Emulsions are used in soups, sauces and casseroles; foams in airy entrees and desserts; leavening agents in baked products such as muffins and cakes; microorganisms in yeast-leavened breads and cultured dairy products; crystals in candies and ice cream and finally sprouts can be found in soups, salads and sandwiches. Let's start with emulsions.

## Emulsions

What's an emulsion? It is the blending of two (or more) substances that do not mix easily together. The best way to explain an emulsion it is to give an example. You have all seen oil and vinegar together in a jar. They separate in two layers or two phases. They will not become dispersed into one another unless you shake the jar. The shaking or whipping or mixing action is crucial as it disperses small particles of the one phase into the other phase.

### What's an Emulsifier?

An emulsifier is a helper or a connector. Because food emulsifiers have molecules with both a **fat-loving** and a **water-loving** end, they can bind to both fat and water. In that way they help fat and water mix together. To give another example, imagine you have some butter on your hands and you want to wash it off. If you only use water, the butter will not mix with the water very well and will stay on your hands. But if you put soap on your hands, suddenly the butter washes off readily. Soap is an emulsifier because it has molecules with both a fat-loving and a water-loving end. The lecithin in egg yolks is another common emulsifier. It is found in mayonnaise for example. Fine powders and starches are also emulsifiers.

### Temporary (or Unstable) Emulsions

Let's take our previous example of oil and vinegar. When you put them in a jar together, you see two layers or phases. Then when you shake that mixture, it becomes a cloudy mass, an emulsion. But within a few minutes, it will revert into two layers again. We call those emulsions, temporary or unstable as the drops of one phase are not suspended permanently throughout the other phase.

## Permanent (or Stable) Emulsions

In a permanent or stable emulsion, the drops of one phase will stay dispersed permanently into the other phase. Mayonnaise, for example, is a permanent emulsion. It lasts for months in the fridge without separating into oil and lemon juice. To achieve a stable emulsion, you need to whisk or beat or whip. And you also need an emulsifier such as egg yolks. The secret is to add the oil slowly and only a little at a time, as you will see when making mayonnaise.

**Mayonnaise**, **hollandaise sauce** and **béchamel sauce** are all stable emulsions. Mayonnaise is the base of other sauces like **aioli**, a very garlicky sauce popular in France, and **tartar sauce**, a favorite with fish. Traditionally, mayonnaise was done by hand. But you can also make it with a blender. It's quicker and still good. Hollandaise sauce is used in Egg Benedict while Béchamel sauce is used in cream soups, pasta sauces and as binder in many casseroles.

## Two Types of Emulsions

There are two types of emulsions. The first one is called an **oil-in-water** emulsion. In oil-in-water emulsion, the fat is dispersed into a watery solution. Milk, for example is an oil-in-water emulsion as the fat globules of milk are dispersed into the watery phase. The fat is the dispersed phase and the water is the dispersion phase.

The second type of emulsion is a **water-in-oil** emulsion. Butter is an example of water-in-oil emulsion. Droplets of water are dispersed throughout the fat globules. In this case water is the dispersed phase and fat is the dispersion phase.

## Demulsification

You can **demulsify**, which means break a stable emulsion, by heating or freezing.

## Other Applications of Emulsions

The principle of emulsions, which is mixing two (or more) non-easily mixable substances together by shaking or adding an emulsifier, is applied to other fields as well. The digestion of fats in your intestine, for example, is done through emulsification. Medicine, metallurgy, cosmetics and soap fabrication are other fields, besides food science, where emulsions are used.

# Foams

We could call the next two sections, *The Science of Air Bubbles* instead of *Foams* and *Volume of Baked Products* because both the lightness of foams and the volume of baked products depend on the amount of air bubbles you will incorporate in your creation. Let's start with foams.

## What are Foams?

You've probably had whipped cream, ice cream, cakes or even mousse for dessert. Unless you have a gluten or wheat allergy, you have had breads and maybe even a soufflé. And if you love campfires, you have no doubt burned a few marshmallows trying to roast them to perfection. What do all these foods have in common? They're all foams.

Foams consist of tiny air bubbles individually surrounded by a protein film, and dispersed in a liquid or a solid. Let's imagine for a moment that you have blown many individual bubbles with bubble gum, stuck them together and then put them in a large bucket of water. Now you have a big model of foam; a real foam just has much smaller air bubbles. The gum itself is like the protein film that surrounds the air bubbles in foam. And like the gum, the protein film can stretch around the air bubbles and create what we call a matrix. The result is air bubbles held in a liquid or solid, suspended and separated from each other by this protein film. These tiny, dispersed air bubbles are what give foams their airy texture. Generally foams are created by whipping, shaking or beating.

## What are Foaming Agents?

Foaming agents are also called **surfactants**. In small amounts they help foams to form and allow them to be more stable by preventing their break down. As the air bubbles get larger and larger, the foam eventually becomes unstable because not enough protein can stretch around the air bubbles to keep them contained. And this **coalescing** will eventually cause the foam to collapse.

## Different kinds of Foams

### Egg White Foam



The first skill you need to get under your belt is to separate the white from the yolk very carefully. Any trace of yolk (or fat) left in an egg white will "kill" that foam because the fat will interfere with the formation of the protein film. Once your foam is formed you can add some fat if you need to. If you have not mastered that skill yet, ask someone who knows, to show you how to do it. It takes some practice and even the best chefs fail occasionally. Next, as you beat the egg whites, you will learn the appearance of the four stages of egg white foam.

1. The first stage is called **frothy**. After beating the egg whites for a few minutes, they are still clear, but you can see they are bubblier than just plain egg whites.
2. The second stage is called **soft peaks**. Now the egg whites are no longer clear but have become white. If you lift with a beater, the peak will fall back on itself. This is the stage where you would start adding sugar if you were making a meringue, for example.
3. The third stage is called **hard peaks** or **stiff peaks**. The egg whites are white and lustrous. They have a sheen and if you lift a beater, a peak will hold itself. It will no longer fall back. This is the stage where you would stop beating the egg whites if you were making a meringue.
4. The last stage is **dry peaks**. If you keep beating the egg whites past the hard peaks stage, you will eventually see the egg whites becoming dull in appearance with little specks of curdled egg whites. Liquid will also appear at the bottom of the bowl.

Most recipes will suggest stopping when the egg white foam is at the soft peaks or hard peaks stage. By the dry peaks stage the egg whites have been overbeaten and are less stable.

Here are some tips to help you make beautiful and fluffy egg white foams:

1. Have the egg whites at room temperature as they will achieve greater volume than if they're cold.
2. Add one teaspoon of cream of tartar for three to four egg whites to make the foam more stable. (If you don't have cream of tartar you can also use a small pinch of salt).
3. If the recipe calls for sugar, as in a meringue, add it slowly, little by little at first, after the soft peaks stage until you reach the hard peaks stage. By adding sugar you also help the foam to be more stable. Meringues are egg whites foams beaten to the hard peaks stage, with sugar and flavouring such as vanilla extract added to it. They can be used as toppings on pies such as lemon meringue pie or they can be made into individual cookies.
4. If you have a copper bowl, like the French chefs, use it.

**Whole Egg Foam**

You would use whole egg foam if you make a sponge cake or a Genoise cake. Having the eggs at room temperature will take less time to beat them to the **ribbon stage**, which is reached by beating the whole eggs at high speed for about 10 minutes. When a ribbon of the foam spread

across the top of the foam stays on top for a few seconds rather than melt into the underlying foam right away, you have reached the ribbon stage. If you beat cold eggs, instead of eggs at room temperature, it will take longer to reach that ribbon stage (up to 20 minutes).



**Cream Foam**

When you make whipped cream foams, there are two things to keep in mind.

1. Make sure to use cold cream, bowl and beaters. Have them in the fridge for a few hours or in the freezer for 10-15 minutes before making your whipped cream. If you use warmer cream, it tends to become oily, because of the heat created by the friction, and is not able to retain air bubbles as well.
2. Remember to use cream with at least 32% to 35% milk fat. Cream milk, with only 10-18% milk fat, just doesn't have enough fat globules to clump together into whipped cream. Whipped cream is white, light and airy and twice the volume of the liquid cream.

## Volume of Baked Products

Have you ever made a cake that did not rise? Or it rose for a while but then collapsed? Or made bread that failed to rise and ended up hard as a rock? If your answer is yes, then you had a problem with **volume**. When you make a cake or bake bread, you need **leavening agents**. Leavening agents makes your batter rise and gives your baking a nice texture and a beautiful appearance that beckons to you: Eat me! Leavening agents work by creating air pockets within the dough or the batter to give your cake, bread or Yorkshire pudding a light and fluffy texture.

In general there are three ways to create volume, by:

1. Provoking a chemical reaction with the addition of baking powder and/or baking soda to batter.
2. Incorporating air with a mechanical or physical method such as creaming, kneading, beating or whisking.
3. Using natural agents such as yeast, steam or eggs.

Often, you use a combination of these methods to create volume. For example, when you bake bread, you use yeast to produce carbon dioxide, and you knead the dough to develop the gluten so it is able to stretch around the carbon dioxide bubbles.

## Chemical Leavening Agents: Baking Soda and Baking Powder

Both baking soda and baking powder cause the batter to rise by producing a gas, carbon dioxide.

### Baking Soda

When you use baking soda, an alkali, you need to add an acid such as vinegar, sour cream, yogurt, buttermilk, lemon or other acidic fruit juices, to provoke the reaction that will produce the gas carbon dioxide ($CO_2$). If you're using only baking soda, make sure to bake your creation right away. The reaction between baking soda and acid starts as soon as the liquid is added to the dry ingredients and there is no other leavening action.

For those of you who love chemistry, here is the formula of the reaction of baking soda with an acid, in this case vinegar, to produce carbon dioxide ($CO_2$).The proper name for baking soda is S*odium hydrogen carbonate*, with the formula $NaHCO3$. Vinegar, a solution of 5% acetic acid (ethanoic acid), has a formula of $CH_3COOH$. The reaction equation of baking soda with vinegar is:

$NaHCO_3 + CH_3COOH => CH_3COO\text{-}Na+ + H_2O + CO_2$

Baking soda + vinegar => sodium acetate + water + carbon dioxide.

### Baking Powder

When you use a double-acting baking powder, the reaction will happen in two stages and that's why it's called double-acting. Most baking powders you find in stores nowadays are double-acting. When your batter is moistened, the calcium acid phosphate and baking soda found in baking powder react to release a small amount of carbon dioxide, but then release much more carbon dioxide when the batter is heated. Because of these two stages, usually you can delay the baking of your batter for 15-20 minutes without problems.

When using baking powder you need to use the right amount. If you add too little, you won't have enough gas and your cake will end up small, tough and compact. But if you add too much, then you'll end up with a cake having a coarse, fragile crumb and a fallen centre because the batter rose too quickly and then collapsed as the air bubbles grew too large and broke down causing the batter to fall.

When you add both baking powder and baking soda, the rising action is done mostly by the baking powder, but the baking soda still adds tenderness and some leavening to your creation. Always add the exact amount of baking soda and acid called for in a recipe because if you add excess baking soda, the unreacted soda will give your baking an off taste.

## Mechanical Raising Agents: Creaming, Kneading, Beating, Whisking

### Creaming

*Creaming* is the most traditional method you can use to make a light and airy cake. The secret is trapping a lot of air bubbles in your batter.

1. Start by beating your butter, which should be at room temperature (68-70° F or 20-21° C), for about five minutes. Butter is at a **plastic stage** at that temperature, cold enough to hold its shape and trap air bubbles, yet soft enough that it can be beaten.
2. Then add the sugar very gradually, trapping more air bubbles, till the mixture is pale yellow, fluffy and double in size.
3. Then add the eggs one at a time and beat in between each addition. It's important you add them one at a time to give the lecithin in the eggs, which is an emulsifier, a chance to do its job.
4. And since fat is a good carrier for flavourings, now is a good time to add your vanilla.
5. Meanwhile you'll have your dry ingredients – flour, baking soda, baking powder and salt mixed together.
6. Then you add them to the batter, alternately with the milk (or juices). You should add about a third of the flour mix followed by half of the milk and repeat till all the dry and wet ingredients have been added. Mix just long enough to combine the ingredients, but no longer. To avoid developing the gluten, a protein in the flour that will make the cake tough. We'll talk more about gluten later on but for now remember to mix just enough to combine the ingredients if you want a cake that's tender.
7. Now that you've done all this beating, mixing and combining, in the right amounts and at the right time, you should end up with a thick batter filled with tiny air bubbles, well emulsified and ready to expand and provide you with an amazing cake!

**Kneading**

Kneading is the process of folding and turning dough with the palm of your hand while punching it down. As you knead, you need to add more flour to keep it from getting too sticky. It's better to add the flour on the board than directly on the bread. Kneading is done to develop the gluten. What is gluten?

Gluten is made of two proteins, gliadin and glutenin, which you find mostly in wheat, and other grains mentioned already in the section on grains and flour. When the molecules of glutenin and the molecules of gliadin bind together and with water, it forms gluten. Gluten is the stretchy, elastic matrix that holds the carbon dioxide bubbles made by the yeast. That is why any manipulation of the dough develops the gluten. Every time you beat, fold, stretch and knead dough, you increase the chances for glutenin, gliadin and water molecules to bind to each other and to form gluten.

If you don't knead the dough enough, you won't develop those gluten strands, so they won't stretch well to hold the gas bubbles. But if you over knead your dough, you'll eventually make that gluten tough. So generally, the dough is ready when it's nice and soft and stays indented when you push two fingers in it. It might help to watch an experienced bread baker to really see how dough is properly kneaded. As with any physical activity, watching a pro in action will help you see the subtle things that cannot be taught from books.

**Beating and Whisking**

**Beating** is a rapid up and down circular motion to smooth out batter or to incorporate air. It's usually done with a rotary or an electric mixer. **Whisking** is a technique of blending ingredients by hand to mix or fluff. It also helps to smooth or add air to a mixture. It's usually done by using a wire whisk, a kitchen tool with a long thin handle and wire hoops attached at one end in the form of a tear shape.

## Natural Leavening Agents: Yeast, Steam, Eggs

**Yeasts**

Even though yeast buds are very small, they are still living organisms. They're what we call a **single-cell fungus**. One of the most important yeast in the history of the world is called **Saccharomyces cerevisiae**, a Latin name meaning **sugar fungus**. It's often called brewer's yeast or baker's yeast as it is responsible for the production of ethanol in alcoholic drinks and for fermentation in bread making.

So how does yeast work? When you buy yeast in jar or envelope, it is in a **dormant** stage. When you add water and sugar, the yeast becomes active which means it will make carbon dioxide and divide to make other yeasts that will also make carbon dioxide.

When you go to the store looking for bread-making yeast, you might have a choice of **Active dry yeast** or **Instant active dry yeast**. What is the difference? Active dry yeast needs to be hydrated. It means you add water to it, first by mixing it with warm water and sugar. Then it can be added to the liquids and flour. It's a little more work and it also works more slowly. However some people find that the bread tastes better. The instant dry yeast can be directly added to the flour and liquids without hydrating it first. Because these yeasts have cells with porous walls, they can just absorb water directly.

Now how does adding a few teaspoons of these tiny yeasts end up giving us our daily bread? It does so by starting what we call the **fermentation** process. The yeast feeds on the sugar in the ingredients and produces a gas, **carbon dioxide** and **alcohol**. The chemical formula for the overall fermentation reaction is:

$C_6H_{12}O_6$ ----------→ $2(CH_3CH_2OH) + 2(CO_2)$

Glucose (sugar)------→Alcohol+Carbon dioxide (gas)

And when we make bread we want to trap those carbon dioxide bubbles. The alcohol will just evaporate during the baking.

Those little yeasts actually play three major roles when you bake bread.

1. They act as a leavening agent. The yeast feeds on the sugars in the dough, produces carbon dioxide, released throughout the dough, and causes it to rise.
2. It makes the gluten in the dough stronger. When you stretch, fold or squish the dough, you increase the chances for gliadin and glutenin to bind to each other and to water to form gluten. So every time a little yeast releases a carbon dioxide bubble it sneaks through the dough, gives a little stretch and makes that gluten stronger. As there are millions of yeast doing that, it's really good for the gluten.
3. It helps to develop the flavour in the bread. The big molecules of starch, proteins and fats in bread dough aren't that flavourful. But when you break them into their smaller parts, the starch into sugars, the proteins into amino-acids and the fats into free fatty acids, they have much more flavour. Yeasts contain enzymes (compounds that help reactions happen) that break the starch, proteins and fats into their smaller parts.

We've mentioned that yeasts are live cells. They need to be hydrated in warm, not hot water, around 77° F (25° C). They will tolerate temperatures as high as 120° F (50° C), but no higher. Higher than 140° F (60° C) you will kill the yeast. If the dough temperature is at 39° F (4° C), which is the temperature of a cool fall day, yeasts will not grow. If it's slightly warmer, like 50° F

(10° C), they will grow, but more slowly. Some bakers actually experiment with those low-rising temperatures to create different flavours in the bread. To get the knack of baking breads, you might want to use a thermometer the first few times around.

**Steam**

When you convert water to steam, you increase the volume by approximately 1,600 times over its volume in the liquid state. When you bring a moist batter to 212° F (100° C), you transform the water in the batter into steam. Then the steam becomes trapped in the batter, which then solidifies as it bakes. When you look at a recipe for Yorkshire pudding, cream puffs or gougère, you may be wondering what the leavening agent is. Now you know. Steam is the leavening agent.

**Eggs**

Eggs are wonderful and very versatile. As we've seen in the foam section, eggs act as leavening agents. When you beat egg whites, you provide leavening by trapping air in the foam. Egg whites create more volume than egg yolks because the fat in the egg yolk retards the foaming. But beating egg yolks vigorously, for a few minutes, will also help with your volume.

And while we're talking about eggs, let's just briefly say that eggs are used as thickeners for sauces, emulsifiers and tenderizers. They also inhibit sugar crystal formation in some syrup, candies and frostings. And you can use them as wash on breads and pastries. So let's all be thankful to chickens for providing us with such an amazing food!

# Microbiology

## What is Food Microbiology?

What do you think the word **micro** means? Micro is a Greek word meaning small and the word biology means life. So microbiology is the study of tiny organisms and microbiologists study those using very powerful microscopes. We divide microorganisms roughly into four categories: **viruses**, **bacteria**, **molds** and **yeasts**. If you were to measure them, you'd use microns. One micron is a thousand times smaller than one millimetre. Can you imagine how small that is? If you take 1,000 microorganisms and line them up side-by-side, they'd still be barely visible to the eye.

## Beneficial, Spoilage and Pathogenic Microorganisms

When it comes to food, we divide these microorganisms into three groups. The first group is called **beneficial microorganisms**. They are the ones used in fermentation to provide us with delicious food. The second group is called **spoilage microorganisms**. They're responsible for food spoiling, but may not cause sickness. The third group is called **pathogenic microorganisms**, which means disease carriers. They can cause food poisoning.

1. Let's start with the beneficial microorganisms. They provide us with tasty food like bread and croissants, yogurt, cheese, sour cream and sauerkraut. In addition, lacto-fermentation or fermentation with **Lactobacilli** bacteria preserves food and provides

health benefits by making the food easier to digest and providing the colon with friendly bacteria. So turning your crop of cabbage into sauerkraut, for example, will give you tasty and healthy food all winter.

2. Spoilage microorganisms: Different yeasts, molds and bacteria cause food spoilage by altering the colour, the texture, the taste and the smell. Those microorganisms may not necessarily be harmful and make you sick. But it could be that other microorganisms which can make you sick have grown with them too.
3. Pathogenic microorganisms: They are responsible for food poisoning outbreaks. **Escherichia coli** (**E.coli**), **Listeria** and **Salmonella** are examples of pathogens**.** When ingested they can cause diarrhea, vomiting, stomach cramps, chills and more. Usually we talk about **food borne infections** when we ingest live bacteria that grow and establish themselves in our intestinal tract. And we talk of **food borne intoxication** when we ingest foods that contain the toxins formed by the bacteria. We may not have ingested the live organisms themselves but the toxins can still make us sick.

To get food poisoning there are five things that need to happen:

1. The microorganisms or their toxins need to be present.
2. The food must be the right food for that microorganism. That's why you need to be careful with raw eggs or meats. Given the chance, harmful bacteria love to grow on them.
3. The temperature must be right for them to grow. That's why it's important to keep cold food cold and warm food warm. Room temperature is often the ideal temperature for those unfriendly organisms to reproduce.
4. They need enough time to reproduce and produce their toxins. The longer the food that might be contaminated stays at room temperature, the more time the organisms have to reproduce. Your body can deal easily with one unfriendly microorganism but if you have a million, it can be overwhelming. With the right conditions, due to exponential growth, it is surprising how fast these organisms can grow.
5. Lastly, to get food poisoning, you need to eat the food.

**Remember** the four safety rules to prevent food poisoning outbreaks:

1. Clean your hands and cooking surfaces often, before and while cooking.
2. Separate foods that could contaminate each other, such as raw meat and vegetables.
3. Chill by refrigerating promptly all easily spoiled groceries and all leftovers.
4. Cook to adequate temperatures fish, chicken and meat since they are more prone to bacterial contamination.

# Crystallisation

## Principles of Crystallisation

What's crystallisation? It's the formation of crystals which are *any solid material in which the component atoms are arranged in a definite patterns and whose surface regularity reflects its internal symmetry.* When you make candy or ice cream, you have to think about crystals. There are two types of candy: crystalline and amorphous. In crystalline candy, crystals need to be kept small, to create a smooth feeling on the tongue. Fudge is a crystalline candy. In amorphous candy, there are no sugar crystals. It's more like glass. Peanut brittle and marshmallows are two amorphous candies.

When you make ice cream, you think of ice crystals rather than sugar crystals. The water crystals need to be kept small to create a smooth feeling on the tongue.

But whether you make candy or ice cream, it's important to know what you can do to favor the formation of crystals, if you need to, and what you can do to prevent the formation of crystals, if you need to.

## Crystallisation and Temperature

When you make candy, the end temperature is all important because it determines the sugar concentration. You have two ways to determine that end temperature. The first one is with a candy thermometer, which is easy to use if you have a thermometer on hand and the second is by the cold-water test, which many people find confusing.

You can make two types of candy: crystalline and amorphous candies. Crystalline candies contain very small sucrose crystals and should feel smooth to the tongue. Fondant, fudge, divinity, centres of butter creams, pralines and nougats are all crystalline candies. In amorphous or non-crystalline candy, there are no sugar crystals. There are two reasons for that. The first reason is because there are many **inhibitors**. Inhibitors prevent the formation of crystals. The other reason is that the sugar is cooked to such high end temperature that all water has evaporated. Now the syrup is too viscous to orient itself into a crystalline structure. When you eat caramels, taffies, hard brittles, hard candies, marshmallows and gum drops, you are eating amorphous candies.

So what are those factors that inhibit or prevent the formation of sugar crystals, or prevent them from getting big? Any acids, such as cream of tartar, fruit juices and vinegar; fats, such as margarine, butter, whole milk and chocolate; proteins, such as milk, egg white and gelatin; and corn syrup and honey are all crystals inhibitors.

When you make ice cream, some form of whipping is used to stir the ice cream, which keeps the ice crystals small. Using a higher fat content will help give you a smoother ice cream because the

fat coats the tongue, so it doesn't feel the crystals. By adding eggs and chocolate, you will add flavour but you will also minimize ice crystal size.

## Sprouting

Sprouting seeds is one way for you to eat local fresh foods in the winter. It's like having a garden on your countertop. When you sprout a seed it increases its vitamin C, vitamin B and carotene, a precursor of vitamin A, content. It reduces the presence of phytates, which cause digestion problems in some people. It produces some enzymes that help digestion. And finally, it lessens cooking time.

You can sprout grains, beans and seeds because they are all types of seeds really. You should also be aware that Health Canada has issued an information update on the risks of eating raw sprouts. Outbreaks of food poisoning bacteria, Escherichia coli (E.coli) and Salmonella, have been linked to commercially grown sprouts. When sprouting, apply all the rules of food safety mentioned already. Wash your hands before handling the seeds, make sure your jar and lid are very clean, rinse your seeds well when you start sprouting and at least two to three times/day thereafter and refrigerate once the seeds are ready.

To sprout seeds, soak the grains or beans in water for 24 hours and then rinse them twice a day for a few days using a Mason type jar with a piece of clean cheesecloth fastened by the metal ring. Or use a sprouting tray if available. Some sprouted seeds such as alfalfa can be added to salad or sandwiches. If you sprout beans such as garbanzo, kidney, lentils, you can use them in any soups or dishes that calls for that particular bean. The sprouted bean will take less time to cook.

## References and other Resources


- Encyclopedia Britannica p.37 vol.8
- http://culinaryarts.about.com/od/glossary/g/emulsion.htm, Danilo Alfaro
- http://busycooks.about.com/od/glossary/g/emulsify.htm
- http://britannica.com/EBchecked/topic/1312929/oil-in-wateremulsion
- http://www.transtutors/chemistry-homework-help/surfce-chemsitry/emulsion.aspx
- http://science.jrank.org/pages/2461/Emulsion-uses-emulsions.html
- http://recipes.howstuffworks.com/food-facts/question617.html
- http://culinaryarts.about.com/od/sauces/tp/MotherSauces.htm
- http://www.scienceofcooking.com/foams/culinary_foams.html.
- http://www.get-baking.com/raising_agents.html
- http://www.joyogbaking.com/bakingsoda.html
- http://chemicalformula.org/baking-soda, by Robert Donnelly
- http://joyofbaking.com/ButterCakes.html
- http://preparedpantry.com/How-eggs-work.htm
- http://foodreference.about.com/od/Ingredients_basics/a/All-About?

- http://science.howstuffworks.com/life/fungi/yeast-info.htm
- http://www.preparedpantry.com/howyeastworks.aspx
- http://www.finecooking.com/articles/yeast-role-bread-baking-as?
- http://www.streetdirectory.com/food_editorials/pastry/baking_tips?/
- http://www.agriculture.technomuses.ca/english/schoolprograms/agpdf
- http://www.exploratorium.edu/cooking/bread/bread.science.htm
- http://food.unl.edu/web/safety/poisoning
- http://www.askdrsears.com/topic/family-nutrition/yogurt/10?
- http://resources.schoolscience.co.uk/sgm/sgmspoil/.html
- https://www.msu.edu/lentnerd/NewFiles/Crystallization.htm, Michigan State University
- http://www.hc-sc.ca/ahc-asc/media/advisories-avis/-2012-201
- http://www.foodsci.uoguelph.ca/dairyedu/findsci.html

# Unit 4: Combining Systems

## Introduction

Let's review. We have talked about emulsions, foams and leavening agents. We have talked about microorganisms, both the friendly and the not-so friendly ones, and we've discussed crystallisation, both of sugar and water, and talked about sprouting.

When you recognize what is at play in a recipe, it will help you understand the reason behind the methods suggested. It can also help you vary the recipe or substitute ingredients if you want to make it healthier or tastier. The following foods represent different combinations of the different systems.

## Ice Cream: Foam, Emulsion and Crystallisation

When we eat ice cream on a hot summer day, we're looking for a smooth, cool, airy creamy and sweet treat. What makes ice cream all that? The smoothness comes from the emulsion of eggs and milk, combined with small ice crystals coated with whipped cream. Sometimes gelatin may be added, as it helps keeping the ice crystals small. The coolness comes from ice crystals developed by churning at sub-zero temperatures, by adding salt to the brine surrounding the ice cream churn. The airy feeling comes from the foam of whipped cream. The cranking or whipping adds air bubbles in the cream. The amount of air whipped in ice cream is called the overrun. And finally the sweetness comes from the sugar or honey or other sweetener added.

You may have heard of **gelato** being called Italian ice cream. Gelato is slightly different than ice cream. It has lower butterfat content, is churned more slowly, so less air is whipped into it, and it has 10% more sugar than ice cream. Because it's denser, the flavours seem more intense.

## Breads: Yeast and Foam

When you make bread you're like a juggler struggling to keep many balls in the air.

1. As we mentioned before, yeast needs water and sugar to start producing carbon dioxide. Then the right temperature range needs to be maintained to keep them productive. Too cold and they go on strike. Too warm and they just up and die. (If you use fast-rising yeast, you can actually just add it to your dough. You do not need to hydrate it first.)

2. Then you need to think of gluten development. You develop the gluten by beating and kneading the dough. All those molecules of gliadin and glutenin just love being squished, folded, kneaded so they link together to form that stretchy matrix, gluten, that will hold all the air bubbles that your yeast is so busy making.
3. Then you need to think of the ingredients you will add. Wheat has a lot of gluten. Rye, barley, kamut, spelt and triticale also have gluten. Pure uncontaminated oats and millet, for example, basically have none. If you decide to make multigrain bread, make sure you add the grains without gluten, *after* you have first developed the gluten in the wheat flour.

Have you ever had a sweet cinnamon bun or a buttery croissant? You may not think they resemble very closely the piece of toast you had for breakfast. But they are all essentially bread dough. Cinnamon buns have sweeter dough, rolled flat and spread with butter and cinnamon and then rolled, cut and left to rise. Croissants are bread dough rolled flat with a sheet of hard butter spread on top, and then layered by folding and turning the dough many times and cut and rolled into that characteristic croissant shape. Once you master the basic breads, you can have as much fun as you want trying different variations.

## Soufflés: Emulsion and Foam

**Soufflés** comes from the word souffle in French, which means breath. And really soufflés are just about as sturdy as your breath – or a light wind! They are fluffy and airy and may collapse quickly once out of the oven. So make sure everyone who will be eating this dish is sitting and ready when you bring it out.

When you make a soufflé, you combine a béchamel (or white sauce), which is an emulsion, and an egg white foam. You can also add other ingredients such as cheese, fish or vegetables. You usually add those ingredients to your béchamel sauce first.

You need to be very careful when you mix your emulsion with your egg white foam. Using a whisk and a spatula, you fold the egg white foam into the white sauce very gently, in order to keep all those air bubbles in the soufflé. You also use an ungreased baking dish with straight sides (or a soufflé dish if you have one). Or if you want to grease your baking dish then sprinkle it with parmesan cheese or fine bread crumbs to give your soufflé a gripping surface to climb.

## Chiffon Cakes: Emulsion and Foam

You make chiffon cakes by emulsifying oil and egg yolks and adding flour and sugar to this emulsion. Then you fold in egg white foam very gently with a whisk. An angel food cake is also an egg white foam, but without the emulsion of egg yolks and oil. Sugar and flour are added to the egg white foam.

You bake both of these types of cakes in an ungreased pan, so the foam can climb up the sides and cool them down by inverting the pan to keep the airy texture. If you cool down a chiffon or angel food cake without inverting it, it will compact.

## Cream Puffs: Steam and Foam

You want to make something to impress your friends? Then make them homemade cream puffs. You might have to work on your technique with the pastry bag if you want them to look like the ones we buy in pastry shops. But even if they don't quite look like those ones, they're fun to make. The shell of cream puffs is made of something called chou paste. Chou paste is an emulsion of milk, butter, flour and eggs, risen by steam. When they are done, make sure you prick them to allow the steam to escape. You will then turn your oven off and let them finish baking with the oven door ajar. Take them out of the oven, once they're cooled off and slice them in half and fill them with crème Chantilly. Crème Chantilly is basically whipped cream foam with a little sugar and vanilla added to it. And voila! Cream puffs!

## Gougère: Steam and Emulsion

What do cream puffs and stuffed gougère have in common? They are both made with a chou paste, even though one is a dessert and the other an entree. Gougère is a French pastry made from a chou paste. To make a stuffed gougère, the pastry is spread on a pie plate and topped with an emulsion of butter (with added onions and mushrooms), flour and chicken broth. Usually juliennes of ham and tomatoes are also added to the filling.

## Marshmallows: Foam and Crystallisation

Here is another way to impress your friends, or any member of your family. Most people have seen commercial marshmallows and probably cooked a few over campfires. But very few people have actually seen or tasted the homemade variety. And if you have an electric mixer, they are really not that hard to make. They are basically egg white foam with an amorphous sugar structure and some gelatin added in. By using corn syrup and gelatin, you will be keeping any sugar crystals from forming.

## Cream of Sprouted Lentils: Emulsion and Sprouting

You make a cream of sprouted lentils by making an emulsion of white sauce with onions added to it. Then you add it to the steamed sprouted lentils.

## Baked Alaska: Foam, Emulsion and Crystallisation

Have you ever heard of a baked Alaska? The name implies that you're going to bake a frozen land mass and that's exactly what you'll be doing. A baked Alaska has three parts. The first is a cake. You can use a Genoise cake, which is a whole egg sponge. But you can also use a pound cake or a butter cake. The second part is the ice cream you put on the cake. By now, you know

that ice cream is a foam, an emulsion and a mass of small water crystals, all in one. Then you cover this completely with the third part, a meringue, which is an egg white foam. As you can see there's an infinite variety of Baked Alaska you can make by varying the cake and the ice cream you use.

Keep it in your freezer till you bake it, and then bake it just long enough to lightly brown the meringue (5-10 minutes at most). The meringue serves as an insulator and protects the ice cream from melting during the time in the oven. Serve right away. And if everything went well, by this time, you should be hearing delighted gasps from your guests, because it looks truly beautiful and is so tasty!

## References and other Resources


- https://www.msu.edu/lentnerd/NewFiles/Crystallization.htm, Michigan State University
- http://www.hc-sc.ca/ahc-asc/media/advisories-avis/-2012-201
- http://www.foodsci.uoguelph.ca/dairyedu/findsci.html
- http://www.allrecipes.com
- http://www.joyofbaking.com

# Unit 5: Cooking in the Community

## Introduction

When we talk about basic needs, food and water top the list. Since we're talking about food and cooking in this guide, let's take a look at food security globally and in your community.

## Food Security

### Worldwide

In 1996, the **World Health Organisation (WHO)** held The World Food Summit and defined food security as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life."

The debate around food security centres around four questions:

1. Is there enough food in the world to feed everybody or is the problem one of distribution?
2. Can future needs be met by the existing level of food production?
3. Has global trade made national food security paramount or no longer necessary?
4. Does globalisation lead to persistence of food insecurity and poverty in rural communities?

The **Food and Agriculture Organisation (FAO)** and other agencies of the United Nations work together on finding ways to eliminate hunger and poverty in the world.

> *Food waste is an important issue related to food security. Worldwide, roughly one-third of food produced for human consumption is lost or wasted which amounts to about 1.3 billion tons wasted per year. This inevitably means that a huge proportion of the resources dedicated to food production are also used in vain and that the greenhouse gases emitted during the production of that food are emitted to no good end.*
>
> (Global food loss and food waste – FAO).

> *Overall, on a per-capita basis, much more food is wasted in the industrialized world than in developing countries. We estimate that the per capita (per person) food waste by consumers in Europe and North America is 95-115 kg/year, while this figure in Sub-Saharan and South/Southeast Asia is only 6-11kg/year.*
>
> (www.fao.org/docrep/014/mb060e/mb060e00.pdf
> Global Food Losses and Food Waste – FAO)

*In Canada in 2007, an estimated 38% of solid food available for retail sale was wasted, the equivalent of 183 kg/person. A decrease in food waste would reduce negative environmental impacts associated with food production, processing, distribution and services.*

(http://www.statcan.gc.ca/pub/16-201-x/2009000/aftertoc-aprest
Human Activity and the Environment. Overview.
Feature article: Section 1 Food in Canada (highlight #7)

It is tragic that so much work and energy is wasted on one hand, while millions of people continue to live on marginal diets.

### In your community

Food security is an important issue in most communities. Can you name some organisations in yours that work to ensure that nobody's going hungry? The Salvation Army, Food Banks, Anti-Poverty Ministries, your church (or other churches) and your school probably come to mind. What do these organisations do? They might offer warm meals and shelter, provide food baskets to families in need, provide meals to kids in disadvantaged areas schools or work to improve federal and provincial policies to help people at risk become more independent. The Canadian farming community has been very active in the issue of food security by pooling their on-farm efforts to harvest and donate food for famine relief overseas, through the Canadian Food Grains Bank.

What are some other ways to help people achieve food security? Learning to cook with basic foods, growing gardens, learning to hunt and fish might all be useful things to do. For example, many cities have community garden plots where, for a small fee, citizens can grow food. It beautifies vacant lots and feed people.

Food is often involved in community fundraising activities. You're a member of 4-H but you might also be a member of a historical society or horticultural society or a church. Often these groups hold fundraising events having to do with food. They might hold Victorian Teas, special suppers around Thanksgiving and Easter, bake sales and many other such events where food is involved.

And since time immemorial, people of all races and ages have gathered with friends and families, in small or large groups around simple or extravagant meals to enjoy the fruit of their labours.

Happy cooking and eating!

## References and Other Resources


- World Health Organisation (WHO): http://www.who.int/trade/glossary/story028/en/
- Food and Agriculture Organisation (FAO): (www.fao.org/docrep/014/mb060e/mb060e00.pdf- Global Food Losses and Food Waste-FAO)
- Statistics Canada: http://www.statcan.gc.ca/pub/16-201-x/2009000/aftertoc-aprest Human Activity and the Environment. Overview. Feature article: Section 1 Food in Canada (highlight #7)
- Food Banks Canada: http://www.saynotohunger.ca/
- Salvation Army: http:// www.salvationarmy.ca
- Canadian Food Grain Banks: http://canadianfoodgrainbanks.ca

# Glossary

**Acetic acid**: Vinegar is dilute acetic acid and is also called ethanoic acid.

**Amorphous structure**: Too viscous to be aligned in a crystalline structure; glass-like structure.

**Bacterial contamination**: the process of disease-causing bacteria entering food.

**Bacterial decomposition**: the breakdown of food, by bacteria, into simple chemical compounds.

**Biological contamination**: Contamination by unwanted bacteria, molds, viruses, insects or rodents.

**Calcium acid phosphate**: Active ingredient in baking powder.

**Candling**: Use of a strong light to spot defects in eggs.

**Carbon dioxide**: Gas responsible for the rising action in some baked products.

**Chemical contamination**: Contamination with unwanted residues of pesticides, cleaners or other toxic chemical compounds.

**Chemical leavening agents**: Agents causing the rising in a baked product by production of carbon dioxide.

**Coalescing**: Breaking of the protein matrix surrounding the air bubbles in a foam.

**Concentration**: The amount of a substance per unit volume of a liquid.

**Crystalline structure**: A regular and repeating pattern of atoms or molecules in a lattice structure.

**DHA milk**: Milk from cattle fed a specially formulated feed to produce Docosahexaemoic acid (DHA) in the milk. DHA is from the omega-3 family of fatty-acids.

**Dispersed phase**: The liquid in suspension in an emulsion.

**Dispersion phase**: The liquid that holds the suspension in an emulsion.

**Demulsify**: To break a permanent emulsion.

**Dormant stage**: Stage in which yeasts are inactive.

**Emulsion**: Mixing of two substances that do not mix easily.

**Emulsifier**: Agent that helps two substances that don't mix easily, to mix more easily.

**Enzymes**: Compounds that help reactions occur more easily.

**Enzymatic reaction**: Reaction promoted by the activity of enzymes.

**Exponential growth**: Doubling of population every generation.

**Fermentation**: Conversion of a base food into a different form by microorganisms.

**Filtered milk**: Regular milk passed through fine filters to remove most microorganisms.

**Food spoilage**: Decomposition of food due to action of bacteria, viruses, yeasts and fungi. Enzymatic action and oxidation can also cause food spoilage.

**Food borne infections**: Sickness due to the ingestion of live bacteria.

**Food borne intoxication**: Sickness due to the ingestion of toxins produced by bacteria.

**Fungi**: Plural form of fungus.

**Fungus**: Class of non-photosynthetic plant-like organisms; mushrooms, yeasts and molds are well-known fungi.

**Fungal decomposition**: Decomposition of food due to the action of fungi.

**Gliadin and Glutenin**: proteins that combine to make gluten.

**Gluten**: Protein responsible for the stretchiness of dough.

**Hydrated**: Water added.

**Julienne**: Cut in long thin strips.

**Lactose-free milk**: Milk without the sugar lactose, which is found naturally in milk. For people who are lactose-intolerant.

**Mechanical leavening agents**: Creaming, kneading, beating and whisking are methods used to trap air bubbles and create volume.

**Microbiology**: Study of microscopic organisms such as bacteria, viruses, yeast, and molds.

**Micron**: Unit used to measure the size of bacteria, viruses, molds, yeast. 1,000 microns equal one millimetre.

**Natural leavening agents**: Steam, yeast and eggs cause leavening in baked products.

**Oxidation**: Reaction of food with oxygen in the air.

**UHT milk**: Ultra-heated milk; can be stored unrefrigerated, if unopened, for months.

**Organic milk**: Milk from cows raised organically; land, crops and cattle must all be certified organic for the milk to qualify for this label.

**Overrun**: The amount of air whipped into ice cream.

**Pathogenic**: Disease-causing.

**Permanent emulsion**: Emulsion that is stable.

**Plastic butter**: State of butter at room temperature; ideal for trapping air bubbles.

**Saccharomyces cerevisiae**: Latin name for baker's yeast.

**Sodium hydrogen carbonate**: Baking soda.

**Temporary emulsion**: Emulsion that rapidly reverts into separate phases.

# Resources

- Agriculture Agri-Food Canada
- Health Canada
- Slow Food Movement
- Food Bank Canada
- Canadian Food Grain Banks
- Department of Food Science in Universities

**Useful websites**

- http://www.joyofbaking.com
- http://www.alltherecipes.com

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4-H Saskatchewan

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