dextran is not over. Clinical dextran is stockpiled for use in national emergencies, both civilian and military. It has become a standard item in many civilian hospitals in the United States. The Vietnam conflict again brought quantities of dextran onto the battlefields. During 1967, total civilian and military purchases of clinical dextran (6 percent solution in physiological saline for intravenous injection) were valued at $2 million.

Clinical dextran does not replace the blood bank. Many patients still must have blood transfusions. But dextran can tide them over until the blood can be administered.

So—He might have died
But he lives
Because of dextran.

The Many-Splendored Potato, A Marvel of Convenience

BERNARD FEINBERG *and* MERLE L. WEAVER

There is one field in which the average Russian does better than the average American—eating potatoes. The Russian eats over 400 pounds a year, the American little more than 100. Back in 1910, we were pretty good potato eaters; we ate about 180 pounds per person. However, by 1952, this had dropped to about 100 pounds.

One reason for this drop in potato consumption was the growing concern of the public with calorie intake and the mistaken belief that potatoes are high in calories. It is unfortunate that potatoes acquired this undeserved reputation. It is not the potato, but the added butter, gravy, or the absorbed frying oil which account for most of the calories in our favorite styles of cooked potatoes.

Another reason for the decline in potato consumption was growing competition from other starchy foods like rice and macaroni. Just as important was the fact that American housewives became time-conscious and impatient with the task of food preparation. Peeling, cutting, boiling, and frying potatoes just took too much time. Other processed foods which were already prepared, cooked, and flavored, and therefore provided convenience, pushed potatoes out of the shopping basket of Americans.

The only processed potato product readily available in the supermarket up until about 1950 was potato chips. Potato chips still qualify as the ideal convenience food because they can be eaten directly from the bag. Chips remain one of the most popular processed potato products. Indeed, until 1965 when frozen french fries production topped 1.5 billion pounds, chips were the most important processed potato product.

Beginning around 1950, a variety of new processed potato products began to appear on the market.

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They included instant mashed potatoes, dehydrated potato slices au gratin, frozen french fries, and many other products.

Per capita consumption of potatoes began to climb from its low point in 1952. Fresh potato consumption, however, has continued to decline so that in 1966 we consumed only 65 pounds of fresh potatoes per person. Fortunately for the potatogrower, another 45 pounds or so were consumed in the form of processed potatoes. It is estimated that by 1970, 50 percent of the potatoes we eat will be consumed in some processed form.

With the high cost of labor today, restaurants are just as interested in "convenience" foods as the housewife. More than two-thirds of all mashed potatoes served in restaurants are now made from dehydrated potato flakes or granules. And more than two-thirds of the 1.5 billion pounds of frozen potato products—primarily frozen french fries—packed in 1966 were used in restaurants.

The Department of Defense has long recognized the advantages of dehydrated foods from the standpoint of convenience, shipping weight, stability, etc. In 1966, Defense purchased some 22 million pounds of dehydrated potatoes. The savings in transportation and storage alone from the use of dehydrated potatoes are evident in the fact that 22 million pounds of dehydrated potatoes are the equivalent of 179 million pounds of fresh potatoes. And unlike his father in World War II, today's fighting man finds mashed potatoes made from dehydrated products a most acceptable item.

That potato processing is big business is illustrated by just one plant in Idaho which makes frozen french fries.

Processed Potato Products

Frozen Products

French fries, regular and crinkle cut
Patties
Shredded
Diced
Hash brown
Mashed
Whipped
Stuffed baked
Rissole
Au gratin
Delmonico
Scalloped
Dutch potato salad
Small whole potatoes
Vegetable stew mix
Roasted
Cottage fried
Boiled
Pancakes
Dumplings
Knishes
Blintzes
Pirogen
Hashed in cream
Soup
Potatoes and peas in cream sauce
Dehydrofrozen: Diced

Dehydrated Products

Instant mashed: Granules, flakes, "buds"
Diced, for preparing hash brown potatoes, general purpose dishes, and for remanufacture in canned hash and stews
Slices, chiplets, shreds, for preparing salad, hash brown, casserole, and other general purpose dishes
Scalloped; salad mix; pancake mix; cream of potato soup; au gratin
Flour, for potato bread, doughnuts, crackers, and other specialty baked goods and breading material

Starch

Regular and chemically modified potato starches for use in paper manufacture, textile sizing, and food processing

Potato Chip Products

Regular and crinkle-sliced chips; shoestring or julienne; barbecue-, cheese-, onion-, and smoke-flavored chips; dip chips; crackers

Prepeeled Products (for fresh delivery to the restaurant trade)

Whole potatoes; hash brown; oil blanched; salad; french fry cuts

Canned Products

Whole potatoes; stew; soup; sliced potatoes; shoestring potatoes; salad (American and German style); potato pancakes; hash; chowder; au gratin; strained (baby food)

Each working day this plant processes the equivalent of a trainload of 100 cars of potatoes and a 10,000-gallon tank car of vegetable oil.

Food processors have found the potato a most versatile raw material, adaptable to a wide variety of products. The accompanying table is only a partial list of processed potato products available today. Most can be found in the supermarket, but some are used only by restaurants or by manufacturers making items such as beef stew or corned beef hash.

The diversity of products made from the potato is equaled by the diversity of processing equipment. Potato cubes have been experimentally shot from specially designed guns so that after drying they cook much faster than conventionally dried cubes. The pieces of potatoes are first dried in hot air to about 25 percent moisture, then loaded into the gun where they are quickly heated to a temperature that superheats the moisture in the piece above its atmospheric boiling point. When the pressure is suddenly released, the pieces explode from the gun and steam escapes from the pieces and leaves a porous texture.

After final drying in a hot-air oven, the dry, porous cubes can now rapidly reabsorb moisture during cooking.

Several potato chippers are using microwaves, a kind of high frequency energy much like TV and FM radio waves, but at higher frequencies, to make a better potato chip.

The chips are taken from the conventional fryer just as they begin to develop a golden brown color. Since they are not dry and crisp enough at this stage, the drying is completed by evaporating the remaining moisture with microwave energy.

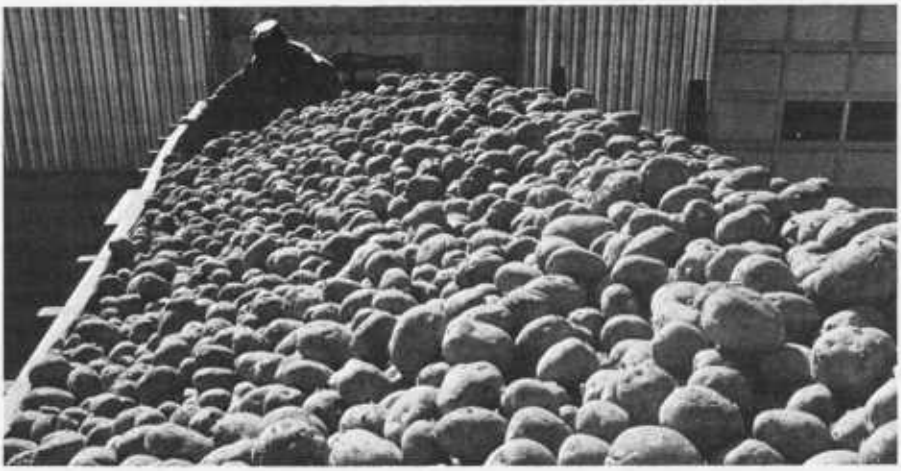
This technique permits the use of potatoes which would make objectionably dark-colored chips if cooked to dryness in the conventional fryer. Microwaves selectively heat water by molecular agitation throughout the chip, not just at the surface. In microwave drying, the chip does not get hot enough for further browning.

Dehydrofrozen potatoes, based on a process developed at USDA's Western Utilization Research and Development Division, are made by precooking potato cubes or slices, evaporating sufficient water to reduce their weight by 50 percent, and freezing. The resulting product is a potato chunk both larger and quicker cooking than that which can be made by conventional dehydration. Yet it still retains the advantages of weight reduction.

Newest of the many varied forms of processed potato is the extruded french fry. This ingenious product is made from a dry mix of dehydrated potato granules with added starch, vegetable gum, and flavoring and is designed primarily for restaurants or hamburger stands. The mix can be packed either in a metal can or in a paper bag and held without refrigeration. To use the mix, the cook adds sufficient water to make a dough which is placed into a cylinder and extruded into noodlelike ribbons with the same general cross section as conventional french fried potatoes. A knife cuts the ribbons to the desired length, and they fall into hot fat to become french fries within 2 minutes.

The development of instant, dry potato flakes offers an excellent example of the path that a U.S. Department of Agriculture development can follow from the laboratory to industrial use. For the past 17 years, USDA has sponsored a series of National Potato Utilization Conferences at various potato-growing areas around the country. These conferences are attended by growers, processors, distributors, and others interested in the growth of the potato industry.

During the Sixth National Potato Utilization Conference held at Cornell University, Ithaca, N.Y., in 1954, USDA's Eastern Utilization Research and Development Division announced development of a method for making potato flakes by drum-drying mashed potatoes. In this process, the potatoes are first cooked and cooled under carefully controlled conditions and then spread onto a heated drum. The dried



Freshly-harvested potatoes at a processing plant in Presque Isle, Maine.

potatoes come off the drum in a thin sheet which is broken into flakes.

To determine whether this product was a feasible commercial venture, a carload of Maine potatoes was processed into flakes at the Division's research laboratory pilot plant in Philadelphia. In 1956, a market test of the finished product was conducted by USDA's Marketing Economics Division. This test demonstrated that consumers would buy potato flakes.

The first commercial production of potato flakes began in 1957, and annual production is now more than 100 million pounds.

Yet another form of instant mashed potatoes is dehydrated potato granules. Potato granules are one of the most unusual of all processed vegetables. Every granule is a dry, whole, unbroken plant cell. The potato cell resembles a kind of Easter basket, the cell wall being the basket and the starch grains the "eggs." If the cell wall is broken during processing, the starch grains escape, and the reconstituted mashed potato has an undesirable sticky texture.

Learning how to separate the individual potato cells and to dry them so they remain intact and unbroken proved a difficult task. The secrets of how to do this were still being learned even as late as the Korean war. The consistency of mashed potatoes produced at that time left much to be desired. GI's in that conflict often found reconstituted mashed potatoes to be rubbery and sticky, a far cry from the fresh mashed potatoes they were accustomed to at home. But the instant mashed potato of 1968 has come a long way and has been readily accepted by housewives and restaurants as well as by soldiers.

The Western Utilization Research and Development Division at Albany, Calif., made many technical contributions to development of a high-quality potato granule. One of these contributions was adaptation of the fluidized bed dryer to granule processing. Various types of this dryer are now used by most potato granule manufacturers.

The fluidized bed dryer consists of a long box or trough with a porous ceramic bottom. Warm air is blown up through the bed at a velocity which is sufficient to suspend the granules. Drying is rapid and gentle under these conditions.

Restaurants, cafeterias, hospitals, and others in institutional feeding now find that the use of dehydrated mashed potatoes is an economical—and highly acceptable—method for preparing mashed potatoes.