avenue for collaboration is the use of American systems by Japanese linguists. Such a plan would avoid serious duplication of effort.

"In both countries, work on automatic print readers is underway. Successful completion of such a machine will reduce the cost of both linguistic research and machine translation. Meanwhile, it is noted that text can be obtained for study by collection of tapes produced as byproducts of book and newspaper publication. Such tapes could be exchanged with mutual benefit.

"Information is exchanged inadequately between the two countries. Dissemination of titles and abstracts is needed, as are translation and also distribution of semipublished reports to more interested persons. It was suggested that the Association for Machine Translation and Computational Linguistics, the Research Committee for Machine Translation of Japan, and the Information Processing Society of Japan might help with these problems.

"Results of machine translation studies, such as programs or algorithms, dictionaries, and grammars, are not easy to publish, but private arrangements are possible. . . . the value of much cooperative work will be proportional to closeness of collaboration, especially in Japanese-English translation, and vice versa.

"The delegates recommend:

"1) A systematic program of exchange of researchers between American and Japanese mechanical translation projects, especially in the field of linguistics and computer programming applicable to mechanical translation; these exchanges should be used to aid establishment of programs of research on Japanese in the U.S.

"2) Increased availability [of] and ready access to highspeed digital computing facilities for language processing research in Japan and also in the U.S.

"3) Encouragement of continued exchange of published and unpublished reports on an informal and individual basis and the establishment of an appropriate mechanism for the timely exchange of both research reports and published literature, with adequate provision for translation of the significant literature.

"4) That all Japanese reports and articles on mechanical translation and computational linguistics be provided with English abstracts which would be made available to appropriate announcement and dissemination services such as *Computing Reviews* and the Association for Machine Translation and Computational Linguistics.

"5) Exchange of Japanese and English textual material in machine-usable form such as punched paper tape, punched cards, and magnetic tape.

"6) Exchange of coding systems, algorithms and programs.

"7) A second seminar on mechanical translation, after sufficient time and opportunity have been allowed to implement the kinds and means of cooperation suggested in the preceding recommendations.

"8) A planning meeting in the US in 1965 to determine areas for further cooperation; it should be preceded or followed by visits to US research centers.

"This seminar feels it desirable to establish close relationships between the Mechanical Translation Committee of the Information Processing Society of Japan and the Association for Machine Translation and Computational Linguistics, in order to promote the recommended actions, such as 3,4,5,6, on a non-governmental basis."

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Radiation Preservation of Foods

A comprehensive review of research activities on radiation preservation of foods throughout the world was given at an international conference held 27–30 September in Boston, Massachusetts.

S. A. Goldblith (Massachusetts Institute of Technology) opened the conference by challenging the 350 scientists attending to make sound judgments about the safety of foods preserved by radiation. "Let us not allow our thinking to be muddled by 'theoretical hazards' that do not and cannot exist in the practical situation," Goldblith admonished. He pointed to the application of the 12-decimal-reduction-time (12D) principle for thermal processing to radiation sterilization of foods as an example of such "muddled thinking."

Expanding this point, Hamed El-Bisi (U.S. Army Natick Laboratories) described the formulation of the 12D concept as a mere experimental coincidence, supported only by circumstantial, and not by direct, scientific evidence. El-Bisi noted that there was no available evidence to support the claim of industry-wide compliance with the 12D principle in the thermal canning of foods. He called for a positive effort directed toward the establishment of a sound, realistic, and experimentally supported definition of the minimum radiation dose required.

In summarizing studies on the wholesomeness of radiation-preserved foods, Nicholas Raica, Jr., (U.S. Army Medical Research and Nutrition Laboratory) said that recently completed studies indicate that foods electron-irradiated with 11–12 Mev to 5.5 Mrads are wholesome. (Current Food and Drug Administration clearance for radiation-preserved canned raw bacon limits the use of electrons to a 5-Mev maximum.) Raica stated that induced radioactivity cannot be detected in foods irradiated with energies of less than 10 Mev. He explained that, on the basis of theoretical considerations, it has been determined that if a person's entire diet consisted of food electron-irradiated with 24 Mev to 5 Mrad, his total exposure would be 0.26 Mrad per year. It has been estimated that one is exposed to about 150 mrem per year from natural sources and that 5 mrem of this is contributed by fallout.

The pasteurization of fish products by radiation was a major topic discussed at the conference. Kevin G. Shea (U.S. Atomic Energy Commission) said that radiation pasteurization has been shown to extend refrigerated shelf-life of marine products for 30 days or more.

Areas of study pursued by the AEC and the Bureau of Commercial Fisheries in the field of radiation microbiology of marine products include: (i) shifting ecology of the irradiated flora due to variation in irradiation resistance and the unique spoilage patterns resulting; (ii) whether significant numbers of microorganisms which survive are mutants, and what their disease-producing role is, if any; (iii) extent of increase in radioresistance; (iv) synergistic radiolethal effects of food additives (such as nitrates, sodium chloride, antibiotics), concomitant heat, and other agents.

John Dassow (Bureau of Commercial Fisheries) reported that a minimum radiation dose of 0.2 Mrad will give reasonable (two- to fourfold) extension of shelf-life to Pacific crabmeat and flounder fillets at a storage temperature of 0.5°C. He explained that the advantages of using this low

level of irradiation are: (i) it allows the survival of microorganisms capable of producing recognizable evidence of spoilage in the product at the end of its storage life; (ii) bacterial spoilage probably will occur if the product is mishandled in storage or shipping; (iii) bacterial spoilage will occur before degradation from other causes which would affect product odor, flavor, and texture; (iv) the cost of irradiation per pound of product would be kept at a minimum.

Dassow also reported a study of the amount and rate of production of trimethylamine, total volatile bases, and volatile acids in irradiated and unirradiated marine products to evaluate their usefulness as objective indices of product quality. Volatile acids were considered to be the best index of quality. The rate of nucleotide degradation and accumulation of hypoxanthine in three species of fish was studied. It was found that these measurements could be made rapidly and showed a good correlation with fish freshness during the first 8 days of storage.

The economic outlook for radiation-preserved foods was discussed by Anthony A. Bertsch (U.S. Department of Commerce), chairman of the U.S. Interdepartmental Committee on Radiation Preservation of Foods. He reported that products and processes which appear most favorable at this point are: (i) sterilization of ham for domestic and foreign markets and of bacon, pork, and beef for foreign markets; (ii) pasteurization of strawberries, poultry, and seafood products for both domestic and foreign markets; (iii) disinfection of liquid eggs; (iv) disinfestation of wheat and wheat products and pork, especially for foreign markets, and of mangoes for domestic markets; (v) the inhibition of sprouting of potatoes, especially for foreign markets; (vi) improvement in the quality of dehydrated vegetables for both domestic and foreign markets.

Howard Hembree (U.S. Army General Equipment Test Activity) reported that in a series of soldier-consumer preference tests, irradiated and nonirradiated pork products, chicken, beef, and seafood items were fed as part of normal meals. Results in general showed that nonirradiated control foods were preferred over their irradiated counterparts. However, irradiated and nonirradiated pork chops and haddock were equally preferred. The results also showed that radiation doses of 0.25 Mrad will prolong the storage,

at 0.5° to 1.7°C, of haddock for 14 days and shrimp for 7 days, without adversely affecting consumer preference.

W. T. L. Neal (Ministry of Agriculture, Fisheries and Food, Great Britain) indicated that the principal interest of European countries is in the use of radiation to pasteurize foods to eliminate salmonella infection. He indicated that there is a potential in Britain for the application of radiation to the processing of imported frozen eggs, frozen horse meat imported for pet foods, coconuts, meat and fish meals, and chicken.

Lloyd L. Kempe (University of Michigan) reported on the unusual problems in studying Type E botulism in connection with the radiation preservation of foods. Citing studies on the heat resistance of Type E spores, he pointed out an apparent anomaly in the temperature at which they are inactivated. He reported on a study using spore suspensions of the Beluga strain in sealed ampules in which the number of spores was reduced by 5 cycles in 3 minutes at 78°C but survivors remained at 60 minutes. These remaining spores produced Type E toxin upon subculture. Kempe said that this indicates the existence of the so-called "tail" on the heat-survivor curves and that the surviving spores are Type E. Studies to confirm this are continuing.

The conference was sponsored jointly by the National Academy of Sciences–National Research Council, the U.S. Atomic Energy Commission, and the U.S. Army Natick Laboratories. Proceedings of the conference will be published by NAS–NRC.

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Vesalius Commemoration at Brussels

Vesalius was born in 1514 and died in 1564. His activities took him from his native Belgium, through France, Switzerland, Germany, Austria, Italy, Spain, the Holy Land, and the Greek islands. The widespread impact of his work amply justified the international celebration of the fourth centennial of his death which was held in Brussels 19–24 October 1964.

The meeting comprised two programs, one historical and humanistic, and the other concerned with contemporary biology. An elegant facsimile