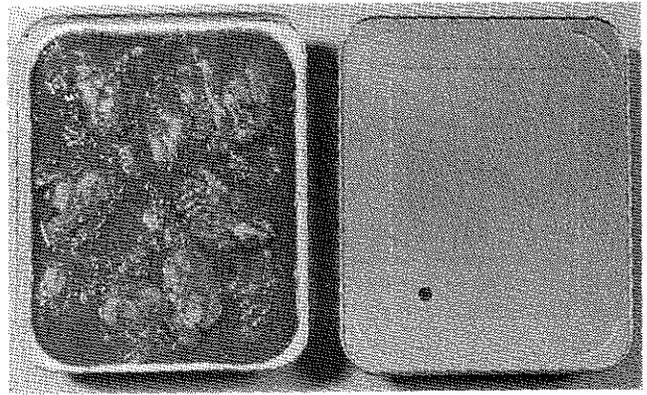


FEATURE INTERVIEW

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Longer shelf life for non-frozen

Irradiation may be closer than you think. An interview with Dr. Ari Brynjolfsson, chief of the radiation food preservation division, U.S. Army Food Engineering Laboratory, Natick, MA.

Q. Dr. Brynjolfsson, you are one of the world's foremost researchers in the design and application of irradiation techniques for pasteurizing and sterilizing food products. With the shortage of energy, our poultry industry is deeply interested in added shelf life techniques that will permit it to make fewer deliveries a week, but with assurance of wholesome product. Can we expect some help from work like yours?

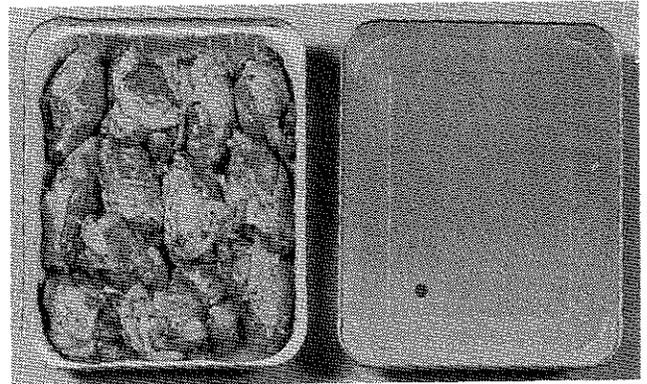
A. Yes, I think quite soon. The World Health Organization already has had toxicological experts review the health aspects and recommend irradiation as a safe means of preserving food. Some of us feel it may be a safer approach than anything yet applied in food technology.

Q. What is FDA's position?

A. The only application in the United States for clearance for use of irradiation on poultry has been filed by Dr. Martin Welt, of Radiation Technology, Rockaway, NJ. If your industry is interested, and can satisfy itself that the method has value, I think Dr. Welt and others would welcome any support you can give. Within FDA, the chief toxicologist happened to have chaired the WHO sessions which approved of the technique. I believe you'll find wide support for irradiation within USDA and FDA, especially among the microbiologists.

Q. Within a few moments we'd like to ask some specific questions about how you would use this process in a typical poultry plant. But first, just what is the process?

A. Radiation used for preserving poultry is closely related to light and it kills bacteria in much the same way.



COOKED CHICKENS (barbecued above, baked below,) have been radappertized (sterilized) after preparation, and are kitchen-fresh two years later. An intermediate step, which this story centers upon, can pasteurize ice-pack or deep-chilled product on line, with dramatic increase in shelf life.

Light, especially ultraviolet light from mercury lamps or sun lamps, often is used for surface sterilization. But for poultry and meat, light is practically useless. It has very limited penetration and this makes it possible for bacteria to hide just under the surface.

X-rays and gamma rays, on the other hand, penetrate a whole turkey or a 12-inch-thick poultry tray. Bacteria no longer can hide and the food can be sterilized quite easily. This irradiation process sometimes is called "cold sterilization" because the energy required is so small that the product does not heat up appreciably.

Q. For purposes of this article, perhaps we ought to define the difference between "pasteurization" and "sterilization" of a chicken product —

A. We can go into more detail about that later. Very briefly, if you irradiation-pasteurize a poultry product, you can expect a shelf life of up to 20 days under standard handling methods, using refrigeration. Once you sterilize a product, you require no refrigeration and shelf life can be as long as two years, given proper packaging.

Q. What happens in a radiation chamber?

A. Food moves through the chamber with a dwell time for pasteurized poultry of about one hour. It would take about 15 times that long to sterilize product if the radiation intensity inside the facility were the same. In prac-

IRRADIATED CHICKEN

tice, however, you would increase the intensity to reduce treatment time on sterilized product.

The food is exposed to gamma radiation from radioactive cobalt-60. It can be used on red meats and other foods, of course, even strawberries. It kills or arrests bacteria, molds and other organisms that cause food spoilage, depending upon length of exposure to the rays.

Q. Is this process safe?

A. Certainly the product is. Astronauts have eaten irradiated food in space. Commercial radiation equipment is available, and in use, especially for sterilizing disposable syringes, catheters, gauze, bandages and equipment used in hospitals. Doctors welcome the assurance of such complete sterilization.

The process has not been cleared for use in meat and poultry, except on an experimental basis, such as here at Natick, where our Army research centers on new kinds of foods a soldier can use under prolonged field maneuvers.

Q. Have you tasted irradiated poultry?

A. Of course! Your industry is fortunate. Poultry makes an excellent product.

Q. How would this technique work in a processing plant? What would it cost?

A. I would estimate that it would require an expenditure of about \$2 million for the equipment required to irradiate, say, 100 million pounds of product a year. The more you process, the less the cost per pound . . . perhaps a half cent a pound or a little more to pasteurize, perhaps four cents a pound to sterilize.

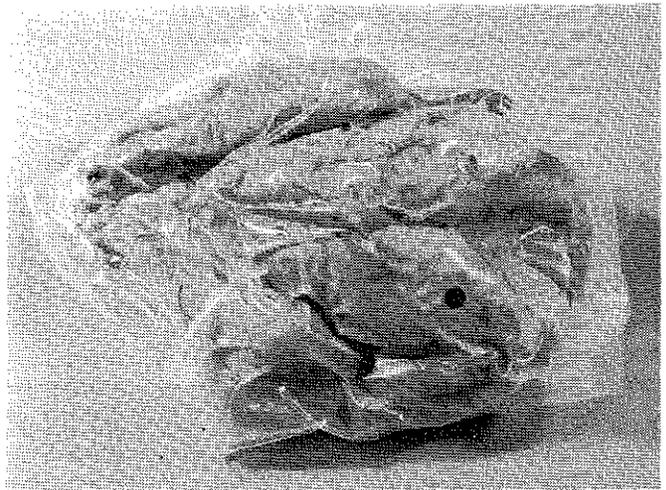
You would simply move the product through the radiation facility, just as you would at the end of a line for product going into a blast freezer or chilling room. In your industry, where shelf life probably need not extend more than seven to 14 days, I would imagine you'd irradiate at the end of the processing line before you would put product into the chiller or freezer. Remember, you still need to refrigerate product but you certainly can reduce the number of shipments weekly, or hold shipments longer at point of distribution.

Q. Could poultry be packaged before it is given the cobalt treatment?

A. Yes, like you would put your briefcase or bag through an X-ray machine at the airport.

Q. Somehow it sounds a little scary. Are you sure the process is safe?

A. Many people associate food irradiation with atomic fallout and atomic reactors. Or the cobalt treatment given cancer patients. But they need to distinguish between irradiation of living organisms and irradiation of the food consumed by those organisms. There is no residual effect at all. The treatment can be likened to switching lights on and off. There simply are no lingering rays, no entrapment of any kind.



WHOLE TURKEY lends itself to sterilization or pasteurization, and product can be cooked or uncooked, depending upon marketing needs.

Q. Is anyone irradiating poultry on a large scale?

A. No, not on a large scale, but the Netherlands has given unlimited clearance (since 1978) for sale of radiation-pasteurized poultry. However, recent developments make it likely that irradiated poultry soon will move into international trade.

Q. Any international clearances yet?

A. My cause for optimism centers, in part, upon recent unconditional approval of irradiated poultry by a toxicological "Expert Committee of Food Irradiation." This group was commissioned to study the wholesomeness aspects of several irradiated food items, including pasteurized poultry, by the World Health Organization.

Q. Where does it stand now?

A. Subsequent to the recommendation by the toxicological experts' committee, the influential Codex Alimentarius Commission began to proceed most speedily to obtain international acceptance of (a) "A General Standard for Irradiated Foods," and (b) "A Draft Code of Practice for Operation of Radiation Facilities Used for Treatment of Foods."

Q. Where does it rest now in Codex?

A. These two standards already have moved through eight steps of an 11-step procedure. After the ninth step — which could come as early as this December — irradiated poultry will be permitted into international trade.

Q. Does that mean that the Food & Drug Administration will approve, too, so that the U.S. can participate?

A. First, let me clarify that the Codex approval will apply only to the pasteurization process of iced or frozen eviscerated raw poultry. Clearance of Codex standards for sterilized poultry products cannot be anticipated before present studies are completed in 1983-84.

Q. How about pasteurized product?

A. Some are hoping for FDA clearance by as soon as this summer, but FDA may not move that rapidly. Indications from industries like yours that such an alterna-

IRRADIATED CHICKEN

tive may be consistent with the Administration's effort to conserve energy might accelerate the process.

It is our firm belief here at Natick, and of the experts who have advised WHO, that irradiated foods are safe. However, in the U.S., final confirmation of the safety of irradiated poultry products must await approval by FDA.

Q. You say there is a specific application pending for clearance of irradiated pasteurized poultry?

A. Yes, by Dr. Welt, as I mentioned earlier. FDA approval for iced or frozen, eviscerated, irradiated — pasteurized poultry may be granted this year, or perhaps next. But approval of sterilized poultry products could come later — after review of the data from current tests for wholesomeness of chicken.

I have reason to believe, however, that the majority of microbiologists, both in FDA and USDA, supports the efficacy of irradiation.

Q. Would this mean special labeling?

A. When these foods are marketed, it will be clearly indicated that they are irradiated. To me that label would be a sign of quality, just as the irradiation sign on surgical devices is a sign of quality to the medical doctor. You can be certain, too, that the equipment as used on line, and its safety in operation, will be under continual inspection by a federal agency.

Q. You mentioned earlier that you need to refrigerate irradiated poultry. Will you explain why?

A. Radiation only kills bacteria and parasites. It reduces hazard from salmonella and E. coli. But there is much more to preserving food — such as preventing enzymatic breakdown, preventing oxidation, or bacterial recontamination or parasitic reinfestation — and, of course, keeping food palatable.

Q. What will be the practical application for poultry?

A. Small amounts of irradiation (pasteurization) can free poultry from common spoilage microorganisms, such as pseudomonas and also from salmonella, E. coli and other pathogens that often remain on poultry until thoroughly cooked. Irradiation also saves energy in its broadest sense, from the need for fewer deliveries for pasteurized product to the longer-term value of sterilized product. Sterilized product offers a multitude of opportunities for new product developments.

Q. What does irradiation do to taste and color?

A. Pasteurization of raw chickens uses small amounts of radiation (about 200 kilorads) and flavor is not a problem. (A few experts are able to detect, just after processing, an irradiation odor — but by the time product gets to market, the odor cannot be detected at all, even by experts.

At sterilizing dosages, however, off flavors are a prob-

About Ari Brynjolfsson



AN INTRIGUING Scandinavian accent is a tip-off to the heritage of 52-year-old Dr. Ari Brynjolfsson, Chief, Radiation Preservation of Food Division, at the Army's Food Engineering Laboratory in Natick, MA.

Born in Akureyri, Iceland, Brynjolfsson earned a doctorate in theoretical nuclear physics from the University of Copenhagen's Niels

Bohr Institute. Later, he studied nuclear engineering and geophysics at West Germany's University of Gottingen. Later in the U.S., Brynjolfsson completed Harvard University's Advanced Management Program. Prior to coming to the U.S. in 1965, he worked as a geophysicist for the Icelandic government and headed radiation research laboratories for Denmark's Atomic Energy Research Establishment.

Brynjolfsson, who became a naturalized citizen in 1970, served as consultant to the Army Natick Laboratories from 1962 to 1963. He then went back to Denmark, but in 1965 returned here to become chief of Natick's radioaction sources branch. In 1972, he was named acting director of the food irradiation program. In 1974, Dr. Brynjolfsson was appointed director

of the radiation laboratory and chief, radiation preservation of food division.

The irradiation specialist is a member of numerous professional societies, including the American Physical Society, the American Ass'n of Physicists in Medicine, American Nuclear Society, The Institute of Food Technology and New York Academy of Science and Arts. He has contributed numerous articles to professional journals on such subjects as nuclear physics, nuclear engineering and food technology. He's a past editor of International Journal of Radiation Engineering.

Brynjolfsson lives with his wife and family — whose five children range from 12 to 25 years — in Wayland, near the Natick headquarters laboratories, in Massachusetts.

— BERNARD HEFFERNAN

IRRADIATED CHICKEN

lem. It is important to heat the product to about 160°F to inactivate the enzymes that otherwise will destroy food stored for a long time at room temperature. It also is important to reduce or eliminate oxygen by vacuum packaging to prevent oxidation. Further improvements are obtained by irradiating at low temperatures.

In this way, a series of highly acceptable ready-to-eat products has been developed by the U.S. Army. As I have mentioned, the astronauts have eaten these foods as delicatessen items in space.

Q. A point of curiosity--how and where would you treat product?

A. You would first prepare the product exactly as you would like the consumer to have it. You would place the food under vacuum into a container, such as a tray pack, flexpack, or a can. The packaged product could then be put into a carton box (which, for example, could have the dimensions of 8" x

12" x 16"). Then you would simply put the carton box on the conveyor that would take the boxes through the radiation chamber. The rays will penetrate cardboard, aluminum foil and other types of food containers. The irradiation chamber itself, however, would be shielded by concrete.

Gas flush/vacuum packaging would be done before the product is put into carton boxes. Irradiation of deep-chilled or frozen poultry would be done after packaging and refrigeration--and in the standard carton boxes that today are used for shipping. Also, ice-packed poultry would be pasteurized in the carton boxes used today for shipping.

Q. Any danger from the rays escaping at the entry or exit doors of the chamber?

A. Not at all. They are directional and can be kept away from either entrance. The boxes, on a conveyor, would enter the irradiation chamber through a labyrinth, or entrance tunnel, and they would exit through the same or similar labyrinth. But, just as you must prevent people from being locked in a refrigerator or in an ethylene oxide sterilization chamber or for that matter, in a cooker, you must prevent the people from entering the radiation chamber while the source is in use.

Around the world sailor/scientist thrives on irradiated chicken breasts

HOT ON THE TRAIL of the commercial aspects of food irradiation is Dr. Martin Welt, president of Radiation Technology, Rockaway, NJ, whose laboratory includes a machine that can pasteurize a quarter of a million pounds of chicken a day. That means double shelf life for standard ice-pack or deep-chill.

Dr. Welt, a nuclear reactor pioneer, formerly with the Atomic Energy Commission, has filed four petitions with FDA for permission to use the irradiation equipment and process. One of them is for poultry use.

FDA has made a preliminary response, he told **BROILER INDUSTRY**, which presents no major technical barriers. FDA agrees, he says, that the technique of irradiation offers no hazards in the areas of toxicology, chemistry, microbiology, wholesomeness and environmental impact.

He has been given to understand he may get a preliminary clearance for poultry use by "early summer," but others feel FDA will not move that rapidly into publication of proposed regulations for use of the method.

By way of an aside, Radiation Technology supplied "radappertized" precooked chicken breasts and other foods to a scientist who made an around the world trip in seven months without a refrigerated product on board. That person, Dr. Sims, is chief medical officer for the Fiji Islands and has told Dr. Welt that his own health at the end of the voyage offered eloquent testimony that there was



Dr. Martin Welt

absolutely no loss of vitamins and other nutrients in the sterilized foods.

Food that has been irradiated has been fed to hundreds of thousands of rats, cats, dogs and other laboratory animals, Dr. Welt said, without any ill effects. "They've eaten more irradiated food, perhaps, than all other foods combined in a given year."

So confident is he that FDA will clear his petitions that Dr. Welt has just begun to build three radiation units that will handle various kinds of foods in large volume. One of these would be capable of irradiating a million pounds of poultry a day.

The scientific name applied to the process, if pasteurizing product, is "radacidation." If sterilizing product, which requires about 15 times as much radiation, the process is called "radappertization."

Some fact sheets on the nutritional, energy conservation and export potential for irradiated foods are available to processors. Write Radiation Technology Co., Lake Denmark Rd., Rockaway, NJ 07866. The telephone number is 201/627-2900.

IRRADIATED CHICKEN

Q. We have heard that irradiation could be a possible substitute for nitrite in poultry and red meats?

A. It is an excellent substitute for nitrite or any other chemical additive whose purpose is only to inhibit microbial growth. Our tests show that to most consumers bacon without nitrite is just as good as bacon with nitrite. To prevent the botulinum hazard, we could irradiate nitrite-free bacon. It would contain no nitrosamines.

Q. What are the implications of irradiation for the poultry industry, as you see it?

A. The poultry industry will continue to operate in much the same way it does today. A few companies will introduce low dose irradiation of raw, fresh, refrigerated, cut-up poultry to extend shelf-life from about 10 days to 20 days. A few companies also may export frozen, low-dose irradiated, salmonella-free poultry. Companies which have irradiation facilities also could produce enzyme-inactivated chicken rolls irradiated with a low dose for increased flexibility in marketing the product. Later, ready-to-eat sterilized dishes of chicken will be marketed. These changes will be gradual and coexist with present methods for a long time.

The consumer will have a greater variety, the industry greater flexibility to meet market fluctuations, and the grower will have more stable production. The increased stability will become clear when irradiation sterilization is introduced. We estimate that when we reach the sterilization stage — admittedly many years away from complete acceptance — food energy requirements from plant to home use can be reduced 2¹/₂ times. It simply will not require refrigeration.

Q. Would irradiation end the need for frozen poultry?

A. No. When Nicholas Appert, in 1807, unveiled thermal canning for Napoleon's army, people did not stop eating fresh foods. When freezing was introduced, people did not stop eating fresh and thermally canned food. When irradiation processing is introduced, people will not stop eating fresh, thermally canned, or frozen food.

Q. You sound quite optimistic for the poultry industry?

A. The American poultry industry will adapt easily to this new technology and gain an advantage in foreign competition. The reason: U.S. poultry plants are larger than those abroad, and our distribution system already is more advanced than that of overseas.

Q. How much research has been done in the U.S.?

A. Currently, research in the U.S. is limited to government-supported wholesomeness studies on irradiated chicken. Those studies are done mostly on contract. In-house studies at the U.S. Army Food Laboratories have focused on radiation chemistry and food technology. These chemical studies, both in-house and on contract with universities, are for broadening the FDA's clear-

ances. The ultimate goal is to have food irradiation cleared as a process.

Q. You feel irradiation, then, may be just around the corner?

A. Clearances, at least. I believe the regulatory agencies, FDA and USDA, will welcome food irradiation. I think that perhaps they would approve it faster if industries like yours find this technique compatible with your interests. It looks as if the energy crisis makes this alternative look especially promising. (END)

Michigan State pioneered irradiated food research

DR. WALTER M. URBAIN, retired professor of food science and human nutrition at Michigan State University, has been involved in irradiation research for 25 years. He believes tests now nearing completion will win approval of the Food and Drug Administration. And when FDA says "go," MSU will be ready with years of data on the hows and whys, and the do's and don'ts of food irradiation. Most likely use for irradiation in the United States will be for extending shelf life for fresh meats of all kinds, according to Dr. Urbain.

An article in a recent issue of *Michigan Science in Action* points out that food irradiation basically is a very simple process. What's more, it's the first basically new food process since canning.

At MSU, food is exposed to gamma radiation from radioactive cobalt 60 that kills bacteria, molds and other organisms that cause food spoilage, destroys insect pests or halts deterioration of food plants by stopping their maturation.

A complex system of warnings and interlocked controls prevents the cobalt from being used when anyone is inside the radiation room. Frequent inspections insure there are no slip-ups.

FDA hampered by "additives" clause

THE FOOD & DRUG ADMINISTRATION has the major responsibility for clearing the food irradiation process because food irradiation is defined by law as a food additive.

When the law was passed in 1958, some people were proposing to use, as the irradiation source, nuclear reactors and very high energy (more than 24 million volt) accelerators, both of which could introduce new nuclei and radioactivity to the food. This kind of radiation would then be equivalent to a food additive. Subsequently, when this kind of radiation was abandoned, FDA continued to consider radiation as an additive.

The justification for this opinion is that irradiation can cause chemical changes, and those chemical changes constitute a food additive. This interpretation applies to any other process, such as heating, drying and freezing of food. Each plain storage of food could be considered an additive because chemical changes occur in storage. Food irradiation, however, is the only process that has been defined as a food additive. There is no good reason to single out food irradiation in this respect. (Maybe wholesomeness testing should be applied to all new processes or to changes in old processes.) When all testing is done, the effect of irradiation processing on food will have been more scientifically understood and proven safer than any other food processing method.

Welt's application is being reviewed by the FDA's Division of Food and Color Additives. Food safety laws now classify irradiation as an adulterant, but Welt's applications seek to have the agency revise its regulations to permit gamma radiation to be used as a preservative.

George Pauli, a consumer safety officer in FDA's Food Additives Division, said there still are some questions about the toxicology data. He isn't as optimistic as Welt about early summer clearance.

But Welt says that the World Health Organization and the Food and Agricultural Organization (both United Nations' subsidiaries) and the Codex Alimentarius — which he likens to an International FDA — have recommended that radicidized (pasteurized) food be approved for international commerce.

Results of the numerous studies in this country and abroad are now very convincing. I believe, therefore, that regulatory agencies soon will approve the process.

— DR. ARI BRYNJOLFSSON