YOU can prepare better food if you know what goes on in the food you are preparing and why things happen as they do.

Foods change physically and chemically during cooking. If you know their composition and structure you can control these changes and have superior products from your efforts.

Proteins, fats, and carbohydrates are your major allies (and maybe problems) in cooking.

Protein in egg white, for example, serves as a stabilizer for foams and makes possible such products as meringues, angel food cakes, souffles, and so on. Proteins help emulsify, thicken, and bind together other food materials.

Fats give flavor and richness to foods in which they occur naturally, as in milk, eggs, and meat, and the foods to which they are added, as in vegetables, baked products, and salad dressings. They are used to fry or to cook foods and to add tenderness to breads, cakes, and pastry.

Carbohydrates have a part in thickening, tenderizing, or sweetening cakes, breads, candies, ice cream, and other foods.

Each group of foods has its own chemical and physical properties that determine the best method of preparing or cooking it. These properties I discuss in relation to their application in the preparation of food. They are the secrets of good cooking.

Eggs are highly useful in cooking. They give color and flavor and hold other ingredients together. The proteins in the white and yolk coagulate on heating and thicken the liquids they are mixed with, as in custards. The proteins can encase air, and so provide leavening power, or lightness, as in cakes. Eggs bind ingredients together, as liquids in mayonnaise and solids in croquettes, and help to form an elastic framework, as in cream puffs and popovers.

Eggs often are sold by grade. Grade AA and Grade A eggs are of top best quality. They have a large proportion of thick white, which stands up well around the firm, high yolk. High-quality eggs are good for all uses, but their appearance and fine flavor are especially appreciated for poaching, frying, and cooking in the shell.

Because most of the white of Grade B and Grade C eggs is thin, it spreads when the egg is broken out on a flat surface. The yolk is rather flat and
may break easily. In hard-cooked eggs of B or C quality, the yolk is offcenter because the white is too thin to hold the yolk in place. B and C eggs have dozens of uses in which appearance and delicate flavor are less important. They are good to use for scrambling, baking breads and layer cakes, thickening sauces and salad dressings, and combining with other foods.

Grade AA and Grade A eggs make larger and better flavored angel-food cakes than Grade B or Grade C eggs.

The ability to coagulate—to change from liquid to solid form—is an important characteristic of the proteins in egg. The change is largely physical, from soluble to less soluble protein or from liquid to solid form. The commonest method of coagulating protein is by heat.

Proteins have no definite temperature for coagulation, because it may be raised or lowered by a number of conditions, such as the presence of varying amounts of salt, sugar, acid, alkali, or alcohol. Sugar raises the temperature of coagulation of egg protein. Acids and salts usually lower it. Eggs can coagulate faster in the presence of salts or acids, such as those in milk and fruit juices, and the alcohol in wines that are sometimes used in cooking.

The texture of eggs cooked in the shell is affected by the heat. The white is firm but tender, and the yolk is smooth when eggs are cooked at simmering temperatures below the boiling point of water. Cooked at the boiling point of water, the white is firm but somewhat tough and the yolk is mealy.

Cooking eggs at high temperatures for a long time causes hydrogen sulfide gas to form from the sulfur present in egg white. The gas comes into contact with the iron in the yolk and forms ferrous sulfide, which causes a green discoloration on the surface of the yolk. The green color is harmless, but it looks less appetizing than a yellow yolk. The hydrogen sulfide diffuses to the outer surface and less discoloration takes place if the eggs are cooled quickly in cold water immediately after cooking.

For the same reason, a green color sometimes develops on the bottom of a foamy omelet during cooking. It happens oftenest when the omelet is cooked in the oven, because a longer cooking time is needed, and some of the yolk may separate from the white and drain to the bottom of the pan. You can prevent it in omelets by beating the white thoroughly, mixing well with the yolk, and cooking promptly.

The coagulation temperature of an egg-milk mixture is higher than that of egg alone. It depends on the proportion of such ingredients as egg and sugar. If you use more sugar, the coagulation temperature of the egg is higher and there is less chance of overcooking. The egg in baked custard thickens more readily when less sugar or more eggs are used.

Custards separate or curdle because they are cooked at too high a temperature or too long a time. Then the proteins shrink, and the mixture becomes watery. The safest way to keep the liquid from separating is to control the temperature and time of cooking custards by placing them in a pan of hot water and cooking in a moderate oven to maintain a uniformly low temperature. They should be removed from the heat as soon as coagulation takes place. A knife blade inserted in the center of the custard will come out clean when the egg has coagulated. Soft custards must be removed from the heat when the mixture coats the spoon and has the thickness and smoothness of cream.

When you make pie fillings and use egg in combination with starch as a thickening agent, you have to cook the starch with the liquid before you add the egg, since each thickening agent requires a different temperature and time of cooking. The mixture must be heated enough to coagulate the egg after you add it, or the filling will be thin. The coagulation tem-
perature of the egg in pie fillings is generally higher than in custards, as more sugar is used, and there is more danger of undercooking than overcooking the egg. The filling may have a grainy texture if the egg is overcooked.

Eggs help two liquids—such as oil and vinegar in mayonnaise dressing—to form stable emulsions. Oil and vinegar mixed together by beating tend to separate quickly unless the oil droplets are coated with thin layers of some substance such as egg yolk. The yolk is better for this than the white or whole egg because it contains fat as well as proteins. Adding salt, paprika, mustard, sugar, or other seasonings to the yolk before the oil is added makes a more stable emulsion.

In cream puffs and some types of cakes, other emulsions are formed, which eggs help to stabilize. The stability in cream puffs is important, and cakes made from stable emulsions are better than those made from batters containing broken emulsions. Egg brings about an intimate mixing of fat and liquid with each other and with other ingredients in batters and doughs. This gives cake fineness of grain, particularly in a mixture containing fat, and makes it lighter. If a cake is not rich enough, yet falls when more fat is added, the addition of another egg permits the use of more fat. The same rule holds if you want richer muffins; egg as well as fat may need to be added if the product is to retain its lightness.

A foam is formed when egg white is beaten. It is due to its albumin, a tenacious and viscous protein that stretches and holds the air beaten into it. The foam consists of many tiny bubbles surrounded by a film of coagulated protein. The coagulation of the protein, caused by the whipping, makes the foam rigid. The yolk does not increase in volume when it is beaten as much as the white, and the foam is much finer. If the white and yolk are beaten together, a frothy foam is formed after long beating. The emulsified fat in the yolk apparently cuts the foaming power of the proteins of the white. That is why you should not permit any of the yolk to get into the white when you separate eggs if the white is to be beaten stiff.

A little sugar added to beaten egg white increases the stability of the foam. There is less danger of overbeating egg whites when sugar is added at the start of beating, because the beating time is increased. This is an advantage with electric beaters and a disadvantage with hand beaters. Overbeating the egg white before adding the sugar increases the tendency of liquid to separate from the foam (leakage). You get a more stable meringue if you add the sugar at the start or during beating. Salts or acids in the form of cream of tartar or lemon juice also increase the stability of beaten egg white for meringues and angel food cake.

Many cooks encounter leakage and beading (droplets of sugar sirup on the surface) in soft meringues for toppings of pies and puddings. The degree of coagulation of the egg white is important in controlling the amount of beading and leakage in a soft meringue. Too little coagulation leads to leakage. Too much leads to beading.

The temperature of the filling has a lot to do with it. When the filling is cold at the start of baking, the meringue is apt to leak. When the filling is warm, it is more apt to form beads of sugar sirup on top. Less leakage occurs on cold fillings when meringues are baked at 325° F. for 10 minutes than at 425° for 4½ minutes. On warm fillings, where leakage is at a minimum, less beading occurs when meringues are baked at 425° than at 325°. On either filling, meringues baked at 425° are more tender and less sticky when cut than those baked at lower temperatures.

The grade of the egg makes little difference in the extent of beading, but the addition of cream of tartar (an acid salt), especially to eggs of lower grades, tends to increase the beading
because acids coagulate egg protein. Hard meringues are usually crisp and puffy. They are used for dessert, alone or with fruit and ice cream. You make them by drying foams of sweetened whites in the oven. The sugar crystallizes as the water evaporates. Because you use a large amount of sugar, 4 to 6 tablespoons for each egg white, you have to beat the whites a long time to form a stable foam. Acid or cream of tartar is sometimes added to produce a more stable foam and to increase the tenderness of hard meringues.

A crisp, tender meringue, however, depends largely on the baking. The oven is set at as low a temperature as possible, and the moisture is evaporated slowly. High temperatures cause browning before the water has a chance to escape from the inside, because the heat penetrates slowly through the foam. To get a meringue that cuts and eats well, the sugar must crystallize in small crystals during the drying-out process in the oven. Many sugar crystals give a product that is easily broken apart; few or no crystals make it chewy.

On a moist or rainy day, the sugar in the meringues attracts water from the atmosphere, and the meringues may become wet and sticky if the sugar crystals take on water.

Milk and milk products are available in many forms. Fresh fluid milk is almost always pasteurized. It may be homogenized—treated under pressure to reduce the size and increase the number of tiny fat globules so they will not rise to the top as cream. Sometimes vitamins A and D are added to it. Sometimes nearly all of its fat may be removed. Evaporated, dry, frozen, condensed, and fermented milk (buttermilk and yoghurt) are used in the preparation of food.

Low cooking temperatures are recommended when milk is a main ingredient of a recipe. Long cooking at high temperatures coagulates some protein, causes an off-flavor in the milk, and caramelizes the lactose—that is, it decomposes or breaks it down into simpler compounds. The milk gets a brown color.

Milk soups and sauces therefore are cooked usually in a double boiler, and custards are cooked in a baking dish set in a pan of hot water.

You can use most forms of milk in place of fresh, whole milk in a recipe. Exceptions are buttermilk and yoghurt, which might give an unwanted flavor, and sweetened condensed milk, which contains such a high percentage of added sugar that it is used almost entirely in making candy, cookies, and desserts.

Homogenized milk may be used interchangeably with nonhomogenized milk in a number of dishes. You may, however, find slight differences in texture of the finished products or variations in cooking times with some recipes. Sauces made from homogenized milk are stiffer and show more fat separation than those made from nonhomogenized milk.

Cornstarch puddings made with homogenized milk are more granular. Homogenized milk tends to curdle more readily than nonhomogenized milk in soups, gravies, scalloped potatoes, cooked cereals, and custards.

Baked and soft custards made with homogenized milk take 15 to 20 minutes longer to cook than custards made with nonhomogenized milk because the rate of heat penetration is slower.

Evaporated milk is homogenized whole milk concentrated to double strength by evaporating part of the water from the milk. If you use equal parts of evaporated milk and water, you can use evaporated milk as you would any other fluid milk. It produces excellent results in making cream soups and other foods where a fine, smooth consistency is desired.

Evaporated skim milk, one of the newer forms of milk, may be diluted with an equal amount of water and used like fresh skim milk.

Dry whole milk and nonfat dry milk, made by removing all the water from
When you cook

Milk, may be used in any recipe calling for whole or skim fluid milk, respectively. The dry milk mixes readily with water to make fluid milk, or it can be sifted with dry ingredients for cakes and breads, stirred into flour for gravy and sauce, or mixed with cornstarch and sugar for puddings.

You can use dry milk in addition to fluid milk to increase the nutritive value of many foods. The proper amount of dry milk to use depends on the effect the added milk has upon the palatability and physical qualities of the product.

Cream must contain at least 20 percent of butterfat to whip easily—25 to 40 percent is better. Both the fat particles and the air bubbles are stabilized by films of protein in whipped cream. For a stiff, stable foam, there must be enough protein to form the stabilizing film around the air bubbles, and the fat particles must clump. Larger fat particles clump more readily and thus give more structural support, but too much clumping causes butter to form.

Higher viscosity increases the whipping properties of cream. Aging increases the acidity and viscosity of the cream and hence its whipping properties. Warm cream does not whip well, because the fat particles are oilier and thinner. The fat stiffens and the cream thickens as the cream is chilled. The best temperature for whipping cream is between 35° and 40°.

The addition of sugar to cream, before or after whipping, reduces its stiffness and stability by preventing coagulation of the protein around the air bubbles. Adding the sugar before whipping the cream increases the whipping time and reduces the volume.

Evaporated whole milk has about one-fifth of the amount of fat of whipping cream, but it has more whole milk solids. Undiluted evaporated milk may be whipped if it is first chilled to about 32° or lower until fine ice crystals form. Bowl and beater should also be chilled. Lemon juice or vinegar in the proportion of 2 tablespoons for each cup of milk may be added for greater stiffness and stability when the flavor is suitable to the food with which the whipped milk is to be combined. The volume of evaporated milk increases two to three times when it is whipped. The foam produced is smooth, thick, and glossy, and will be stable for 45 minutes to an hour if it is chilled.

The foaming ability of nonfat dry milk varies widely. In the best brands, the volume increases about four times, and the foam may be stable for several hours. The foam is more stable if the mixture of nonfat dry milk and water, 1 cup of each, is chilled first and if 2 tablespoons of lemon juice and 4 tablespoons of sugar are added before whipping. Nonfat dry milk then makes an acceptable, light-bodied topping.

Meat is made up of bundles of fibers or cells that contain a solution of proteins, nitrogenous substances, salts, carbohydrates, pigments, enzymes, and vitamins.

The fibers are surrounded by fluids of similar composition. The muscle fibers are surrounded and bound together by protein membranes, called connective tissue. Collagen and elastin are two proteins in connective tissue.

Among the muscle fibers are globules of fat. In general, the less connective tissue and the more widely distributed the fat, the tenderer the meat. The size of the muscle fibers, which depends on the exercise and age of the animal, also influences the quality of the meat. Tough meat usually has a coarser grain than tender meat.

Tender and less tender cuts of meat are obtained from the same animal because the muscles are not exercised or used equally. The muscles in the animal that get the most movement develop the most connective tissue, and so are less tender. Cuts from the leg, shoulder, and neck generally are not so tender as those from the middle back. From the middle back come steaks and roasts from the loin and sirloin, and rib roasts, which are considered tender cuts of beef.

All cuts of pork are generally tender
because of age and fatness. Most lamb cuts are tender because of age.

Aging or ripening of meat permits its natural enzymes to become active and induce tenderness by making some of the proteins more soluble. An animal’s muscles become stiff or rigid soon after slaughtering. If the muscles are cooked soon thereafter, they are apt to be tough. After some time, they become pliant again. With longer storage, enzymes and chemical changes produce ripened meat.

Various treatments before cooking have been recommended for tenderizing meat. Grinding, cubing, slicing, and pounding break up the muscle and connective tissue and make meat tenderer.

Several commercial preparations containing an enzyme are available. The enzyme often used is papain, which is obtained from the papaya plant. You sprinkle the enzyme powder over the meat and pierce it with a fork to aid in getting the enzyme into the meat. A solution of the enzyme is used commercially. The enzyme softens the connective tissue as well as the muscle protein. The maximum activity of the enzyme seems to occur at higher temperatures during the early cooking process, as the best temperature for papain activity is about 176°F. If the meat is not well done, the continued activity of the enzyme in the warm meat after cooking would break down the muscle tissue to an unpalatable stage.

Heat causes the coagulation of proteins, melting of the fat, and change in color of red meat to pink and finally brown or gray. In the presence of water or moisture naturally present in meat, collagen hydrolyzes to gelatin when heated.

Heat affects tenderness of meat. The coagulation of proteins causes a toughening of the meat and the hydrolysis of collagen to gelatin makes it tender. The total effect of heat depends on which reaction predominates. The changes in flavor caused by heat are due partly to the loss of volatile matter, caramelization of carbohydrates, decomposition of proteins and fats, and coagulation of protein. More and more changes in flavor take place the longer the meat is cooked.

The shrinkage of meat during cooking is due mainly to the loss of water, which escapes as steam, and to the loss of the water and fat, which are released from the meat and collect at the bottom of the cooking pan.

Losses due to cooking increase as the roasting temperature is increased with all varieties of cuts—ribs, chuck, rump, sirloin tip, or heel of round.

Searing at a high temperature for a short time followed by a low cooking temperature may cause greater shrinkage than if the meat is not seared. For a minimum amount of shrinkage and the most servings per pound of meat, low oven temperatures are recommended for as short a time as possible.

Some kinds and cuts of meat (chops, steaks, rib and loin roasts of beef, veal, pork, and lamb) are most palatable when cooked by dry-heat methods—baking or roasting, broiling, pan-broiling or pan-frying. Other cuts (pot roast, round steak, stew meat, heart, kidney, and tongue) are best cooked by moist-heat methods—braising, stewing, or simmering. Dry-heat cooking generally is successful with naturally tender meats that have little connective tissue. They need only to be heated to the desired temperature for eating. Moist-heat cooking is required by meats with much connective tissue, which is tenderized by long, slow cooking in a moist atmosphere.

For oven roasting, you put the meat on a low rack in a shallow pan at about 325°F, with fat side up so it will be self-basting. You add no water and do not cover the pan. The heat moves freely around the meat. The rack in the bottom of the pan keeps the meat from sticking. The bones of some cuts form a natural rack to keep the meat out of the drippings.

You do not need to flour, sear, or baste the roast during cooking. Good-quality meat holds its juices and cooks
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perfectly in an open pan if you use a constant low heat.

Roasting directions are similar for beef, lamb, and pork.

Many cuts of beef, including rib, loin, chuck, round, and rump, are tender and flavorful when cooked by the dry-heat method. Actually, the meat has enough natural moisture to soften small amounts of connective tissue and produce tender meat in the time required to cook by low heat.

Leg of lamb retains its shape, cooks in less time, and is juicier when the fell—a thin, paperlike, tasteless membrane or skin covering—is left on the leg of lamb roast until after cooking.

A meat thermometer shows the temperature inside the meat and is the most accurate measure of doneness. You insert it so that the bulb is at the center of the thickest part of the meat and does not touch bone or fat.

Beef may be cooked to the degree of doneness you desire—rare (140°F), medium (160°F), or well done (170°F). If beef is cooked so that it is still pink on the inside, shrinkage will be less and the meat will be juicier than if it is well done.

Veal is usually cooked well done to soften the connective tissue and to develop good flavor. Veal is young beef (calf) and is, therefore, lacking in fat. It is cooked by roasting, braising, or stewing until it is thoroughly done.

Lamb can be either medium or well done. Lamb chops are juicier if they are not overcooked.

Fresh pork needs to be cooked all the way through to bring out its flavor and to make it safe to eat. For best eating quality, it is usually cooked until the temperature inside the meat is 185°F (well done) as indicated by a meat thermometer. At this temperature, no traces of pink color in the juice or meat are present.

Tender turkeys, chickens, and ducks can be roasted in the same way as tender cuts of beef, lamb, and pork—in an oven at 325°F on a rack in a shallow uncovered pan. Ducks have a lower yield of cooked meat and more fat than turkeys and chickens roasted at the same temperature. Four-pound ducks have 22 percent of edible cooked meat; chickens and turkeys have 41 to 47 percent, respectively, of edible meat.

Cooking losses for roasted duck are exceptionally high, 42 percent, compared to 29 percent for roasted chicken and 27 percent for roasted turkey. The yield of meat from chicken and turkey compares favorably with that from beef, pork, and lamb cuts with bone in.

The cooking time for young turkeys can be shortened by covering the turkey and cooking it at the higher temperature of 450°F, but the cooked bird does not look quite so good as when it is roasted uncovered at 325°F. When the pan is covered, the steam is held around the bird and the collagen is solubilized to gelatin faster than by roasting in dry heat. The roasted turkeys have less splitting, the skin is less blistered and shriveled, and the browning is richer and more even.

The meat from turkeys cooked covered or uncovered is equally as tender, juicy, and flavorful, although thigh meat is juicier than breast meat in both cooking methods.

Most persons like poultry well done for full development of flavor, but you must be careful to cook poultry no longer than necessary for adequate doneness, because a few minutes of extra cooking results in considerable loss in juiciness. An internal temperature of 185°F to 195°F, with the thermometer bulb inserted in the center of the thickest part of the thigh muscles or into the breast muscles, usually indicates that the meat is adequately cooked. The muscles are at a higher temperature than the stuffing inside, which is less exposed to the heat. Sometimes therefore the stuffing is undercooked; then it spoils easily.

For broiling tender meat or young poultry under direct heat, you can adjust the temperature by the distance between the meat and the source of the heat. When the broiler rack is placed so that the top of the meat is
2 to 3 inches from heat, the temperature at the surface of the meat is about 350°.

For pan-broiling tender meats with a naturally high content of fat, you use a heavy frying pan and pour the fat off as it accumulates. For pan-frying leaner meats and chicken, you add a small amount of fat to prevent sticking.

Young chickens cut in halves or quarters are easy to cook in an oven set at 400°. The chicken pieces are brushed with soft fat and seasoned with salt and pepper as desired, before you place pieces, skin side down, in a shallow pan. After 30 minutes in the oven, the pieces are turned and basted with fat. The chicken should be done in an hour or less, depending on the thickness of the pieces. They come out brown, plump, and juicy.

You cook less tender cuts of meat and older turkeys and chickens longer, add moisture, and cover the roaster. They can be cooked also by braising and stewing or in steam under pressure.

Braising consists of browning the meat in fat, then cooking it in a covered pan, with or without added liquid, over low heat on top of the range or in the oven. The meat is cooked slowly until the meat is tender when pierced with a fork. Pot roasts and swiss steaks are examples of meats cooked by braising.

The meat for stews and soups is cooked slowly in a small amount of water until the meat is tender. A pressure saucepan may be used to shorten the cooking time of meats cooked by moist heat. Some of the flavor of the meat is lost to the liquid in braising. It is important therefore to use the liquid as gravy or sauce to be served with the meat. The fat may be skimmed off. The meat juices that are left may be poured over the meat or extended by adding more liquid and thickening with flour after the meat has been removed.

Cooking time for rib roasts of beef in the electronic range is less than in the conventional oven. The cooking is done by microwaves, a particular type of high-frequency radio energy. Microwave cooking is the application of this type of energy for producing heat within foods. When microwave energy comes into contact with a food, it is absorbed by the food and converted into heat. The only heat produced is in the food. The air in the range, the range itself, and the utensils remain at room temperature, except for the small amounts of heat they may pick up from the food.

A 4-pound roast cooked to well done in the electronic range takes 25 minutes instead of 3 hours—but roasts cooked electronically have 10 percent higher shrinkage than roasts cooked conventionally. Microwaves at this high frequency fail to penetrate a roast deeply and uniformly. The outer portions are heated rapidly by microwave energy, but the center is heated slowly by conduction. In a roast cooked to rare, there are distinct areas of well done, medium, and rare from outside to inside. When cooked to rare, the roasts in the conventional oven are tenderer than those cooked in the electronic oven. The difference in tenderness is less in medium-done and well-done roasts.

The amount of food to be cooked and its arrangement in the electronic oven affects the time and evenness of cooking. Four bacon slices will cook quickly and evenly to a golden brown. A little more time is needed for each additional slice. Quartered fryers cooked one at a time in an electronic oven take only 16 minutes to cook. Fryers cooked two at a time take about 24 minutes in an electronic oven and 1 to 2 hours in a conventional oven. Beefsteaks and lamb chops require a combination of electronic cooking and conventional broiling. Thus there is little saving in time for steaks and chops cooked in this way.

Most frozen meat may be thawed before cooking or cooked without thawing with equally good results. The usual cooking methods and times are used for thawed meat.
If frozen meat is not thawed, extra cooking time is required to allow for thawing during cooking. Large frozen roasts may take as much as one and one-half times as long to cook as the unfrozen roasts of the same size and shape. Small roasts and thin cuts cooked without thawing require less extra cooking time, depending on the size and shape of the cut.

Thawing frozen meat in the refrigerator results in the most uniform thawing and the most attractive appearance, but it takes longer. The time for the interior temperature of frozen meat to reach the temperature at which ice crystals start to melt (28°) is two to three times as long in the refrigerator as in the room; two times as long at room temperature as in running water; and two to three times as long in running water as during cooking.

Commercially frozen stuffed turkeys and chickens usually are roasted without thawing first. A minimum temperature of 165° must be reached in the center of the stuffing of frozen turkeys during the roasting period to assure adequate destruction of microorganisms. The lower the initial temperature and the larger the turkey, the longer is the roasting period required.

The roasting of a turkey should not be interrupted until the temperature of 165° is reached in the middle of the stuffing. Roasting a turkey partly and holding it to complete the roasting the next day is not advised.

Electronic cooking of frozen stuffed turkey is not recommended, because the meat is done before the temperature of the stuffing reaches 165°.

It is usually best to thaw frozen unstuffed poultry until it is pliable before cooking. The recommended method is to thaw frozen poultry in the refrigerator in the original wrapping. To shorten the thawing time, birds sealed in watertight wrappings may be thawed in cold water. After they are thawed, they can be cooked in the same ways as fresh poultry.

Frozen poultry parts may be cooked without thawing first, if desired.

### THE FATS AND OILS

We use include corn, cottonseed, olive, peanut, and soybean oils and lard, butter, and other semisolid fats from animal and vegetable sources. To make solid vegetable fats, vegetable oils (like cottonseed, corn, and soybean) are partly solidified by hydrogenation, which gives certain characteristics of both the original oil and the solid fats.

We use fats and oils for shortening, as in pastry, biscuits, muffins, and cakes; for frying and cooking foods; in mayonnaise and salad dressing; and to give richness and flavor to such cooked foods as vegetables and meats.

The primary purpose of shortening in pastry, biscuits, muffins, and cakes is to make a tender product. This effect may arise because a thin film of fat forms around the particles of other ingredients and the gluten cannot form.

The tenderness and flakiness of the pastry reflect the way the fat is distributed. Flakiness is determined by the layers of fat that separate layers of dough but melt during baking and allow steam to collect and maintain the open spaces between pastry flakes. Hard or plastic fats form layers more readily than soft fat or oil.

A tender pastry results when the flour particles are well coated by films of fat. Oil or melted fat therefore tends to give a tender, mealy pastry, and a solid fat gives a flaky pastry, although the way the ingredients are mixed and the dough is handled will make a difference in results.

To make pastry with liquid oil, you mix the oil with ice water until thick and creamy and then add all at once to the flour. You roll the dough between two pieces of waxed paper to the desired thickness and bake in the same way as other pastry.

Workers in experimental kitchens use an instrument, called the shortometer, to determine the shortening power of a fat. It measures the force needed to break crackers, cookies, or
pastry made from the fat. Research workers found that pastry becomes tenderer if the fat is mixed well with the flour. Soft fats require less mixing than hard fats to be equally tender. After the water is added, longer mixing develops gluten, and pastry is not so tender. Dough that is held in the refrigerator for a few hours or overnight is tougher than it was at first.

Day-to-day variations in tenderness are due to temperature, humidity, atmospheric pressure, and perhaps the way you handle the dough. If you use more water than is called for in a recipe for piecrust, you get less tender pastry, because the water develops the gluten in the flour. Kneading and re-rolling also increase toughness of pastry because of gluten development. Pastry flour gives a more tender pastry than bread flour, because it makes less gluten when it is mixed with water.

When fat and sugar are creamed—mixed by hand or in an electric mixer—for cake, the fat is adsorbed on the crystalline sugar and air is incorporated. The addition of egg dissolves some of the sugar, but the fat remains widely distributed. The liquid appears to be emulsified by the fat.

The temperature of the fat to be creamed is important, because neither liquid fat nor hard fat can form effective fat films around the sugar crystals. In order to distribute oils successfully in cakemaking, you add the oil, egg yolks, water, and flavoring in that order to a mixture of the flour, sugar, baking powder, and salt; mix them well; and then fold the mixture into stiffly beaten egg whites. In some quick-mix cakes, solid fats are first blended with the flour to distribute them evenly before the other ingredients are added.

If you use too little fat, the cake will be tough. Too much fat means the cake will be excessively fine, compact, and moist. Extra beating will improve the volume, but it will never be quite so large as a cake with less fat.

The amount of heating a fat or oil can stand before it smokes is important in the selection of a fat for frying. Deep-fat frying may require a temperature as high as 400°.

A heated fat is breaking down chemically when it smokes. Its fumes have a sharp odor and irritate the mucous lining of the nose and throat. The fumes give the fried food an unpleasant flavor and may be irritating to the digestive tract or a burden in metabolism. Once a fat is heated to the smoking point, its period of usefulness is limited; it becomes rancid sooner.

Only fats that have high smoking temperatures therefore are suitable for deep-fat frying. They include most of the vegetable oils and hydrogenated shortenings. Olive oil is not desirable for this purpose because of its low smoking point.

Shortenings vary as to the basic fats used and as to the additives that may affect the frying quality.

Because of its high percentage of free fatty acids, lard tends to smoke at a lower temperature, but many people like the flavor of food fried in lard.

The emulsifier type of shortenings (those that contain monoglycerides to make quick-mix cakes possible) sometimes appear to smoke even before they have reached deep-frying temperature. This bluish “smoke” is actually the vapor given off as the emulsifiers are broken down by heating.

Each time a fat is used, its smoking temperature will become lower. If fat used in frying is not overheated and if it is clarified frequently, you can use it over and over again. You should strain it carefully after use to remove crumbs and other foreign matter that escape from the food into the fat.

Solid fats are clarified by pouring hot water over the fat, using 1 cup of water for each cup of fat, and heating this mixture slowly for 10 minutes. The fat and water mixture is strained through a cloth. The cloth filters out the small, charred food particles, which contribute to fat breakdown. Then the fat and water mixture is chilled. When the layer of fat that comes to the top is hard, the water is drained off.
To clarify oils and fats that are soft at room temperature, thin slices of raw potato, 4 or 5 slices to a cup of fat, are added and cooked slowly over low heat for 20 minutes. The fat is then strained through a clean cloth and cooled. Strainers containing copper or iron damage fat and speed its breakdown.

The choice of fats for pan-frying is not limited to those with a high smoking point, because the cooking may be done at lower temperatures than is possible for deep-fat frying. Fats for pan-frying should not be heated high enough to smoke or burn, however.

The cooking time for french-fried foods is very short at the right fat temperature. Croquettes and all previously cooked foods are fried only 2 to 5 minutes at 375°; fritters and raw batter and dough mixtures, 2 to 3 minutes at 350° to 375°; and chicken, 15 to 20 minutes at 350°. Breaded chops or cutlets are cooked 5 to 8 minutes at 375° to 400°.

A thermometer helps you check the temperature of the fat. Fat that is too hot scorches the food and may not cook it through. Fat that is too cool soaks the food before a crust is formed, and the food must be cooked a longer time at the lower temperature. The amount of fat absorbed by fried foods affects their palatability and caloric value; checking the temperature of the fat therefore is doubly important.

The kind and proportion of ingredients used in the food for french frying influences the amount of fat that is absorbed. In doughnuts a rich dough, high in sugar, fat, and eggs, tends to absorb more fat than a lean formula. Longer mixing of the dough, however, develops the gluten and tends to lessen the amount of fat absorbed, but the product will be less tender. Increasing the amount of flour in the recipe or using bread flour instead of cake flour lessens the absorption of fat during cooking.

Cereal products are cooked to absorb water, soften the texture, modify the starch and protein, and develop full flavor.

Proper preparation depends on an understanding of the type and form of the product to be cooked. Some are relatively unprocessed whole kernels. Others are processed so that they require little or no cooking. Modern packaged whole-kernel cereals, such as rice, need no washing before use. Indeed, washing enriched rice removes some of the nutrients.

When you boil rice, you should use the smallest possible amount of water so that none is left over when the rice is tender. Proportions of 1 cup of rice and 2 cups of boiling water are used for regular white rice. The rice is sprinkled into the boiling water, a cover is placed on the pan to hold in the steam, and the rice is cooked over low heat until the water is absorbed (about 20 minutes). The pan then is removed from direct heat and allowed to stand for 10 minutes for the rice to finish cooking in its own steam. The cooked rice will be tender, firm, and dry. For a softer cooked rice, the water is increased to 2 1/4 cups, and the cooking time is extended to 25 minutes.

Another convenient method of cooking regular white or parboiled rice is in the oven. Boiling water is poured over the rice in a pan not more than 2 inches deep, the pan is tightly covered with a lid or aluminum foil, and placed in a moderate oven (350°). The rice will be tender, and not soft and sticky, in about 30 minutes.

A precooked enriched rice product is quickly and easily prepared. Boiling water is added in the proportions recommended on the package, and in 5 minutes the rice is ready to serve.

A canned white rice developed by the Department of Agriculture is partly rehydrated in the can. After the can is opened, the rice is heated for a few minutes in a little water to finish the rehydration while the rice is heated for serving.

Fruit and vegetables are made up chiefly of cellulose, hemicellulose, and
pectic substances that give them texture and form. Starch, sugar, acids, minerals, and vitamins are present in varying amounts.

Many changes take place when a fruit or vegetable is cooked. The flesh is softened by alteration of the cell structure. In starchy vegetables, like potatoes, the starch gelatinizes during cooking; pectins, proteins, and hemicellulose also change. In frying potatoes and other vegetables, some of the sugar is caramelized. Coloring pigments also undergo chemical change when heat is applied.

The color of a fruit or vegetable has much to do with its attractiveness when it is served.

Green vegetables, such as spinach, chard, green snap beans, peas, broccoli, and green cabbage, cooked to the crisply done stage, have a better color than those that are cooked until soft. Alkaline water helps keep the color of green vegetables.

Red vegetables, such as beets and red cabbage, retain their color better when vinegar or some other acid is added to the cooking water. Hard water, which is alkaline, turns red cabbage violet or blue.

Yellow vegetables—carrots, corn, squash, pumpkin, rutabagas—keep their attractive color well during cooking. The yellow color is stable to heat, acids, and alkalies used in food preparation.

The white color of potatoes, cauliflower, white cabbage, celery, turnips, and white onions turns yellow in hard water. Adding a teaspoon of lemon juice, cream of tartar, or white vinegar to the cooking water helps to retain the white color of vegetables cooked in hard water.

Raw apple and other light-colored fruits often darken from exposure to air when they are cut. Some nuts also make raw apple darken, especially if the fruit has come in contact with iron in a knife blade or chopper. Apples cut for salads can be mixed with acid fruit juice—lemon, orange, grapefruit, or pineapple—to protect them from darkening. Salad dressing also acts as a protective coating.

Both acids and alkalies influence the texture of vegetables and fruits. The vegetable softens in a shorter time when sodium bicarbonate, an alkali, is added to the water in which the vegetable is cooked. Quick-cooking vegetables may become too soft and mushy when sodium bicarbonate is added; excess soda lowers nutritive value. If an acid like vinegar is added, a firmer, more solid structure is obtained, and the vegetable takes a longer time to soften.

Calcium chloride is a salt used to increase the firmness of food. It combines with pectic acid present in vegetables and fruit to form an insoluble substance that acts as a binding material between the cells and helps to prevent the breakdown of the structure during cooking.

The flesh of some fruit, like apple slices, can be made crisp and firm when soaked in a water solution of calcium chloride. The sloughing, or breaking up, of the outer layers of a potato during boiling can be controlled by calcium salts in the water.

Sodium chloride, or common salt, on the other hand, softens the structure by replacing the calcium and magnesium naturally present. Cucumber slices soaked in salt solution lose their crispness.

Fruits tend to keep their shape better in a sugar sirup because the sirup attracts water from cells through osmotic pressure and leaves a more dehydrated cell structure. Sugar is absorbed into the fruit only after the tissues are softened by cooking.

Many fruits, like apples, plums, peaches, and apricots, can be cooked directly in a sugar sirup. Others, like Kieffer pears, that have sturdy cell walls become shriveled and hard if cooked directly in a sirup. It is necessary to soften them by cooking before the sugar is added. For making purees, the fruit is cooked in water to soften it, and then the sugar is added to the fruit puree.
Vegetables are more vulnerable to mistreatment in cooking than many other foods. For the best in color, texture, and flavor, one should cook all vegetables the shortest time possible because they are less palatable when they are overcooked. Most vegetables have a mild, sweet flavor when cooked just right. Overcooking causes strong, undesirable flavors to develop.

The commonest method of cooking fresh or frozen vegetables is in a small amount of water in a tightly covered saucepan. After the vegetable is added to boiling water, the water is brought quickly back to a boil over high heat. Then it is turned to low heat to maintain gentle boiling until the vegetable is tender and crisp, not mushy. For many leafy vegetables, like spinach and shredded cabbage, the cooking time is less than 5 minutes.

Rapid boiling does not cook vegetables any more quickly than slow boiling because the highest temperature attainable under atmospheric pressure is 212°, the boiling point of water at sea level. At the higher temperatures and pressures obtained in a pressure saucepan, the tendering process is speeded up, and the cooking process is short for most vegetables.

Other methods of cooking vegetables include baking, braising, steaming, and frying. Baking whole in the skin is commonly used for potatoes, sweetpotatoes, and squash. Carrots, onions, turnips, young beets, parsnips, and cucumbers can also be baked successfully in a covered casserole. A moderate oven (350°-400°), which allows for gradual penetration of heat, is best, although a temperature of 450° is preferred for potatoes.

Braising, or panning as it is sometimes called, is a method of cooking with very little water or with the steam formed from the vegetable’s own juices. The liquid used becomes a part of the flavorful sauce, which is served with the vegetable. Braising works well with a number of vegetables and is thrifty of color, flavor, and food values. Shredded cabbage, kale, spinach, okra, and snap beans are a few of the vegetables cooked successfully by this method. The vegetable is cut into small pieces and cooked in a heavy pan on top of the range. A little fat is added to prevent sticking, and a tight cover is used to hold in the steam. The vegetable is cooked over low heat until just tender.

Steaming vegetables in a home-type steamer, consisting of a perforated pan placed over rapidly boiling water, may take slightly longer than by boiling. There may be some loss of color in certain vegetables, particularly the green vegetables. Others, like beets, carrots, parsnips, sweetpotatoes, squash, and pumpkin, have a good flavor when steamed, and their color is retained well.

**Microwave** cooking of vegetables in an electronic range is new. The color of fresh and frozen broccoli is similar when cooked by microwave and by the conventional method of boiling on top of the range. The flavor of the broccoli is about the same cooked by either method. It is best to pare the broccoli stems because the tough outer layers do not cook to the desired tenderness in the same length of time as the rest of the broccoli.

Frozen vegetables usually require a shorter cooking time than do fresh ones, because they have been blanched before freezing. Most packers give detailed directions for cooking frozen foods, including exact cooking times, and these you should follow carefully, since even slight overcooking adversely affects the quality.

Canned vegetables are quick and easy to prepare for serving because they are already cooked. To serve canned vegetables with the most flavor and food value, the liquid in which they are packed should not be discarded. Sometimes, as for whole-kernel corn, which has only a small amount of liquid, the vegetable may be heated and served in the juice. For some other vegetables, such as peas, beans, and carrots, which are packed with more
liquid than is desirable to serve on them, the liquid is drained off and boiled down to a third of its original volume, and then the vegetable is heated in the concentrated liquid. This conserves all the minerals, although some of the vitamins are lost.

Dry beans and peas require a longer cooking period than fresh vegetables to replace the water lost during drying and to soften the cell structure. To shorten the cooking time, dry beans and peas are soaked to absorb some of this water before cooking.

The rate of rehydration is faster in hot water than at room temperature. Dry beans absorb as much water in 1 hour when soaking is started by boiling them in water for 2 minutes as they do in 15 hours in cold water. When the beans are cooked in the liquid used for soaking, they are as pleasing as those prepared by the standard practice of soaking overnight. Dry beans cooked without soaking take longer to cook and are not so tender as those soaked before cooking.

The minerals naturally occurring in hard water, such as the salts of calcium and magnesium and sometimes iron, affect the softening of dry beans during cooking. The beans will be hard and tough if the water is very hard. The time required for cooking dry beans in softened water is much shorter than in hard water. The addition of small amounts of sodium bicarbonate softens hard water and has a softening effect on dry beans and consequently will shorten the cooking time considerably. Excesses of soda will increase the loss of the B vitamins during cooking.

Dry beans and peas that have been soaked can be cooked quickly in a pressure saucepan. After bringing the pressure up slowly to 15 pounds, only 3 to 10 minutes at this pressure is needed for different varieties of beans and peas, and then the pressure is brought slowly back to zero. Certain precautions are necessary—have the beans soaked, fill the cooker no more than one-third full, including the water, and add a little fat to prevent foaming and possible clogging of the vent tube of the cooker.

Baking is recommended for split peas, unless they are to be pureed, because they break up easily during cooking if other methods are used. After the 2-minute boil and a half-hour soak, the split peas are placed in a baking dish and baked at 350° for 25 minutes. The color and the flavor are good.

Mealiness is an important cooking characteristic generally desired in potatoes selected for mashing, baking, and French frying. Waxy or nonmealy potatoes are good for salads and hash browning and casserole dishes because they hold their shape. One key to the degree of mealiness of a cooked potato is the specific gravity of the raw tubers. This can be measured by placing the potatoes in salt solutions of different concentrations. Those that are heaviest for their size have high specific gravity and are mealy when cooked. It is possible to separate potatoes according to specific gravity and send them to market labeled as to the cooking method for which they are best suited.

For high-quality, French-fried potatoes, the two-stage method is recommended. Raw potato strips are partly fried (parfried) until tender but not browned, taken out of the fat, and browned later in a second frying. The best temperature and time for parfrying is %-inch potato strips is in fat at 360° for 3 minutes. For finishing, the parfried potatoes are cooked in 375° fat until golden brown.

With the two-stage method, potatoes may be prepared and parfried ahead of time during less busy hours, then finished quickly just before serving time. Parfries may be held as long as 4 hours at room temperature or 24 hours in the refrigerator. For longer storage, parfries can be frozen and stored at 0°. Frozen parfries may be thawed, then browned in fat; unthawed parfries may be browned in an extremely hot oven (500°). Parfries browned in the oven are less oily and slightly less tender than those that are browned in fat.
Potatoes are wrapped in a double thickness of aluminum foil for barbecuing on the grill. Other fresh vegetables that can be cooked in foil on the outdoor or indoor grill are sweet potatoes, herb-seasoned carrots, apple-stuffed acorn squash, small beets, and young sweet corn in the husks.

You can also cook frozen or canned vegetables (like peas and snap beans) on the grill or over hot coals. For this, individual portions, seasoned with salt and pepper and a little butter or margarine, are wrapped tightly in aluminum foil and cooked for 10 to 15 minutes.

When vegetables lose their garden-fresh flavor, the addition of a little sugar to the cooking water restores the desirable sweetness and masks the starchy taste, especially in green peas, carrots, and sweet corn. The addition of salt, pepper, and butter reduces even more the differences in flavor of fresh and aged vegetables. Tomato flavor also responds favorably to the addition of a little sugar.

Monosodium glutamate also is thought to enhance the flavor of fresh, canned, dehydrated, and frozen food products, including meats, poultry, vegetables, and many specialty items. Additions of glutamate seem to lessen saltiness in some foods and increase it in others. A great deal of the effect depends on the other flavor factors of the food product. It also accentuates low levels of sugar when they are near optimal value. Small amounts of glutamate reduce the sour taste of tomato juice, catsup, and other tomato products. It acts as a blender of flavors in meats, seafood, and vegetables, especially when these foods have been prepared with other seasonings. The imaginative use of seasonings, spices, herbs, and condiments can lead to highly palatable and interesting flavors.

Cooking can be fun with all the new ideas to try in your own kitchen. You can experiment with new ways of cooking familiar foods, and use garnishes and sauces to make plain cooked foods look and taste better. You can dress up frankfurters with a barbecue sauce, mild or hot as you like. Hollandaise sauce and chopped nuts go well on asparagus or broccoli, a cheese sauce on cauliflower or cubed potatoes. White sauce can be varied by seasoning with onion salt, mace or nutmeg, cayenne, or paprika. You can change the flavor of beef stew or pot roast by adding allspice, cloves, or whole black peppers and a bay leaf or two. Sage, garlic salt, or dry mustard give new flavor to meat loaf.

Frankfurters are served not only as hotdogs in a bun with mustard, onion, and pickle relish. "New England hotdogs" are stuffed with baked beans. "Dutch dogs" are slit lengthwise and filled with sauerkraut.

Kabobs—appetizer, main course, or dessert on a skewer—are popular because so many different foods can be used together. To prepare kabobs, cubes of meat are placed alternately with fruit or vegetables on skewers. Meats to use include beef, lamb, pork and veal, chicken or turkey, fish and seafood. Fruits and vegetables for kabobs are selected for the right flavor and color combination. You can use such vegetables as red or green peppers, tomatoes, small white onions, mushroom caps, eggplant, cucumber, ripe or green pitted olives, or zucchini squash. Fruits to use on kabobs are many—raw or canned peaches, cooked or dried apricots, dried prunes, raw bananas, apples or avocados, peeled oranges, and canned or fresh pineapple chunks. You should choose foods that take about the same time to cook, or cut long-cooking items into smaller pieces.

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