WHAT'S WRONG WITH FOOD IRRADIATION
With Sources for Each Statement

January 2001

Irradiation damages the quality of food.

- Irradiation damages food by breaking up molecules and creating free radicals. The free radicals kill some bacteria, but they also bounce around in the food, damage vitamins and enzymes, and combine with existing chemicals (like pesticides) in the food to form new chemicals, called unique radiolytic products (URPs).

Source: US Government Accounting Office. The Department of the Army's Food Irradiation Program –Is It Worth Continuing: PSAD-78-146. Washington, DC 9/29/78, pp. 27-28. Also David R. Murray, Biology of Food Irradiation, (New York: John Wiley & Sons, Inc. 1990), p. 74-77.

- Some of these URPs are known toxins (benzene, formaldehyde, lipid peroxides) and some are unique to irradiated foods. Scientists have not studied the long-term effect of these new chemicals in our diet. Therefore, we cannot assume they are safe.

Source: A Broken Record, a report by Public Citizen's Critical Mass Energy and Environment Program, October 2000, pages 25 and 26 (Originally in "Evaluation of the health aspects of certain compounds found in irradiated beef." Federation of American Societies for Experimental Biology, Bethesda. Prepared for the US Army Medical Research and Development Command, Fort Detrick , MD, August 1977. Supplements I and II, March 1979). This refers only to compounds found in irradiated beef, however, it is justifiable to assume the same kind of chemical changes occur in other meats, and likely something similar, though probably less extensive, in fruits and vegetables.

- Irradiated foods can lose 5%-80% of many vitamins (A, C, E, K and B complex). The amount of loss depends on the dose of irradiation and the length of storage time.

Source: P.S. Elias and A.J. Cohen. Recent Advances in Food Irradiation. (Amsterdam and New York: Elsevier Biomedical Press, 1983.) P.S. Elias and A.J. Cohen. Radiation Chemistry of Major food Components (Amsterdam and New York: Elsevier Biomedical Press, 1977). W. Heiman. Fundamentals of Food chemistry. (Chichester, England: Ellis Horwood, 1980). Both cited in Kathleen Tucker, Food Irradiation: Who Wants It? (Washington DC: Essential Books, 1987).

- Most of the food in the American diet is already approved by the U.S. Food and Drug Administration (FDA) for irradiation: beef, pork, lamb, poultry, wheat, wheat flour, vegetables, fruits, shell eggs, seeds for sprouting, spices, herb teas. (Dairy is already pasteurized). A food industry petition currently before the FDA asks for approval for luncheon meats, salad bar items, sprouts, fresh juices and frozen foods. Another petition before the USDA asks for approval for imported fruits and vegetables.

Source: The FDA and USDA dockets. See http://www.purefood.org/irradlink.html in the news archive for the news reports.

- Irradiation damages the natural digestive enzymes found in raw foods. This means the body has to work harder to digest them.

Source: In my best judgment "damaged" is a general statement that can be made about all digestive enzymes. I base this judgment on the following: 1) induction: if irradiation breaks molecules and creates free radicals, they will damage large molecules like enzymes as well as bacteria. 2) irradiation at the proper doses delays (or sometimes, if the dose is inadvertently too high, stops) the ripening of fruits and vegetables. Ripening

is caused by enzyme activity, therefore when a fruit doesn't ripen, it is because the enzymes are not activated. 3) Two studies I am familiar with where irradiation caused abnormal growth (which is controlled by enzyme activity) are:

A. (Patel et al, Behaviour of lipase activity of the gamma-irradiated groundnut during germination, Journal of the American Oil Chemists Society, 1965; 42:617-619)

This study investigated the effect of gamma irradiation on lipase activity of the groundnut (peanut) during germination. The dose levels were 10, 30, 50, 70, 90 and 120 Kiloroentgens, which convert to .1, .3, .5, .7, .9 and 1.2 kGrays. These doses range from one-eightieth to one-eighth the maximum dose requested in the Australia/New Zealand application to allow irradiation of oilseeds. The suppression of lipase activity (Figure 1) is for almost all doses dose-dependent.

Figure 1 shows that a difference in the level and rate of lipase activity between control and irradiated seeds begins at day 6 and continues through the germination period. The authors state "irradiation of 50 kr [.5 kGray] and above induced damage to the active centers [of lipase production]." "In general the growth of irradiated seeds was poor (only epicotyls are developed) and seeds irradiated to higher dosage levels, i.e., 70 kr [.7 kGray] and above did not grow at all," although lipase increased without germination in these seeds. The authors attribute the abnormal timing of lipase production and failure to germinate to irradiation damage to the nucleus and mitochondria.

B. (Sitton et al., Electron beam irradiation effects on wheat quality, seed vigor, and viability and pathogenicity of teliospores of *Tilletia controversa* and *T. tritici,* Plant Disease 1995; 79:586-589)

This study specifically addresses the issue at hand. The authors compared irradiated fungus spores and wheat at doses of 0.0, 1.2, 2.6, 4.6, 6.7 and 10.2 kGray for spore viability, wheat usability in baking, and germination. Germination was tested by storing the seeds on germination paper in the dark for 7 days at 20ºC, then planting them in soil in early spring. Table 3 ("germination test," the 'easiest' test) shows that *no* normal germination occurred at any irradiation dose. The percentage of seeds that did not germinate increased from 0.5% (control group) to 6.0% (10.2 kGray). The remaining seeds germinated abnormally.

There are many similar studies on deliberately retarding the sprouting of potatoes, the spoilage of oysters, etc.

- If unlabeled, raw foods that have been irradiated look like fresh foods, but nutritionally they are like cooked foods, with decreased vitamins and enzymes. The FDA allows these foods to be labeled "fresh."

Source: First sentence: see above. Second sentence: Federal Register of January 6, 1993 (58 FR 2302 at 2401), FDA final rule regarding labeling (this applies to "raw" foods treated up to 1 kiloGray).

- Irradiated fats tend to become rancid.

Source: Murray, pp. 83-84.

- When high-energy electron beams are used, trace amounts of radioactivity may be created in the food.

Source: Report on the Safety and Wholesomeness of Irradiated Foods to the British Government, November, 1984, sections 4.6 and 4.7

Science has not proved that a long-term diet of irradiated foods is safe for human health.

- The longest human feeding study was 15 weeks. No one knows the long-term effects of a

life-long diet that includes foods which will be frequently irradiated, such as meat, chicken, vegetables, fruits, salads, sprouts and juices.

Source: The 15 week study was conducted in China. Discussed by Donald Louria, M.D., in "Zapping the Food Supply," The Bulletin of the Atomic Scientists, No. 46 (1990), pp. 34-36. This is available at <http://www.bullatomsci.org/issues/1990/s90/s90louria.html> Interestingly, no feeding studies have been done on pigs, the most common surrogate for humans.

- There are no studies on the effects of feeding babies or children diets containing irradiated foods, except a very small and controversial study from India that showed health effects.

Source: Neither Public Citizen nor Food and Water, which researched the issue, nor my own readings, have uncovered any studies on babies or children. The Indian study had 5 malnourished children given diets with freshly irradiated wheat, compared 5 children given stored irradiated wheat. The first group showed chromosomal damage. I've read the criticisms and the countercriticisms. The criticisms say that the researchers' method of counting the chromosomes was faulty and not reproducible, so their judgment that the children had been harmed is faulty. The countercriticisms deny their counting methods were faulty. I can't judge, so I downplay the study in my materials.

- Studies on animals fed irradiated foods have shown increased tumors, reproductive failures and kidney damage. Some possible causes are: irradiation-induced vitamin deficiencies, the inactivity of enzymes in the food, DNA damage, and toxic radiolytic products in the food.

Source: See Murray, Chapter 6. Also A Broken Record. Both have numerous detailed sources.

- The FDA based its approval of irradiation for poultry on only 5 of 441 animal-feeding studies. Marcia van Gemert, Ph.D., the toxicologist who chaired the FDA committee that approved irradiation, later said, "These studies reviewed in the 1982 literature from the FDA were not adequate by 1982 standards, and are even less accurate by 1993 standards to evaluate the safety of any product, especially a food product such as irradiated food." The 5 studies are not a good basis for approval of irradiation for humans, because they showed health effects on the animals or were conducted using irradiation at lower energies than those the FDA eventually approved.

Source: FDA Memorandum from Marcia van Gemert to Clyde Takeguchi, Dec. 28, 1992, in A Broken Record, note 27

- The FDA based its approval of irradiation for fruits and vegetables on a theoretical calculation of the amount of URPs in the diet from one 7.5 oz. serving/day of irradiated food. Considering the different kinds of foods approved for irradiation, this quantity is too small and the calculation is irrelevant.

Source: First sentence: A document prepared by chemist Jeffrey Reinhardt, from FDA projections, available at http://www.purefood.org/irrad/liverurps.cfm. Second sentence: The FDA considered fruits and vegetables in isolation, not as part of a diet consisting largely of potentially irradiated foods.

- Even with current labeling requirements, people cannot avoid eating irradiated food. That means there is no control group, and epidemiologists will never be able to determine if irradiated food has any health effects.

Source: Not necessary

- Science is always changing. The science of today is not the science of tomorrow. The science we have today is not adequate to prove the long-term safety of food irradiation.

Source: Every scientist knows that science is provisional.

Irradiation covers up problems that the meat and poultry industry should solve

- Irradiation covers up the increased fecal contamination that results from speeded up slaughter and decreased federal inspection, both of which allow meat and poultry to be produced more cheaply. Prodded by the industry, the USDA has allowed a transfer of inspection to company inspectors. Where government inspectors remain, they are not allowed to condemn meat and poultry now that they condemned 20 years ago.

Source: Speeded-up slaughter has occurred as part of deregulation. This is described in Slaughterhouse: The Shocking Story of Greed, Neglect, and Inhumane Treatment Inside the U.S. Meat Industry, by Gail Eisnitz.(Amherst, NY: Prometheus Books, 1997), available from the Humane Farming Association, chapters 26 and 27.

- Because of this deregulation (continued under President Clinton, a protégé of Tyson Foods), the meat and poultry industry has recently lost money and suffered bad publicity from food-poisoning lawsuits and expensive product recalls. Irradiation is a "magic bullet" that will enable them to say that the product was "clean" when it left the packing plant. (Irradiation, however, does not sterilize food, and any bacteria that remain can grow to toxic proportions if the food is not properly stored and handled.)

Source: For the Clinton-Tyson connection, see Slaughterhouse, p. 245. Also of interest is an agricultural journalist's report on his favors to Tyson at <http://www.purefood.org/irrad/tysontakeover.cfm> Losing money and bad publicity—common knowledge (Jack in the Box, Hudson Foods recall of ground beef etc.) Magic bullet statement: my interpretation of the most important value of irradiation to producers: it shields them from liability (of course, they could say that they care most about protecting the customer). Not sterilizing: the doses used for regular food are not sterilizing doses (44 kilograys is the dose for meat for astronauts). Sterilized food is only used for immunocompromised patients (rarely), astronauts' meat (rarely) and lab animals. Regrowth of bacteria at room temperature or warmth: common knowledge.

- In 2000, seven meat industry associations submitted a petition to USDA to redefine key regulations relating to contamination. If accepted by USDA, this petition would permit unlimited fecal contamination during production, as long as irradiation was used afterwards.

Source: [Federal Register: May 15, 2000 (Volume 65, Number 94)][Page 30952-30956], [Docket No. 00-014N], items 4 and 5 describing changes requested by the industry. This is available at http://www.purefood.org/irrad/haccp.html

Labeling--a public policy decision unrelated to science--is necessary to inform people so they can choose to avoid irradiated foods.

- Because irradiated foods have not been proven safe for human health in the long term, prominent, conspicuous and truthful labels are necessary for all irradiated foods. Consumers should be able to easily determine if their food has been irradiated. Labels should also be required for irradiated ingredients of compound foods, and for restaurant and institutional foods.

Source: N/A

- Because irradiation can deplete vitamins, labels should state the amount of vitamin loss after irradiation, especially for fresh foods that are usually eaten fresh. Consumers have the right to know if they are buying nutritionally impaired foods.

Source: N/A

- Current US labels are not sufficient to enable consumers to avoid irradiated food. Foods are labeled only to the first purchaser. Irradiated spices, herb teas and supplement ingredients, foods that are served in restaurants, schools, etc., or receive further processing, do not bear consumer labels. Labels are required only for foods sold whole (like a piece of fruit) or irradiated in the package (like chicken breasts). A radura is required. The text with the declaration of irradiation can be as small as the type face on the ingredient label. The US Department of Agriculture requirements have one difference: irradiated meat or poultry that is part of another food (like a tv dinner) must be disclosed on the label.

Source: First sentence: my judgment. Remaining paragraph:

FDA and USDA regulations. The FDA regulations are available at http://www.fda.gov/ohrms/dockets/98fr/021799a.txt; the USDA regulations at http://www.usda.gov/news/releases/1999/12/0486

- The US Food and Drug Administration is currently rewriting the regulation for minimum labeling, and will release it for public comment by early 2002. They may eliminate all required text labels. If they do retain the labels, Congress has told them to use a "friendly" euphemism instead of "irradiation."

Source: The FDA is planning to resubmit the regulation by early 2002. One of the options in the original February 1999 proposal was to eliminate all text labels (see next item for source)

Electron-beam irradiation today means nuclear irradiation tomorrow.

- The source of the irradiation is not listed on the label.

Source: Current FDA regulation on labeling, 21CFR179.26, Page 419-42, available at http://www.purefood.org/irrad/title21.cfm

- The original sponsor of food irradiation in the US was the Department of Energy, which wanted to create a favorable image of nuclear power as well as dispose of radioactive waste. These goals have not changed.

Source: Michael Colby. "Food Irradiation: An Activist Primer," Walden, Vermont, 1998. Allen Greenberg "Comment," Critical Mass Bulletin, April 1984. Also discussed in Kathleen Tucker's book, Food Irradiation: Who Wants It?

- Many foods cannot be irradiated using electron beams. E-beams only penetrate 1-1.5 inches on each side, and are suitable only for flat, evenly sized foods like patties. Large fruits, foods in boxes, and irregularly shaped foods must be irradiated using x-rays or gamma rays from nuclear materials.

Source: David R. Murray, Biology of Food Irradiation, (New York: John Wiley & Sons, Inc. 1990), p. 34

- Countries that lack a cheap and reliable source of electricity for e-beams use nuclear materials. Opening U.S. markets to irradiated food encourages the spread of nuclear irradiation worldwide.

Source: Inference. Does anyone think that Egypt or Guatemala is going to use electricity?

Irradiation using radioactive materials is an environmental hazard.

- The more nuclear irradiators, the more likelihood of a serious accident in transport, operation or disposal of the nuclear materials.

Source: Opinion

- Food irradiation facilities have already contaminated the environment. For example, in the state of Georgia in 1988, radioactive water escaped from an irradiation facility. The taxpayers were stuck with $47 million in cleanup costs. Radioactivity was tracked into cars and homes. In Hawaii in 1967 and New Jersey in 1982, radioactive water was flushed into the public sewer system.

Source: “Facts about food irradiation,” Global Resource Action Center for the Environment, New York, 1999.

- Numerous worker exposures have occurred in food irradiation facilities worldwide.

Source: See report from government researchers at Pacific National Laboratories at http://qecc.pnl.gov/presentations/hp_midyear_99/index.htm

Irradiation doesn't provide clean food.

- Because irradiation doesn't kill all the bacteria in a food, the ones that survive are by definition radiation-resistant. These bacteria will multiply and eventually work their way back to the 'animal factories'. Soon thereafter, the bacteria that contaminate the meat will no longer be killed by currently approved doses of irradiation. The technology will no longer be usable, while stronger bacteria contaminate our food supply.

Source: Radiation resistant bacteria have already been discovered (not in irradiated food though). I think this scenario is very likely over 20 years.

- People may become more careless about sanitation if irradiation is widely used. Irradiation doesn't kill all the bacteria in a food. In a few hours at room temperature, the bacteria remaining in meat or poultry after irradiation can multiply to the level existing before irradiation.

Source: First sentence: opinion. third sentence: There are several locations: one is in a discussion IDENTIFYING, ADDRESSING AND OVERCOMING CONSUMER CONCERNS: A Roundtable on Food Irradiation, Convened by: Public Voice for Food and Health Policy, National Food Processors Association and International Food Information Council. February 18-19, 1998, page 9.

- Some bacteria, like the one that causes botulism, as well as viruses and prions (which are believed to cause Mad Cow Disease) are not killed by current doses of irradiation.

Source: Botulism: Killed at 50 kilograys, in Murray, The Biology of Food Irradiation, p. 29. Prions: can’t be killed by anything. Viruses: Murray, the Biology of Food Irradiation, p. 30 (cites N.J. Jensen “Irradiation of Food: The Translation of a report by a Danish working Group” pp. 115-131, LST, National Food Agency, Denmark (1986)).

- Irradiation encourages food producers to cut corners on sanitation, because they can 'clean up' the food just before it is shipped.

Source: See above, May 15, 2000 petition.

Irradiation does nothing to change the way food is grown and produced.

- Irradiated foods can have longer shelf lives than nonirradiated foods, which means they can be shipped further while appearing 'fresh.' Food grown by giant farms far away may last longer than nonirradiated, locally grown food, even if it is inferior in nutrition and taste. Thus, irradiation encourages centralization and hurts small farmers.

Source: A logical conclusion from irradiation’s known ability to prolong shelf life of selected foods.

- The use of pesticides, antibiotics, hormones and other agrichemicals, as well as pollution and energy use, are not affected. Irradiation is applied by the packer after harvest or slaughter.

Source: N/A. I suppose one could quibble and argue that by making fruit last longer, slightly less needs to be grown. But because grocers' decisions to keep food on the shelf doesn't have anything to do with the supply, I don't think there would be any difference.

- Free-market economists say irradiation is 'efficient': it provides the cheapest possible food for the least possible risk. But these economists are not concerned about the impaired nutritional quality of the food. They are not considering the environmental effects of large-scale corporate farming, the social costs of centralization of agriculture and loss of family farms,, the potential long-term damage to human health, and the possibility of irradiation-resistant super-bacteria. All of these developments should be (but are not) considered when regulators and public health officials evaluate the benefits of food irradiation.

Source: Look at the context of food production and you can see that there are mega-system effects. These are never discussed by the media or advocates of irradiation.

Brought to you by: Organic Consumers Association <http://www.purefood.org/irradlink.html>
Office: 6101 Cliff Estate Road, Little Marais, MN 55614 (218) 226-4164, Fax: (218) 226-4157
Irradiation Coordinator: Danila Oder, danila@purefood.org