

Molecular Gastronomy Techniques

MOLECULAR GASTRONOMY is the physics and chemistry that take place during cooking. It is a theatrical, modern, creative, and scientific manipulation of the textures and appearance of food. The additives, supplies, and equipment may be found in a chemistry lab. The molecular “caviar bubbles” pictured here on a white serving spoon are easy to prepare.



Objective:



Summarize the science of molecular gastronomy.

Key Terms:



agar-agar

collagen

colloids

dehydration

effervescence

emulsification

fizz

flash freezing or nitrogen
freezing

foam

food science

froth

gastronomy

gelification

molecular gastronomy
(MG)

polysaccharide

siphon whipping

sous vide

spherification

surfactants

xanthan gum

Understanding Gastronomy

Gastronomy is the art or practice of selecting, cooking, and eating “good” food. Most food writers and expert chefs say that gastronomy is a term that indicates a form of respect for the art of preparing and serving food. Over time, some foods fall out of favor and, as a result, new foods are invented. The molecular gastronomy trend adds “science” to the art of selecting, preparing, serving, and enjoying food. However, the true gourmet—no matter the type of food trend—prefers quality to quantity and constructs meals with artful pairings (drinks and accompaniments). The opposite of a gourmet is a glutton.

MOLECULAR GASTRONOMY

Molecular gastronomy (MG) is the study and application of the physics and chemistry that take place during cooking. MG encompasses the art and the science of selecting, preparing, serving, and enjoying food. It is food on a microscopic level: a sub-discipline of food science characterized by avant-garde (experimental) cooking techniques. Molecular gastronomists study the chemical-physical processes that take place when food is cooked. Food science is different than MG. **Food science** is the analysis of the chemical makeup of food and the development of processes for industrial applications.

Innovations

Some innovations from MG include transparent ravioli, hot ice cream, and fried mayonnaise. Restaurants around the country have adopted the trend to transform flavors and presentations. Molecular gastronomy is sometimes referred to as molecular cuisine or modern cuisine. The focus of MG is to create a multi-sensory dining experience.

- ◆ MG may combine unusual flavors. MG uses the term “juxtaposition” (placing two or more substances close together for contrast) to describe one of its most important rules. For instance, some MG chefs pair a flavorful food with a less flavorful food as a contrast, or they combine two dominant flavors (e.g., chocolate and raspberry) for a decidedly rich taste.
- ◆ Manipulating textures (e.g., foam, dust, and gel)
- ◆ Making theatrical presentations (e.g., fizz, froth, and vapor)
- ◆ Using chemistry lab equipment to create unexpected dishes (e.g., liquid nitrogen flasks, vacuum sealers, cream whippers, and siphons)
- ◆ Manipulating food with additives (e.g., agar-agar and calcium alginate)

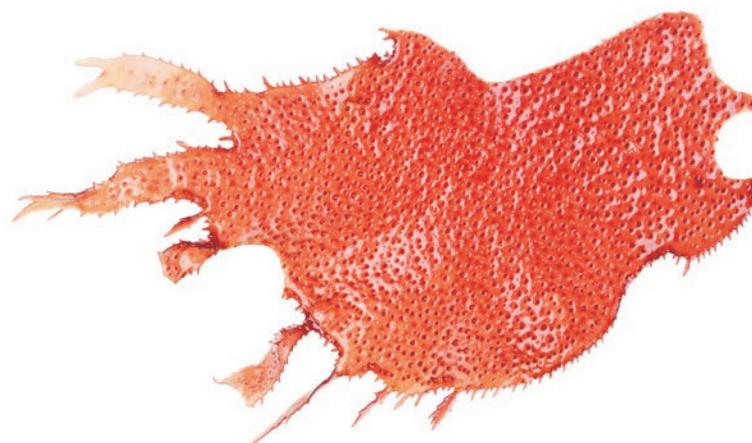


FIGURE 1. Several molecular gastronomy supplies are made from the red marine algae pictured here. Agar-agar is an example of a gelling agent extracted from the cell walls of the red algae and used as a food thickener. It is a vegetarian alternative to animal gelatin.

MG uses high-tech equipment and chemicals to create physical and chemical transformations during cooking that make food unique.

TRANSFORMATIONS: HOW MG WORKS

Chemists sort all matter into three groups: elements, compounds, and mixtures. Elements (e.g., carbon, hydrogen, and oxygen) cannot be broken into other substances. Compounds (e.g.,



EXPLORING OUR WORLD...

SCIENCE CONNECTION: How Molecular Gastronomy Works

Want to see how Jelly Belly candy gets its flavor? Check out “How Molecular Gastronomy Works” at <http://science.howstuffworks.com/innovation/edible-innovations/molecular-gastronomy.htm>. This site identifies the difference in colloidal dispersion, (e.g., foam, solid foam, gel, emulsions, and solid emulsions) with a chart that is easy to understand. Have you heard about the Maillard reaction in science class? The sugars and amino acids in meat cross-link during the roasting of meats. Do you want to know the famous MG (molecular gastronomy) chefs’ signature dishes? The Web site lists several.

water, table salt, and water) are made of two or more distinct elements joined chemically in a specific proportion—water is two parts hydrogen to one part oxygen (H_2O). Mixtures are combinations of substances not held together chemically. They can be separated by physical means (e.g., filtering).

Food dishes are mixtures known as colloids. **Colloids** are materials composed of tiny particles of one substance dispersed, but not dissolved, in another substance.

TABLE 1. Colloid Examples

Type	The Science Description	Examples
Foam	Gas dispersed in a liquid	Whipped cream and beverage foams
Solid foam	Gas dispersed in a solid	Marshmallows
Gel	Solid dispersed in a liquid	Gelatin and jelly
Emulsion	Liquid dispersed in a liquid	Mayonnaise, milk, and cream
Solid emulsion	Liquid dispersed in a solid	Butter and cheese

Source: Molecular Gastronomy at <http://science.howstuffworks.com/innovation/edible-innovations/molecular-gastronomy2.htm>

MG Safety

Is molecular gastronomy safe? Molecular gastronomy uses no synthetic chemicals. Instead, it uses biological



FIGURE 2. This molecular gastronomy dish is mushroom soup transformed by gelification and foaming. The texture and consistency have been manipulated.



BROADENING AWARENESS...

AMAZING ASPECTS: Cognitive Cooking

Check out IBM's "Cognitive Cooking" at <http://www.ibm.com/smarterplanet/us/en/cognitivecooking/index.html>. Watson, IBM's computer, combines flavors for chefs from the Institute of Culinary Education to prepare and offer for sampling from a food truck. Watson pairs flavor compounds by identifying compatible chemical compositions in foods. An example of flavor pairing is a Vietnamese Kebab with pork, mushrooms, and strawberries. Use Twitter to vote for the food to be prepared by chefs for samples from the food truck. Think of the expansion of flavor combinations in molecular gastronomy using the IBM cloud technology.

chemicals from plants and animals in small amounts that meet standards for human consumption.

MOLECULAR GASTRONOMY TECHNIQUES

Various techniques can be used by chefs to make meals memorable and pleasing to various senses.

Dehydration

Dehydration is the process of drawing moisture out of food to preserve it and/or to dry its surface. Most consumers are familiar with dried tomatoes, crispy banana chips, and fruit leathers. Molecular gastronomists use dehydration in a different way. Food is preserved and used for its crunchy or crispy texture and intense flavor (e.g., crispy sheets, dusts, and flavored powders). Dehydration occurs when warm, dry air is circulated around food to crisp and/or to preserve the food for another or a later use. Dehydrating food is conducted in a commercial dehydrator (a series of slotted disks holding food onto which warm, dry air is circulated) or in a restaurant or home oven.

Emulsification

Emulsification is the technique that turns liquid into a light air-foam. It incorporates and stabilizes air bubbles in a liquid mixture. Typical additives that create emulsifications are soy lecithin and methylcellulose (also called surfactants). **Surfactants** are surface-active agents that reduce the tension between the water and air surface to stabilize the air and the foam.

[NOTE: Dish detergent is a type of surfactant. It reduces the tension between baked-on food and the pot, pan, or baking dish surface to help release food particles.]

- ◆ **Foam** is an emulsification process that develops froth from liquids. Foam traps air bubbles in temporary emulsions. (They are temporary emulsions unless stabilized with whipping equipment or with the addition of gelling or thickening agents.) Examples of foams

are meringues and homemade marshmallows (an example of solid foam). Air bubbles are trapped in a liquid and are turned into a foam mixture with agitation. In MG, emulsification incorporates and stabilizes the air bubbles in a liquid. A person can simply whisk air into a mixture to create foam, but this process is unstable and will soon deflate. An emulsifier added to the foam acts as a barrier between air and water to stabilize mixtures. Gelatin, agar-agar, and xanthan gum are replacements for fat molecules in heavy cream.

◆ **Froth** is a cooking term referring to a layer of foam consisting of tiny bubbles or the process used to achieve them.

◆ **Siphon whipping** is the creation of a foam mixture without the addition of an emulsifying agent. The product of siphon whipping is called “espuma,” which is the Spanish word for foam. Culinary gourmet whippers have been used for many years to make whipped cream and Chantilly cream (e.g., iSi Cream Whips with N_2O cartridges). The heavy cream is poured into the whipper along with flavoring and powdered sugar. Then the nitrous oxide cartridge (N_2O) is inserted into the device, and the gas is released in the bottle. Pressurized gas bubbles penetrate the fatty liquid (heavy cream). As a result, the volume of the cream increases. The powdered sugar contains some cornstarch to stabilize the mixture and prevent deflation of the whipped product. Next, the mixture is allowed to hydrate for about 20 minutes. Finally, the device is turned upside down. Then whipped cream is deposited onto desserts, coffee beverages, etc. The volume obtained in the cream whipper is greater than the volume a person can obtain with a wire whisk or hand mixer.

◆ Stabilizing freshly whipped cream is a related emulsification process. To prevent fresh whipped cream from deflating after 3 hours, the following steps should be taken. Start by adding $\frac{1}{2}$ teaspoon unflavored powdered gelatin into $\frac{1}{2}$ tablespoons water. After it stands for 3 minutes, place it in the microwave for 5-second intervals until dissolved. The unflavored gelatin stabilizes the liquid. Food dishes created with unflavored animal gelatin are stable to $99^\circ F$. Begin whipping $1\frac{1}{2}$ cups chilled heavy cream with $\frac{1}{2}$ teaspoons granulated sugar and $\frac{1}{2}$ teaspoon vanilla. The gelatin mixture should be added slowly until soft peaks form.

◆ **Fizz** is a bubbling feeling on the tongue due to concentrated carbon dioxide (CO_2). As the bubbles burst in the mouth, a pain response is triggered from the nerves in the tongue and mouth. The nerve response intensifies the food aromas and flavor. Without carbon-



FIGURE 3. This shrimp with lemon mousse foam illustrates the use of foam in molecular gastronomy.

ation, for instance, beverages taste bland. Carbonation of fruits can be accomplished in a soda siphon or in an iSi cream whip device.

- **Effervescence** is a chemical reaction that results in the escape of gas from a body and the foaming or fizzing resulting from the release of the gas. A common example is the carbonation in soft drinks. The common additive to create effervescence is popping sugar. Popping sugar (Pop Rocks) is, simply put, sugar that contains carbon dioxide. Once the popping sugar melts, usually from coming in contact with moisture, a popping sensation is felt in the mouth.
- A simple effervescent mixture (a mixture that bubbles) can be made with one part baking soda, one part Fruit Fresh or crushed vitamin C tablets, and two parts powdered sugar. The effervescent mixture should be added to the dry skin sides of cut apples or pears. It can be dusted on toffee candy. The fizzing sensation is a combination of sodium bicarbonate (baking soda), citric acid (an ingredient in Fruit Fresh), and water (saliva when tasted). The powdered sugar is added for sweetness and to counteract the bitter taste of baking soda.

Flash Freezing or Nitrogen Freezing

Flash freezing or nitrogen freezing is “cooking” with liquid nitrogen that quickly freezes any food it touches at -321°F (-196°C). In cooking, liquid nitrogen is a coolant. As the liquid nitrogen “boils away,” it gives off a thick nitrogen fog (vapor cloud) that adds drama to food preparation and presentation. Liquid nitrogen is transported in special flasks and is dangerous to the skin. An anti-griddle is an alternative to liquid nitrogen. At -30°F (-34°C), it looks like a cooktop but does not heat food. It instantly freezes sauces and purées on the outside while the interior remains a creamy, thick liquid. Liquid nitrogen creates an instantaneous vapor cloud that results from the condensation of ambient air. It cools the food, causes a vapor (fog), and evaporates. The denser the food, the colder it will become (and the longer it takes for the liquid nitrogen to evaporate).



FIGURE 4. This caramel popcorn vanilla panna cotta dessert has been treated with liquid nitrogen. What is panna cotta?

- ◆ **CAUTION:** The extreme cold of liquid nitrogen makes handling dangerous. Training is required prior to use to understand reactivity and burn risk. Aprons, gloves, and other specially designed safety gear are best used when handling liquid nitrogen.
- ◆ Liquid nitrogen is not an ingredient, so it is not consumed. It cools the food and then evaporates. Food should only be eaten after the liquid nitrogen is fully evaporated. Also, foods cooled with liquid nitrogen are extremely cold and must “warm up” before eating.

Gelification

Gelification is the molecular change of a liquid food to a solid, gel-like food. MG gel types include pearls, ravioli, and spaghetti shapes. Liquids are converted to solids with the addition of a gelling agent. Traditional gels are found in flours, tapioca, cornstarch, eggs, and gelatin. Gelling agents typically are dry (powders and sheets) and need to be hydrated (take up water or another liquid). Gelification occurs when a substance (e.g., agar-agar and unflavored animal gelatin) stabilizes a liquid. MG food dishes created with agar-agar are stable (do not melt) up to 185°F. Food dishes created with unflavored animal gelatin are stable to 99°F.

Gelling agents come from nature. Some are agar-agar (used in commercial puddings, candy, and soups), gelatin (used to make Jell-O), carrageenan (used in commercial chocolate milk and salad dressings), and pectin (used to make jelly). **Collagen** is the structural protein in the connective tissue of animals. It is extracted from meat byproducts (e.g., bones, hides, and hoofs) and is used to manufacture gelatin.

Gelification occurs in many refrigerated cooked meats and fish. The small amount of liquid turns to a gel around the meat when it is refrigerated. The general steps to creating a gel are dispersion, hydration, and formation. Dispersion is distributing the gelling agent throughout the liquid. The gelling molecules must be completely surrounded by water to separate the powder particles, and it must be stirred enthusiastically to disperse the molecules. Gelatin molecules stick together and form lumps when the molecules are not well dispersed. Hydration adds water (or another liquid) to the gel molecules. This causes the molecules to be suspended in the solvent (liquid). Typically, it requires heating to properly hydrate the solution. Formation occurs after hot hydration and the temperature dropping to a gelling temperature. Some gels form at room temperature, and others form under refrigeration.

Sous Vide

Sous vide (French for “under vacuum”) is a technique that involves sealing food in an airtight plastic bag and cooking it in a water bath for several hours on low heat. Sous vide allows food to retain moisture and flavor. Food is vacuum-sealed in airtight plastic and is cooked in a water bath for a longer time than normal. Some sous vide machines circulate the water, and some do not. Circulation speeds the cooking time. Vacuum-packing food and immersing it in a hot water bath changes the physics of cooking. Because the temperature control is so precise, the core temperature is reached within a half-degree, so overcooking is close to impossible.



DIGGING DEEPER...

UNCOVERING ADDITIONAL FACTS: Sous Vide Steaks

Many restaurants purchase or precook sous vide steaks to serve in their restaurants. See the video at <http://www.chefsteps.com/activities/sous-vide-steak>. Sous vide is so popular that a water bath can be purchased for home use. Alternative methods use a small cooler.

Vacuum packing prevents air from insulating the food, increases food safety, and slows oxidation reactions that can lead to unwanted color changes and off-flavors.

Spherification

Spherification is the shaping and encapsulation (capture) of a liquid inside spheres held by a thin gel membrane that visually resembles caviar. It is a food reengineering manufacturing process. Spherification gives liquids—juices, sauces, and soups—the appearance of caviar or small balls. It is solid on the outside with liquid on the inside. Sometimes the shapes are larger spheres called ravioli. Sodium alginate and calcium chloride create a sturdy outer membrane that contains a liquid juice (e.g., fruit, vegetable, or mushroom) because the salt extracted from the brown algae cells (the source of sodium alginate) makes the sphere flexible. The thin membrane bursts when eaten and releases a burst of flavor on the tongue. Unlike agar-agar, the gelling with sodium alginate is completed in cold conditions.

- ◆ Basic spherification is immersing a liquid containing sodium alginate in a high-calcium bath. The calcium ions migrate from the sphere's exterior to its interior and trigger the membrane's gelification. The process creates a wall that traps liquid inside the sphere (a process similar to gelification). A person should scoop out the mixture quick enough so it jellies on the outside and stays liquid on the inside. The result is caviar-shaped balls. Other types of spherification are reverse spherification and frozen reverse spherification.
- ◆ Dropping water into flavored dry gelatin (Jell-O) produces simple spheres. The process works best using an eyedropper or pipette, but drops from a



FIGURE 5. Raspberry caviar on blueberry gel is a dessert made with two molecular gastronomy techniques: gelification (the base) and spherification (the “caviar”).



FIGURE 6. Pictured is apple strudel dessert with molecular sweet caviar and berries. What juices would you use to make the two types of sweet caviar spheres for the apple strudel?

spoon provide irregularly shaped spheres. This is a simplistic method of making spheres using the gelification process.

- ◆ Larger spheres are produced in a silicone mold to flavor ravioli. Any flavors can be formed into ravioli using a recipe containing sodium alginate and calcium chloride. Some large spheres are frozen in the silicone molds.

Other MG Techniques

Powderizing

Powderizing is the transformation of any fatty food ingredient into a lightly flavored powder. High-fat ingredients (e.g., chocolate, peanut butter, and bacon) may be transformed to a fine powder by using maltodextrin. As the maltodextrin additive is blended with the food item, it forms a powder.

Suspensions

Suspensions use xanthan gum to defy gravity by suspending fruit, herbs, or flavor caviar in a liquid. The xanthan gum allows items to be “suspended” in a liquid rather than floating to the top or sinking to the bottom. The xanthan gum creates bonds that join between the gum molecules. These bonds form a network to trap air in the liquid. Many beverages are served with suspended fruits, herbs, or flavor caviar in the drink.

Layering

Layering produces distinctive layers of liquids or gels in a clear glass container or silicone mold. Gelatin is used to thicken and turn liquid food into a solid gummy gel. Each layer added to the product must be less dense (lighter in weight) than the previous layer to allow it to float on top of the last layer.

Smoking

Smoking infuses smoke flavor into unusual foods (e.g., beer, ice cream, and spinach salad). Sometimes dry ice is used to give a smoking appearance. A molecular gastronomy tool—a smoking gun—coats the food with a surface infusion of smoke flavor. It allows the cook or chef to create a smoky flavor without overcooking or drying food. The smoking gun can be used on the surface of beverages, too.



FIGURE 7. The layered gelatin dessert is passion fruit and lemon gelatin pudding served in a martini glass with a mint sprig.

Edible Paper

Edible paper or film is made from soybean, rice, and potato starch. It is used for transparent ravioli, transparent forms to hold morsels, and flavor-infused paper. Soy lecithin is the additive in edible film wrappers and acts as an emulsifier.

ADDITIVES, SUPPLIES, AND EQUIPMENT

- ◆ **Agar-agar** is a gelling agent extracted from the cell walls of red algae and used as a food thickener. In Malay-Indonesian languages, the name agar-agar is literally “jelly.” In molecular gastronomy, this powdered gel is used to form many gel shapes: pearls, spaghetti, lentils, prisms, etc. It is a vegetarian alternative to animal gelatin.
- ◆ Calcium salts are mineral salts. Those used in MG processes include calcium chloride, calcium lactate, and calcium gluconate. A mixture of gluconate and calcium lactate can be found under the name “calcium gluconolactate.” In MG, it is used in basic spherification and reverse-spherification processes in reaction with sodium alginate (e.g., sodium alginate needs a source of calcium to form a gel).
- ◆ Carrageenan is a gelling agent from several species of red algae. It is a thickening and a gelling agent. The commercial food industry is the largest user of carrageenan. It is used as an anti-settling agent for light mayonnaise and light salad dressings; as a stabilizer to prevent the separation of proteins in cottage cheese and ice cream; and to keep the chocolate particles suspended in chocolate milk.
- ◆ Gelatin is a protein food additive from collagen in meat and fish bones released by boiling. It is typically packaged as unflavored gelatin in powdered or sheet forms.
- ◆ Gellan gum is a gelling agent made from fermented algae. In MG, gellan gum produces a variety of firm-jellied pieces with distinctive shapes. It is water-soluble and is used primarily in the food industry as an anti-settling agent, a thickener, and a stabilizer for prepared foods. Chefs use gellan gum to produce the gels for terrines and aspics.
- ◆ Liquid nitrogen is the element nitrogen (N) in a liquefied state. It is used to cool quickly or to extract flavors with evaporation at a temperature of -321°F (-196°C). It is a cryogenic (very low temperature) fluid that causes rapid freezing when it contacts living tissues. Once the food is frozen, the nitrogen “boils away” and creates a thick fog. In MG, this liquefied gas produces frozen foams and ice cream. [CAUTION: The extreme cold of liquid nitrogen makes handling dangerous. Training is required prior to use to understand reactivity and burn risk. Aprons, gloves, and other specially designed safety gear are best used when handling liquid nitrogen.]
- ◆ Maltodextrin is an “unsweet” sugar (a polysaccharide) from corn, wheat, potato, or tapioca starch that absorbs fat flavors (e.g., bacon and chocolate) and remains a powder. First the fatty food is liquefied. Then the maltodextrin is blended until the desired powder consistency is formed. Maltodextrin is a significant portion of powdered energy drinks and is used as filler in manufactured foods. In MG, its primary use is as an “aroma carrier.” It absorbs the flavor of the fatty food in which it is mixed (e.g., chocolate, almond, or bacon) and transfers that flavor to the MG dish.

- ◆ Pectin is a **polysaccharide** (a long chained carbohydrate molecule) from berries and other fruits used in exact combinations of sugar and fruit acid to make jelly or jam.
- ◆ Popping sugar is a sugar that contains carbon dioxide (CO₂), so it “pops” or creates a fizzy feeling in the mouth. The “pops” are usually audible. It is small bits of melted sugar (sucrose, lactose, and glucose syrup) to which carbon dioxide is introduced. The sugar is melted and then cooled in the presence of pressurized CO₂ so the sugar bits trap the CO₂. As a result, when a person bites into popping sugar, the sugar bits “pop.” Carbon dioxide is the same gas used in soft drinks.
- ◆ Sodium alginate is a gelling agent made from brown algae. In MG, it is paired with calcium salts in the spherification technique (e.g., pearls and raviolis). The gelling process with sodium alginate is cold rather than the more common heated process using agar-agar.
- ◆ Soy lecithin is an emulsifier made from soybean oil and is used to make any liquid an emulsion or foam or frozen foam. Lecithin is a lipid (fat) found in the cell membranes of all living beings. It is what allows humans and animals to maintain and repair cells. The soybean oil contains phospholipids: chemical compounds that are fat- and water-soluble. The phospholipids make mixing oil and water—as for mayonnaise and hollandaise sauces—possible. The edible film discs used in MG cookery are produced from soy lecithin.
- ◆ **Xanthan gum** is a thickening agent produced by fermentation, and its main function is to increase the viscosity (thickness) of a liquid. It is a complex polysaccharide: a natural thickener from a process that converts glucose sugar to acids or to alcohol. In MG, it is used to thicken sauces and dressings; to produce low-fat, no-ice cream milkshakes that have viscosity (are thick); and to suspend fruits and other items in liquids. In the food industry, xanthan gum stabilizes emulsions (e.g., salad dressings, mayonnaise, and hollandaise) by preventing oil separation.

High-Tech Cuisine Supplies and Equipment

Molecular gastronomy uses high-tech equipment and chemicals to create physical and chemical transformations during cooking that make food unique. Molecular gastronomists are chefs who experiment with a variety of ingredients, tools, and techniques.

- ◆ Anti-griddles (surface that cools and/or freezes foods)
- ◆ Citrus sprayers
- ◆ Cream whippers and soda siphons (with chargers)
- ◆ Dehydrators (removes moisture and/or dries food)
- ◆ Digital scales
- ◆ Edible film and sealers
- ◆ Hot infusion siphon (infuses and/or adds flavor to a liquid)
- ◆ Liquid nitrogen
- ◆ pH indicator paper and pH meter (checks acid or base level of food products)

- ◆ Plastic pipettes and high-grade plastic hypodermic syringes
- ◆ Silicone tubes, measuring cups, ice trays, and hemisphere molds (to shape foods)
- ◆ Sous vide water bath (machine that cooks food at a constant and specific temperature)
- ◆ Spherical ice molds
- ◆ Vacuum sealer (removes air from plastic bags)



FIGURE 8. An iSi gourmet whip is used to add foam or froth to molecular gastronomy food. Notice the MG foam, spherification, and suspension techniques used in this picture.

Summary:



Molecular gastronomy is the physics and chemistry that take place during cooking. It is a theatrical, modern, and scientific process to manipulate the textures and appearance of food. Molecular gastronomy uses a variety of techniques, additives, supplies, and equipment to make innovative, science-based modern cuisine. Foam, spherification, and suspension techniques are just a few of the strategies utilized by MG chefs.

Checking Your Knowledge:



1. What is molecular gastronomy?
2. What makes the additives used in molecular gastronomy safe?
3. List and describe five MG techniques.
4. List and describe five MG additives.
5. List and describe five MG supplies and equipment.

Expanding Your Knowledge:



Watch the Molecular Gastronomy Prezi presentation at <http://prezi.com/x9xpf6rj3qo9/molecular-gastronomy/>. This computer-designed poster reviews the basics of molecular gastronomy and is for educational use only. Use this as a simple review of molecular gastronomy.

Web Links:



Fruit Juice Spaghetti

<https://www.youtube.com/watch?v=PflRIKIxl6c>

Dehydrating Food

<http://www.backpackingchef.com/dehydrating-food.html>

Liquid Nitrogen in the Kitchen

<http://science.howstuffworks.com/innovation/edible-innovations/molecular-gastronomy4.htm>

Edible Paper

http://www.wilton.com/store/site/product.cfm?sku=pg_patternss