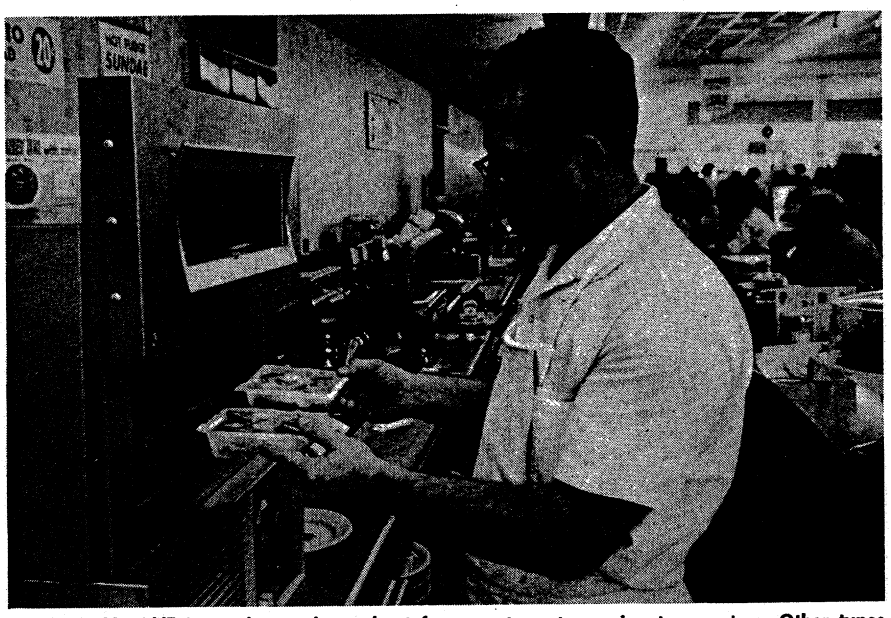
NEW FOOD PRODUCTS AND PROCESSES:

implications for hospital food service



MICROWAVE OVEN may be used to reheat frozen entrees to serving temperature. Other types of equipment that can be used include steamers, quartz ovens, and conventional ovens. Single-portion entrees in plastic pouches can be heated in boiling water.

PART ONE OF A TWO-PART ARTICLE

by R. H. TREADWAY, Ph.D.

Food processing, which began as a primitive attempt to save perishable foods for future use, is also aimed today at more sophisticated objectives—to preserve fragile flavors of fresh foods and to save labor in meal preparation. In a two-part article the author discusses the present and future impact of food technology on hospital food service. His discussion covers a wide range of products, from foods well accepted in the hospital field, such as frozen orange juice and dehydrated potatoes, to products still in the test tube stage, such as edible food packages and vegetable proteins that look and taste like steak.

Part one is concerned with new developments and current trends in fresh and frozen foods.

In the second part, to be published in the Sept. 1 issue, the author proceeds to discuss new developments in dehydrated and canned foods and concludes by assessing some experimental food products that may be found in hospital meals of the future.

THE ADVANCE of food science and technology, particularly during the past 20 years, has had noteworthy impact on food service operations in hospitals and other institutions. The purpose of this paper is to consider some of the ways in which new food developments have become involved in food service management and to speculate on what further changes the future may bring.

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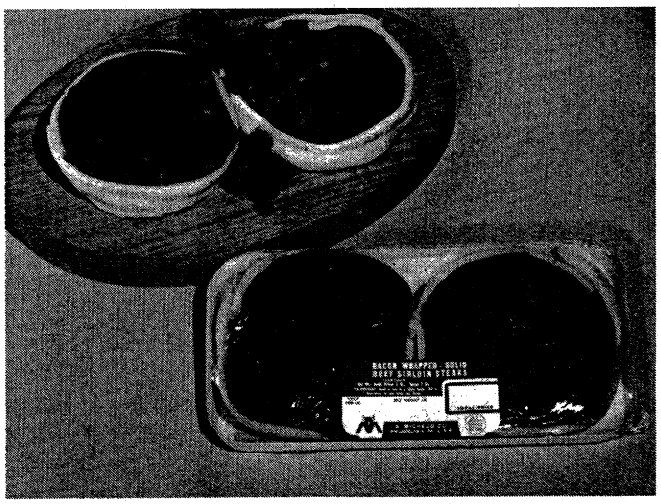
Managers and operators of hospital food service are only indirectly interested in how the new types of ready-prepared foods are processed, but are directly interested in what products have been made available, their acceptance as indicated by current volume of production, and the nature of the products themselves. Hence, in this discussion, the properties of these foodstuffs will be emphasized, with minor attention to processing methods.

The Utilization Research Divisions of the Agricultural Research Service of the U. S. Department of Agriculture (USDA) are concerned primarily with developing and maintaining markets for products of the American farmer. A further objective is to develop new and improved processed foods and processing methods that will benefit consumers and institutional users. Two other divisions in the Agricultural Research Service have related objectives—the Human Nutrition Research and the Consumer and Food Economics Research Divisions whose missions are specifically to broaden knowledge in nutrition and food economics.

FOOD SERVICE PROBLEMS

Problems in institutional food service are not confined to those connected with the foodstuffs. But to an outsider, the following food problems appear to face hospital administrators:

1. Procurement and serving of food possessing good flavor, aroma, color, and texture 365 days of the year.
2. Serving of foods that retain



(LEFT) FROZEN ENTREES can also be packaged and heated in the dishes used for service. In this airline-type service, all dishes, except serving tray, are disposable after the meal. (RIGHT) FROZEN bacon-wrapped sirloin steaks are an example of portioned precut meats finding favor in hospitals today. Portioned meats, both in fresh and frozen form, take much of the labor out of meat preparation.

some of the products—i.e., 83 cents per hour of kitchen worker's time for preparing strawberries—take on a different significance when viewed in this light.

These comparisons assume that the finished products are identical whether prepared from the unprocessed food or the convenience food. In the case of fresh fruits and vegetables especially, this is not necessarily so. For the sake of food quality, nutritive value, and appeal, it is hoped that fresh produce is not entirely lost from institutional menus, a victim of too rigid cost comparisons. Its cost, however, should be subjected to the same sort of analysis as other meal components.

This discussion on recent developments in processed foods will be divided into a series of categories, covering fresh, frozen, dried, and canned foods, plus a consideration of future potentials of food technology in hospital food service.

FRESH FOOD PROCESSES

Fresh Foods—Many innovations have been introduced in commercial food channels in comparatively recent history. A number of processes and practices are carried out on fresh foods, i.e. those that are preserved for a limited time largely by refrigeration. Raw potatoes are peeled in a central peeling plant, dipped in a dilute solution of sodium bisulfite and edible acid to inactivate the enzyme system that causes the potatoes to discolor, and protectively packaged. Then they may be kept under refrigeration for several days until time for cooking. Properly packaged salad mixtures such as coleslaw and potato salad, preserved by refrigeration and the acidity of the mixture, can be stored for several days. Fruit salad mix, preserved with an additive such as sodium benzoate or potassium sorbate and kept under refrigeration, enables one to enjoy fresh fruit for quite some time after packaging. The refrigeration life of fresh chickens is lengthened by dipping the freshly killed, cleaned chickens in a solution of the antibiotic, aureomycin, and packaging them in cracked ice. Packaging technologists have made great strides in the development of precut meats, preformed patties, and cut-up poultry sections in portion-controlled pieces wrapped in protective plastic film.

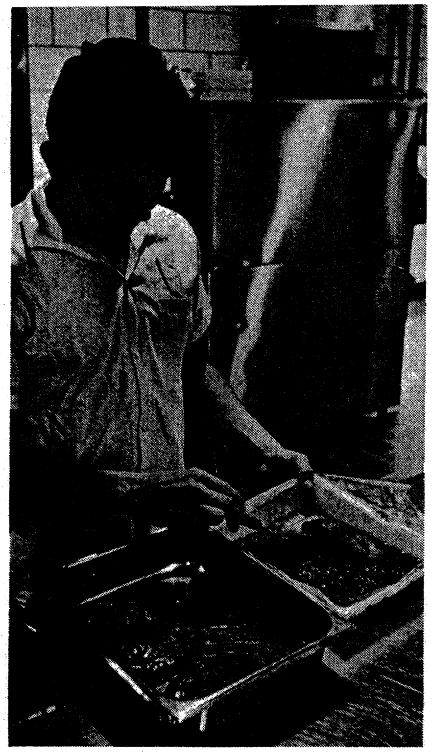
TENDERIZED MEATS

Meat specialists in collaboration with scientists in other fields have developed several processes for tenderizing meat. About 30 years ago a process was developed whereby beef sections can be tenderized by aging at approximately 50°F. for a number of days, with ultraviolet light used to inhibit microbial growth. In the last few years proteases, which are enzymes that promote chemical breakdown of proteins, have been used to some extent to tenderize meat. One large meat packer injects enzyme solution, usually papain or another plant protease, into the circulatory system of the animal just before slaughter. The more common system is to sprinkle the enzyme powder on cut meat or to dip the piece in a solution. Recently, enzyme-treated paper has been made available for wrapping steaks. After one to two hours contact with the enzyme at room temperature or during extended storage in a refrigerator or freezer, some of the tough connective tissue and muscle is predigested or hydrolyzed to a certain degree. Enzymic tenderizing must be controlled so that the hydrolysis does not proceed to the stage in which a broiled steak has the mushiness of long-cooked stewing meat.

Frozen Foods—Freezing has undoubtedly been the most active field in commercializing new types of processed foods since World War II. It is said that the typical supermarket stocks 7000 to 8000 food items, one-half of which have appeared as new foods during the past 10 years. A recent study announced that a total of 2823 frozen food items was found in retail markets, of which different types and packs of vegetables totaled 639 and frozen baked goods totaled 403.* The average supermarket, however, stocks about 353 frozen items because space limitation forces selection of only a fraction of the total available. Interesting as it is to have quantitative information on the total number of frozen items processed, the situation in the institutional field is often different, of course, from that in the consumer markets.

Frozen poultry is a category commonly found in institutional food service as well as in households. Frozen vegetables, fruits,

*Survey made by the A. C. Nielsen Co., New York, N. Y.



HEATED ENTREE can be placed in the original container on the serving line or it can be removed to a cafeteria pan for service.

as much of the original nutrients as possible.

3. Serving of foods that are economical and at the same time meet the first and second requirements.

4. Serving of foods that are convenient to prepare and will keep kitchen labor to a minimum.

After the hospital patient is on the road to recovery, he begins to take an interest in the meals that are served. No one will deny that food satisfaction and good nutrition are important factors in morale in speeding recovery. Thus, persons engaged in hospital food service are partners with the physicians and nurses in the task of getting sick persons back on their feet.

Although we cannot draw a close analogy between food service in a hospital and that in a restaurant, it may be instructive to consider some of the cost factors in restaurant operation. About 20 years ago the average restaurant paid around 50 cents for food for every dollar received at the cash register. While food prices have risen relatively slowly in the intervening years, soaring labor costs and other nonfood expenses have changed this relationship. According to the National Restaurant Association, the food outlay is now 41 per cent of each dollar received by restaurants.* In hospital food service also, the trend toward the labor cost making up an increasingly larger fraction of the total food cost undoubtedly also prevails.

CONTRIBUTIONS OF FOOD SCIENCE

The chief food-connected problem in institutional food service seems to be the control of operating costs by taking advantage of technological developments without sacrificing quality attributes in the foodstuffs. One might ask, what has food science and technology done to meet this problem?

Convenience foods present a strong case for economy on comparison with their equivalents in unprocessed foods. A study made two years ago by the Economic Research Service, USDA, listed cost data on 158 convenience foods commonly purchased for household use.[1] About 116 of the 158 items were somewhat more expensive in prepared forms than in their fresh counterparts, but the remaining 42 items were sufficiently less expensive to make the combined list of convenience foods cheaper than their equivalents in fresh form.

Frozen concentrated orange juice and instant coffee are outstanding in offering savings over freshly squeezed juice and roasted coffee. Canned and frozen peas offer important savings over peas purchased fresh. Cut corn in the canned and frozen forms, canned and frozen spinach, canned and frozen lima beans, canned asparagus, and canned beets all represent savings over use of the fresh vegetables. Use of canned spaghetti, canned chicken foods, dessert mixes, canned beef stew, and frozen fried breaded shrimp all offer savings over preparation of these items from the basic ingredients. The many cost advantages of large-scale processing of food near the place where the raw material is produced, with inedible portions removed, and with final products possessing storage stability, all result in economies in handling, storage, and transportation.

*From personal correspondence with J. Terry Radigan, Director of Marketing and Industry Research, National Restaurant Association, Feb. 1, 1965; for further information the reader is referred to *An Analysis of the Institutional Food Field—Its Size, Products and Markets.* (A report prepared for institutional food manufacturers by the National Restaurant Association, Chicago, Ill., 1962.)

LOW COST OF CONVENIENCE

With most of the convenience foods that cost more than their equivalent counterparts, the extra cost was much less than the value of the kitchen time needed to prepare the dish from the fresh raw material at present wage scales. Table 1, below, shows some examples cited in the Economic Research Service study of values that could be assigned to a kitchen worker's time, in comparing the cost of the unprocessed foodstuff with the higher cost of the equivalent processed counterparts. In this table the types of processed food with which comparison is made is noted in parentheses. At the low end of this scale are frozen prepared french fried potatoes, which were low enough in price when these calculations were made so that the value that could be assigned to a kitchen worker's time was only 4 cents per hour. The moral to be observed here is that if french fried potatoes were to be prepared from fresh potatoes in the hospital kitchen, the kitchen worker's time would cost considerably more than 4 cents per hour, and the cost of the finished french fries prepared in the hospital would be greatly in excess of the finished french fries prepared from the convenience product. Even the higher costs of convenience for

Table 1—The low cost of convenience: The value of kitchen worker's time per hour in preparing fresh foods as compared to convenience foods.

	Value of kitchen worker's time per hour
French fried potatoes (vs. frozen prepared)	4c
Mashed potatoes (vs. dehydrated)	26
Au gratin potatoes (vs. dehydrated)	51
Green beans (vs. canned)	25
Diced carrots (vs. canned)	30
Asparagus (vs. frozen)	17
Broccoli (vs. frozen)	58
Brussels sprouts (vs. frozen)	60
Green beans (vs. frozen)	70
Pineapple (vs. canned)	12
Peaches (vs. canned)	57
Strawberries (vs. frozen)	83

berries, seafoods, and meats are widely used in institutions. Frozen prepared specialties such as entrees in sauce packed in boilable plastic bags, meal platters, and meat and fruit pies, although comprising a large category in retail markets, are not employed at present to a large extent in institutions.

Chicken and turkey make up most of the frozen poultry tonnage used by institutions. Although the major part is uncooked, precooked frozen turkey rolls and roasts are available. Frozen potato products lead all vegetables in volume, with 597 million pounds sold for institutional use in 1963.[2] Frozen peas are in second place with 186 million pounds used by institutions in 1963. Next most popular frozen vegetables used in institutions are, in order of descending tonnage: cut corn, green beans, lima beans, carrots, broccoli, and spinach.

Although frozen fruits and berries (except strawberries) have met with a disappointing demand in the retail market, they are widely used in the institutional field. Red sour pitted cherries plus strawberries comprise over half of the fruit tonnage frozen for institutions, with apples and peaches next in line. Use of frozen concentrated orange juice and other fruit juices is commonplace in the institutional trade, but the volume is far below that sold at retail.

In the category of seafood, shrimp represents almost half of the 454 million pounds total estimated used in the institutional frozen market in 1963 according to *Quick Frozen Foods*.[3] Shrimp is undoubtedly served more commonly in restaurants than in hospitals. Fish portions occupy the number two tonnage position in frozen seafoods, followed by breaded shrimp, fillets, and rock lobster tails.

Frozen meats are used in greater tonnage in the institutional market than in retail channels. Steaks, chops, and packages of portioned cuts and patties are the popular forms.

FROZEN ENTREES IN HOSPITALS

Although the use of frozen entrees and platters in hospital food service is not widespread, the practice has been noted in the press. A hospital in Jersey City, N.J., handling principally geriatric cases, serves 654 patients and employees twice daily with meals reconstituted from frozen platters.[4] The food frozen in sealed aluminum trays is thawed and heated in electrode ovens capable of reconstituting 60 platters in 1¾ hours at 200°F. In this instance the management prefers slow reconstitution to use of more rapid means.

A small hospital in Montgomery, Ala., reported late last year that it was operating without a kitchen.[5] Packaged, precooked frozen foods in an assortment providing for individual dietary needs are procured from processors and kept on the premises in freezers. A high-pressure steam cooker and a microwave oven enable meals to be prepared in less than ten minutes.

At the beginning of the year, a large frozen foods processor in New Jersey began offering a choice of 68 dinners for hospitals and institutions.[6] Meals for general diets are served with seasonings and salt. Meals for diabetic diets are also available for hospital use.

Although much of the research on frozen unbaked bread dough was fairly well worked out about 25 years ago, this item has only recently been commercialized. At present it appears that unbaked frozen bread will find an important place as unbaked frozen fruit and meat pies have already done. Frozen baked cakes are enjoying a dramatic success in the retail market. Partially baked, frozen bread was introduced recently.

Except for 3:1 frozen concentrated milk, commercially available to a limited extent, frozen milk products other than the conventional desserts are not a factor in institutional feeding.

Frozen eggs, both in the forms of the whole liquid and separated into whites and yolks, are used in large tonnages in commercial baking. A light pasteurization treatment has been developed that will successfully control in frozen and dried eggs any possible contamination with the organism responsible for salmonellosis. Pasteurization of egg white was previously unsuccessful because the high temperature necessary damaged the proteins and inhibited the whipping qualities of egg white. USDA research has shown that the addition of edible aluminum or iron salts stabilizes the egg white protein and thus permits use of the same full heat treatment to separated egg whites that is used for whole eggs.

Producers of canned creamed soups, such as shellfish stews, believe that freezing is important in preserving flavor during storage. Frozen soups are employed to some extent by institutions but the amount used is not large, relatively speaking.

REFERENCES

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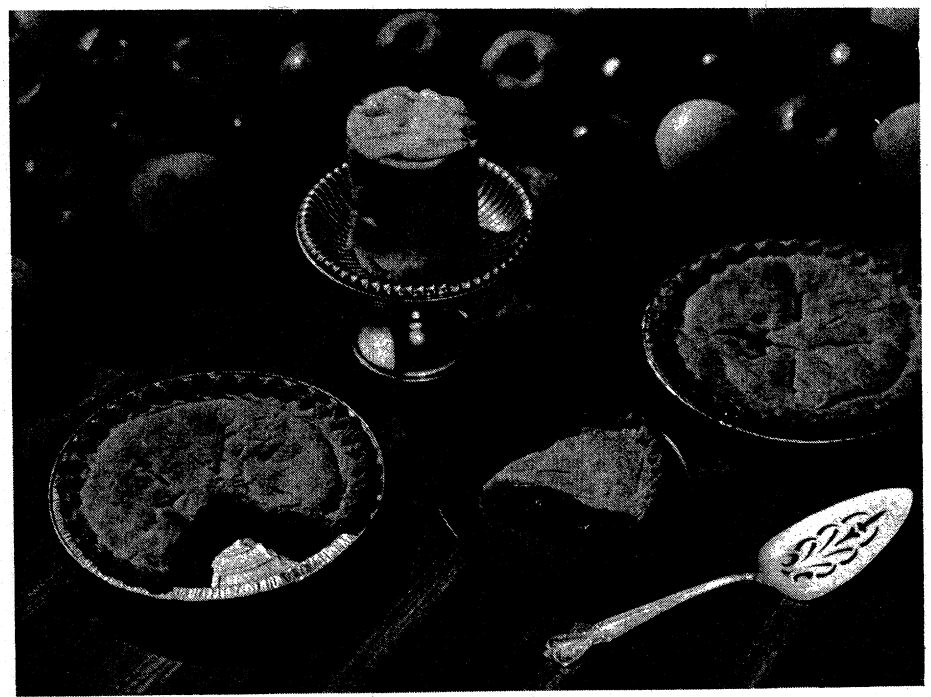
2. Martin, S. The state of the industry. Part I. *Quick Frozen Foods* 27:35 Sept. 1964.
3. All-time record $591 million seafoods frozen for U. S. sale in 1963. *Quick Frozen Foods* 27:127 Aug. 1964.
4. Frozen dinners at Jersey City hospital cut labor, hidden kitchen costs. *Quick Frozen Foods* 26:193 March 1964.
5. Prefabricated hospital without kitchens reduces food service costs, time with FF. *Quick Frozen Foods* 26:131 Dec. 1963.
6. Major packer producing dietetic entrees which currently are in hospital use. *Quick Frozen Foods* 27:117 Aug. 1964.

WHENEVER new food products appear on the institutional market, they must be evaluated in terms of their relation to a specific food service system. Certainly many of the trends in food use today have had effects on hospital dietary management. They have put in motion trends to increase freezer space, to reduce the space needed for other types of storage, and to cut down on the space needed for produce and meat preparation. Cost of the new food products cannot be directly compared with the foods they replace; the amount of labor saved in meal preparation because of their use must also be evaluated.

New processes used for fresh foods and trends in marketing of frozen foods were discussed in the first part of this two-part article. Many new developments have occurred in the processing of dehydrated foods that will probably result in increasing acceptance and use of this class of foods. Even canning of foods, which is a process that has been used relatively unchanged for the past 50 years or so,

is being modified by processes that preserve food flavor better than the conventional methods of heat sterilization.

Dehydrated products—Dehydration of foods was widely practiced during the last war. Following this, there was a long period before research improved existing products and developed new ones acceptable to consumers. Trade information and data on the extent of use of dehydrated foods are difficult to obtain. Dehydrated foods may be arbitrarily divided into two classifications: (1) products dehydrated by conventional or established methods and (2) those dehydrated by newer types of drying.



DEHYDROFROZEN APPLES are produced by a combination of processes. First they are reduced to about half their original weight by hot-air dehydration, then they are frozen and stored in the frozen state.

CONVENTIONAL DRYING METHODS

Under conventional methods of drying the following are included: ordinary hot-air drying such as tray drying; drum drying; spray drying; vacuum drying; and drying in a rapidly moving airstream (sometimes called flash-drying or airlift drying). Even though these methods are classified as "conventional," their use in developing new dried foods still has called for the origination of novel methods through research.

In tray drying, the food is placed on trays or belts that move through the drying chamber. Hot air passes through and over the food and carries away the moisture. Batch kiln drying and rotary cylinder drying are also included in the category of hot-air drying. Considerable improvements have been made in the quality of potato slices dehydrated in hot-air dryers. Although these conventionally dried slices do not reconstitute rapidly, they are quite satisfactory for au gratin potatoes, scalloped potatoes, and other casserole dishes.

Onions rank next to potatoes in the volume dehydrated. Dehydrated onions are processed in minced or small piece form and are convenient for cooking.

In drum drying, a thin film of the mashed foodstuff is applied to the surface of a steam-heated cylinder. After removal of the water by evaporation, the dried sheet is scraped from the drum by a doctor blade or merely falls from the drum into a container. Dehydrated mashed potato flakes, developed by USDA research, are produced by drum drying. Dehydrated sweet potato flakes, another USDA development, are produced by drum drying. This process may also be used to dehydrate cooked, mashed pumpkin and a variety of vegetables. Flaked dehydrated products quickly reconstitute in hot water to give dishes closely resembling the freshly cooked mashed vegetable.

At present, dehydrated skim milk is the food dried in the largest volume, with over two billion pounds produced annually in recent years. Dried skim milk for human food is produced by spray drying. The fluid milk is sprayed into a heated cylinder where the particles lose their moisture as they drop through the heated air. Dried skim milk is widely used in cooking and baking and is finding increasing acceptance reconstituted as a beverage. Some whole milk is spray dried for prompt use in remanufacture for products such as cocoa. Limited storage stability of dried whole milk has restricted its marketing for beverage use.

Dried whey and buttermlk are produced in volume for food use, mainly in baking. Malted milk powder, cream, casein, and ice cream mix are also dehydrated.

Whole eggs, egg whites, and egg yolks are spray dried in fairly large volumes. With the exception of their inclusion in baking mixes sold at retail, dried egg products are used almost entirely in institutional markets.

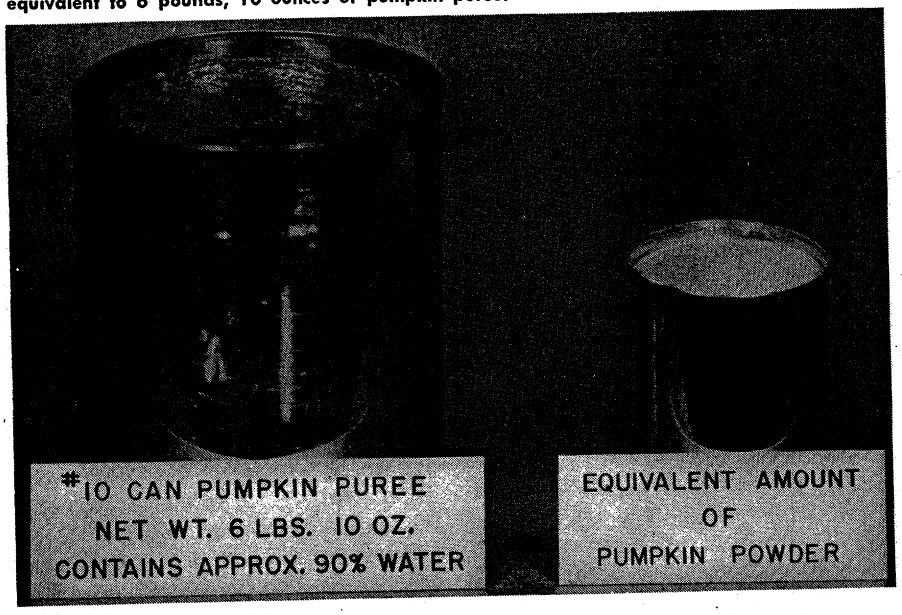
Spray drying of coffee extract is one of the most important commercial successes of food technology. Although it is not the only process used, it is by far the most important method to date for producing instant coffee.

Batch vacuum drying in a heated chamber is used in dehydrating apple slices and other fruits for industrial use. Continuous vacuum drying, in which the food moves on a belt, is used for citrus juice, coffee extract, and tea extract. This type of equipment is being used in USDA research on dehydration of whole milk.

Mashed potato powder, a dehydrated product improved by USDA research, is produced by dehydrating moist granulated particles of mashed potatoes in an airlift dryer. This product (potato granules), along with potato flakes, is widely used in the retail market and in the institutional feeding industry. Granules reconstitute readily in hot water to give high quality mashed potatoes.

Fruit juice concentrates mixed with accompanying concentrated aromas (essences) are a USDA development. Recovery and addback of the essence to the concentrate give juice upon reconstitution that is virtually indistinguishable from fresh juice. Concentrated juice con-

(ABOVE) DRIED HONEY is a great deal easier to handle and measure than the original viscous liquid honey. (BELOW) BECAUSE OF their compactness, dehydrated foods offer economies in shipping and handling costs. Approximately 10½ ounces of pumpkin powder is equivalent to 6 pounds, 10 ounces of pumpkin puree.



taining essence has been used for a number of years in jellies, but this idea was commercialized for beverage use only last year. Frozen concentrated apple juice is now on the market. Fruit juice powders containing essence, another USDA development, may be commercialized for beverage and other uses.

NEWER DRYING METHODS

Among the newer types of dehydration are included freeze-drying, foam-mat drying, and foam-spray drying. Freeze-dried foods have been available for about three years. The food is reduced to small piece form, frozen, and then dehydrated under reduced pressure and usually with application of heat, during which the moisture is removed directly from the frozen food. Because freeze-drying is expensive, its use is confined to the more valuable foodstuffs. The mild heat conditions in freeze-drying result in products that retain the original structure and quality attributes much better and reconstitute much faster than do corresponding products of ordinary hot-air drying. Freeze-dried foods can be stored at room temperature. Shrimp, crabmeat, mushrooms, meat pieces, turkey pieces, and chicken pieces are freeze-dried in fair quantity. Freeze-dried strawberries and sliced peaches are now being produced for inclusion with dried breakfast cereal. Freeze-dried coffee powder was recently introduced, with its manufacturer convinced that this type of drying gives flavor superiority over other types of instant coffee. Scrambled eggs, omelets, green beans, and peas are freeze-dried to some extent. Freeze-dried shellfish are being packaged in cans for the institutional feeding industry as products that are stable and offer economy. The meat and poultry pieces go mainly into dehydrated soup mixes.

Foam-mat drying, developed by the USDA about four years ago, is used to produce several food products including citrus and tomato powders. The juice or puree is concentrated, a stabilizer added in some cases, and the liquid is then foamed with a gas. The heavy foam is then extruded onto a perforated tray and dried by forced hot air.

Foam-spray drying of milk and other dairy products, a development of USDA research, requires only an alteration in the conventional equipment used for spray drying. Compressed gas is injected into the concentrated milk between the high pressure pump and the atomizer of the dryer. The gas foams the concentrate so that it dries quickly to produce a powder that reconstitutes rapidly in cold water without a secondary instantizing step required in conventional spray drying. Foam-spray dried skim milk and cottage cheese whey are now in commercial production and the process has been demonstrated to be of value for malted milk mix, chocolate milk mix, cheese, ice cream mix, and other products.

In dehydrofreezing, a process developed in USDA research, about half of the water content is removed by hot-air dehydration. The product is then frozen and stored in the frozen state until time of use. Dehydrofrozen foods have better flavor, color, and texture than conventional, completely dehydrated foods. They offer economies in handling and storage over conventionally frozen foods. Several million pounds of dehydrofrozen apple slices are processed annually for use in baking. Dehydrofrozen pimientos, peas, and carrots are manufactured to some extent for domestic and export markets. Processing of dehydrofrozen cherries for pies is under consideration.

HEAT STERILIZATION TECHNIQUES

Canned Foods—This review of new developments in food processing has omitted a comprehensive discussion of canned foods. It is not to be inferred, though, that foods preserved by heat processing are losing their important position. Canning is still by far the largest tonnage method of food preservation, but it has not been characterized by sensational market developments as found in recent years in frozen and to a lesser extent in dehydrated foods.

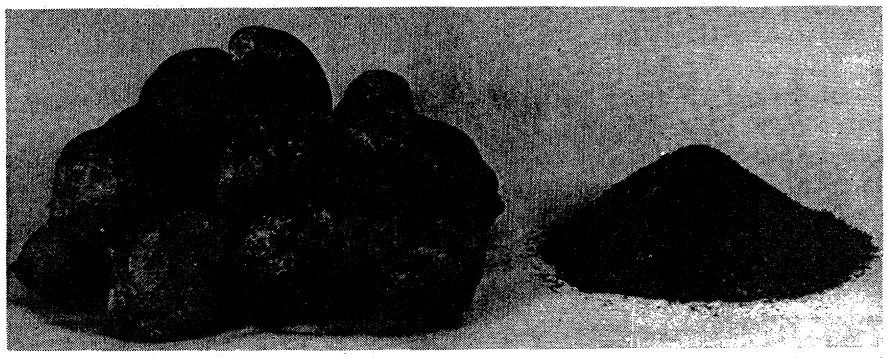
High temperature-short time (HTST) processing of canned foods, a field that has undergone experimentation for many years without yet reaching full potential, provides high quality, uniform, sterile products that are economical. Oversimplified, the HTST process uses a higher temperature and shorter exposure to heat than in conventional canning to result in better food quality. Violent agitation of the food in the sealed can is one of the techniques used to get rapid heat transfer during the sterilization process and during cooling. HTST processing may be carried out under conditions such that the food and can are both sterile at time of sealing (aseptic canning) or sterilization may be completed after sealing. HTST processing is being used to some extent for dairy products and vegetables, and offers much potential for canning of meat and other types of food.

POTENTIAL DEVELOPMENTS

Some of the newer developments in commercially processed foods have been summarized. Speculation as to the future development of commercial food processing includes not only the continuation of trends already in the making, but also the appearance of new commercial products now in the laboratory stage.

There is a transitional area between what is commercial and what is potential. Research is often many years ahead of adoption, and even test marketing of a new product may precede commercialization by several years. It seems that quick freezing of foods in liquid nitrogen may eventually find wide application. The food pieces are either immersed in liquid nitrogen (boiling point of −320°F.) or are frozen in a spray of nitrogen. The extremely rapid freezing prevents formation of large jagged ice crystals, which, if present, puncture cell walls in the food. Intact cells guard against mushiness, food discoloration, and juice loss. The method is ideal for the type of freezing in which individualized pieces are quick frozen and packaged in loose bulk in "pour and store" plastic bags. Whole mushrooms, frozen by liquid nitrogen were recently introduced on the market. The following nitrogen-frozen items are reported to be available or are being considered for institutional use: fish fillets, asparagus tips, whole kernel corn, cherries, sliced peaches, sliced pears, strawberries, raspberries, and onion rings. Although tomato slices evidently cannot be frozen successfully in ordinary blast freezing, this product has been frozen in liquid nitrogen and was test marketed one year ago.

The New York State Department of Agriculture and Markets is attempting to develop a frozen homogenized whole egg product for preparing scrambled eggs and omelets. Use of frozen eggs would thus be extended beyond the present employment in commercial baking. The homogenized frozen eggs are packaged in 10-pound polyethylene bags equivalent to 100 medium-size eggs.



(ABOVE) DRY SWEET POTATO FLAKES have a longer storage life, are smaller in volume, and are more convenient to use than their fresh counterparts. (BELOW) 'EXPLOSION-PUFFED' dehydrated foods, a product of USDA research, reconstitute faster than foods dehydrated by conventional drying. Explosion-puffed dehydrated potato slices (left) can be prepared in 15 minutes. Conventionally dehydrated slices (right) require 45 minutes to one hour of baking.

A new method of drying fruit, called "DBD" after the sequence of operations of dry-blanch-dry, was developed recently by the USDA. The products have excellent flavor and color, even without adding sulfites in the instances of apple slices and raisins.

Osmotic drying is a novel procedure, now in the laboratory stage, developed by the USDA for dehydrating fruit slices. For example, apple slices mixed with an equal weight or somewhat less of table sugar can be reduced to half their original weight by treatment for 1¼ hours at 170° F. By osmotic action, the sugar draws water out of the apple slices. The fruit can be separated from the heavy sirup and then further dried in hot air to the desired moisture content.

'EXPLOSION-PUFFED' FOODS

Dehydration of "explosion-puffed" fruit and vegetable pieces, a development of USDA research, gives products that reconstitute quickly in hot water to material resembling the original pieces cooked from the fresh state. The slices or pieces are first dehydrated by conventional means in hot air to remove most of the water. Drying is interrupted and the pieces are put in a rotating pressure vessel resembling a cereal "puffing gun." Heat is applied to bring the contents above 212°F. The pieces

are then suddenly released to the atmosphere, which results in a porous texture, and the product can be rapidly finish-dried by conventional means. Whole blueberries and slices of apple, potato, carrot, beet, turnip, and sweet potato have been successfully explosion-puff dehydrated. These products reconstitute much faster than the corresponding items dehydrated by conventional means. Further, they can be produced at a much lower cost than freeze-dried fruits and vegetables.

Preservation of foods by radiation with beta and gamma rays has been described as the only completely new method of preservation since the development of canning 150 years ago. No toxicity due to feeding of irradiated foods has been found. Irradiation for preservation of bacon and for treatment of fresh unpeeled potatoes to prevent sprouting is now permitted by the U. S. Food and Drug Administration. Most of the research on irradiation of foods has been supported by the Quartermaster Corps with the objective to develop improved methods of preserving foods for military feeding. The army's radiation laboratory at Natick, Mass., completed two years ago, provides a good pilot facility for developmental work. There are problems in off-flavor and off-odor in irradiated foods, however, and it will apparently be at least a number of years before such processed foods become commonplace. A distinct possibility exists that low-dosage irradiation may be combined with pasteurization or freezing to give improved methods of preservation. The Bureau of Commercial Fisheries, U. S. Department of the Interior, has just established the marine product development irradiator at Gloucester, Mass., to serve as a demonstration unit that works cooperatively with industry on the pasteurization of fresh fish to extend its shelf life.

VEGETABLE PROTEINS SIMULATE MEAT

Already introduced but still in the stage in which the future acceptance is unpredictable are textured foods spun from vegetable proteins, such as soy protein, that are flavored to simulate various meats and chicken. Vegetable protein foods should be more economical than meat and would be valuable in certain diets in which meat fat is eliminated. However, since steaks no longer seem expensive to affluent Americans and chicken is actually cheaper than at any time since the 1930s, it seems that vegetable proteins are not about to replace meats and poultry.

To furnish one other projection, dairy products seem destined for big changes. If flavor stability problems can be solved, powdered whole milk produced by continuous vacuum foam drying and by foam-spray drying should come into beverage use. Prevention of gelation of HTST sterilized concentrated milk has been solved by USDA research by the use of polyphosphates. Solution of the remaining flavor problem would open up markets for canned fluid concentrates. There would seem to be good future prospect for commercialization of frozen milk concentrate by use of polyphosphate to prevent gelation plus the enzyme, lactase, to prevent crystallization of the lactose. Those who like Cheddar cheese but must avoid 30 per cent fat in a food product will most likely at some future time have a cheese of similar flavor and properties that contains only 5 per cent fat.

EDIBLE PACKAGES

Development of edible transparent films for foodstuffs, particularly for measured portions of frozen foods, coffee, tea, chocolate, etc., may become an important packaging advance of the future. Such a film is being developed from a high amylose starch or the amylose fraction of cornstarch. The film is soluble in hot or cold water and is digestible. Another new type of edible film is that extruded from a concentrated dispersion of food-grade collagen. Collagen is the principal protein in animal hides. Regenerated collagen is now used for sausage and frankfurter casings and may well find other food uses.

In this survey of new food products having an impact on hospital food service, such important basic research areas as nutrition, texture, and flavor investigations have not been considered. Readers looking for recent and comprehensive information on nutrition are urged to refer to *Composition of Foods—Raw, Processed, Prepared,* Agriculture Handbook No. 8, Agricultural Research Service, USDA, (revised Dec. 1963). In texture studies, investigators now analyze food structure in terms of fundamental properties such as consistency, viscosity, compression strength, shearing strength, cohesiveness, adhesiveness, and elasticity. Testing equipment to simulate chewing and to measure mechanical properties of food structure is also used. In flavor studies, the newer techniques applying gas-liquid chromatography and infrared spectroscopy make it possible to learn (with the help of organoleptic tests) what constituents of foods are responsible for good aroma and flavor and which ones are the culprits in off-odor and off-flavor. Flavors of processed foods, never quite equal to flavors of corresponding freshly prepared foods, are being enhanced by adjuncts. Thus, monosodium glutamate and disodium inosinate are used with meat, poultry, fish, and vegetable products. Malton (3-hydroxy-2-methyl-4-pyrone) is used to accentuate the flavor of processed fruits and fruit juices. Use of enzymes to release flavor components seems to have some merit with processed vegetables.

Compositional studies on raw and processed foods are furnishing fundamental data that will be put to use by industry in controlling chemical reactions taking place during preparation and storage of the food product. Basic information is accumulating on fatty and other components susceptible to oxidation to provide practical know-how on control of end product storage stability.

In conclusion, food science and technology have done much to make foods more convenient and economical. We may expect that food service 10 to 20 years from now will be decidedly different from today, with food quality factors retained and labor requirements for meal preparation reduced still further. ■