# AN INTERNATIONAL MILK TEETH RADIATION CENSUS

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WITHOUT expressing here any opinion concerning atomic weapons test programmes, I wish to suggest a scientific study which would at the same time have educational values in its practical demonstration of the peaceful applications of atomic research. The suggestion arises from the belief that any family, regardless of whether or not its country has ambitions in the development of atomic weapons, would be sympathetic to and support an international study involving atomic radiation and ultimately concerned with the health of its own children.

It is generally recognized that young children take up radioactive strontium and cæsium more intensely than adolescents and adults. It is most likely that they also have higher biological radiosensitivity, regardless of whether the dosage results from radioactive strontium, cæsium, iodine, or X-rays. Hence radiation hazards, both those stemming from the peaceful use of atomic power and those having to do with the military use of nuclear energy, must be recognized as being greater during early childhood. Moreover, modern biology has demonstrated the incidence in various human races of certain aberrations, such as defects in reductive metabolism. These considerations, together with the great need for precise knowledge of the biological factors involved, should be stressed to the general public and to all those whose informed participation would be essential to the success of the project to be described.

The official public health agencies of every nation, and especially of the British Commonwealth, China, India, the United States and the U.S.S.R., should organize a large-scale collection of milk teeth (with dates of appearance and shedding, and the child's age in each instance) and conduct measurements of radioactivity on this material. Thousands of countings, performed on a decentralized basis in individual communities and collected on a national basis, would be essential, both to ensure the validity of the results and to assure a widespread sense of active participation on the part of the people of many nations.

Such an International Milk Teeth Radiation Census would contribute important information concerning the amount and kind of radiation received by the most sensitive section of any population, namely, the children. At present, important although rather erratic data exist, based on autopsy of bone samples derived mainly from adults. If a study of a large-scale collection of deciduous teeth were to be initiated in order to confirm and extend these data, it would require an extensive technical organization, adequate equipment, and trained personnel.

Early work by Hevesy, Holst and Krogh[1], Armstrong[2] and Pedersen and Schmidt-Nielsen[3] made it clear that dental enamel takes up phosphorus-32 rapidly during its formation but does not significantly renew itself; dentine renews itself to a detectable degree but much more slowly than bone. Dr. Wallace Armstrong, University of Minnesota, and Dr. S. Kreshover, National Institute of Dental Research, directed my attention to the fact that measurements of radiation from deciduous incisor teeth would reflect the situation as it existed about seven years previously, namely, at birth or shortly before, when the calcified structure of the deciduous teeth is deposited. At present it would seem necessary to pool several deciduous teeth in order to acquire sufficient material.

The proposed milk teeth census is, of course, a long-range programme. If a continued general trend toward a rise in radioactivity in children's teeth were ascertained, it might well have important bearings on national and international policy. The results should be conveyed to the public without interpretations which might give rise to either complacency or fear, but rather in a spirit that would encourage sober, continued, active concern. It should be emphasized that the data would portray the situation as it existed about seven years previous to the study. In spite of this, the fact that these data would give a general estimate of the exposure of newborn children to radioactivity should be stressed.

Measures to keep the radioactivity of teeth and bone structure at low values, especially in young children, should—in accordance with the results of the study—be initiated with full public explanation, emphasizing the limitations of such measures. In connexion with the diet, the increasing use of soybean milk, especially in the Orient, would make it of interest to compare the radioactivity in milk teeth of children reared on soybean milk with that of children drinking cow's milk. The former might be less radioactive because the added calcium stems from rock which represents ancient deposits that have not been in contact with radioactive fall-out. However, the calcium present in the soybean itself may actually exceed that of dairy milk with respect to concentration of strontium-90. An appreciable group of children inhabiting the Pacific islands and Japan derive their calcium intake from fish-bones which might be relatively high in strontium-90, although the dilution factors of the ocean may tend to produce lower values.

It would be most effective if the International Milk Teeth Radiation Census could be carried out simultaneously, or nearly so, throughout the world. The United Nations might be the best agency to handle such a project. It would be particularly impressive if the Western world—which has contributed so greatly to the development of ingenious tools for the peaceful use of atomic energy—took the initiative by offering to make its equipment and technical advice available to any country interested in participation in this project. India, for example, would be uniquely equipped to give impetus to the study in the Orient, both as a direct participant and as a means for contact with China and other countries of the Far East which would have much to contribute.

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In another continent, the Scandinavian countries, and notably Denmark, might be in a position to play a comparable part. Such a concrete demonstration of respect and reverence for life, regardless of creed, colour, or political system, might well contribute to a growing feeling of confidence among nations, and a special confidence in those nations which might elect to give initiative to or participate in a world-wide study of this kind.

It is a pleasure to express my grat Warren Weaver, vice-president of the Foundation, for his kind interest and en and for his valuable advice during the of this article.

[1] Hevesy, G., Holst, J. J., and Krogh, A., *Kgl. Dan. Biol. Medd.*, **13**, 1 (1937).
[2] Armstrong, W. D., "Ann. Review of Biochem.", **21**,
[3] Pedersen, P. O., and Schmidt-Nielsen, B., *Schwei Zahnheilk*, **51**, 647 (1941); *Acta Odontol Scand.*,

# THE INTERNATIONAL SCIENCE HALL AT THE BRUSSELS EXHIBITION

THE exhibition in the International Science Hall at the Brussels Universal and International Exhibition is designed to show the aims, methods, and results of pure scientific research in the fundamental sciences, with a special emphasis on developments since the last World Exhibition was held in New York in 1939. The exhibits are restricted to four main topics of research—the atom, the crystal, the molecule and the living cell—and are arranged in the main body of the hall in four overlapping sections, one for each of these subjects. The growth of science from the earliest times to the present day is illustrated in the entrance hall.

The scope of the exhibition is perhaps best indicated briefly by a list of the headings under which the exhibits are described in the catalogue. In "The Atom" section these are: atoms and nuclei, isotopes, radioactivity, neutrons and fission, nuclear reactors, accelerating machines, elementary particles, cosmic rays, cloud and bubble chambers and nuclear plates, solar energy and thermonuclear reactions. In "The Crystal" section they are: the crystal lattice and lattice defects, the determination of crystal structures, crystal growth, dislocations and diffusion, phase changes, mechanical properties, electrical and magnetic properties, optical properties and crystal surfaces. In "The Molecule" section the main headings are: chemical bonds, molecular energy states, structural properties, techniques of separation (including thermodiffusion and chromatography), catalysis and kinetics, surface phenomena, colloids, radiochemistry, general chemistry and macromolecules. Finally, in "The Living Cell" section, the exhibits are concerned with the chemical constituents of cells, genetics, radiobiology, viruses, bacteriophage and bacteria, protozoa and fungi, photosynthesis and vegetable cells, animal cells and embryology.

The idea of staging an international exhibition of pure science as part of the Brussels Exhibition was due entirely to the Belgians, who have also provided the hall, the essential organization and a large number of the exhibits. Fourteen other countries, Austria, Czechoslovakia, the Federal German Republic, France, Holland, Israel, Italy, Portugal, Spain, Switzerland, the United Kingdom, the U.S.A., the U.S.S.R. and Yugoslavia, have also contributed to it. The overall plans were made by a committee of scientists from all the participating countries under the chairmanship of Prof. Robert van Cauwenberghe, and the exhibits were selected and co-ordinated by four sub-committees with the Belgian scientists, Profs. M. de Hemptinne, W. Dekeyser, G. Smets and P. Bordet, as chairmen respectively for Crystal, Molecule and Living Cell sect individual exhibits, of which there are hundred, have been devised by leading the contributing countries, generally assistance of professional designers.

One of the principal objects of the orga show that pure scientific research is a national activity. A great deal has been fore, to avoid attracting attention to th nationalities of the contributors and to the aims and methods they have in com exhibits are arranged strictly accordin scientific content without regard for their origin; they are more or less uniform in the names and countries of the scientists for them are displayed for the most part in trusive manner. Naturally enough, the e not all conform exactly to the recommende pattern, but there is certainly enough uniformity of design for the organizers' main realized, and the few exhibits that are different add a necessary touch of variety to

It is hoped that all sections of the public and profit by this exhibition, and exhibits h fore been provided both for laymen and for s In addition, the Belgians have made a spe ductory film in which most of the concepts for an understanding of the exhibits are intr simple terms for the benefit of visiting non- This film is shown at regular intervals durin in a special cinema inside the hall, every seat is equipped with ear-phones on which commentary can be heard in any one of languages, French, Flemish, English, Ger Spanish. There are two smaller cinemas programmes of the best scientific films ma the contributing countries are shown.

The exhibits in the hall are of three ma Those of the first kind are intended to supple film in introducing the fundamental id principal experimental techniques of modern to visitors with little or no scientific training exhibits include, for example, atomic models, tory models of instruments such as the cyc demonstration of diffraction phenomena a use in crystal structure analysis, an explan chemical bonding and an account of the M laws of heredity vividly illustrated in a coll birds and animals. The exhibits of the seco are historical and show by means of origin ments and models and replicas of famous ap the development of important experiment