

## Editorial

### Low dose ionising radiation and cancer

Today's society is concerned about the dangers of ionising radiation, especially in the aftermath of Chernobyl. On the other hand, there exists a widespread lack of understanding radiation biology and radioepidemiology – the very sciences which provide the data from which today's risk estimates have been derived. The papers in this issue of the Journal were presented at a workshop on "Low level radiation and cancer: data and methods" held on 10th–11th December 1990 in Feusisberg, near Zurich. The meeting was organised by the Institute of Social and Preventive Medicine of the University of Zurich under the auspices of the Swiss Federal Office of Public Health. Its aims were threefold. First, to give an introduction to some basic facts and methodological issues in radiation physics, biology and epidemiology. Secondly, to give an overview of the availability of data for radioepidemiological research in Switzerland and, thirdly, to evaluate possible research strategies in this country.

A list of some notions and units commonly used in the radiation sciences serves as an introduction to the field (G. Schüler et al.). In using units and notions it is important to distinguish the description of biological experiments and epidemiological observations from definitions and risk projections proposed by international reports and consensus bodies for radioprotection purposes.

The next papers deal more specifically with selected aspects of the basic sciences. Dosimetry means quantifying the physical effects of ionizing radiation in human tissue; this is not a straightforward procedure (I. Cordt). The foundations of general radiation biology are succinctly summarised by C. Michel. An account of our present knowledge and theories of radiation carcinogenesis is provided by W. Burkart. W. Lutz compares dose-response models of chemical carcinogenesis with those used in radiation carcinogenesis.

During the last decade the epidemiological foundations of radioprotection have changed considerably. Longer follow-up studies have become available from the atomic bomb survivors and from other cohorts. A new dosimetry system (DS 86) has been introduced for Hiroshima and Nagasaki. Exposure to domestic radon has become a major focus of interest. Not only the data, but also the methods of analysis and modeling of risks have evolved, as shown by the recent reports of national and international scientific committees.

Today's risk estimates are 3–4 times higher than those of ten years ago. S. Darby explained at Feusisberg how to derive such estimates from the available data; according to her, 5–6% of total cancer mortality in the U.S. may be attributed to ionising radiation of natural origin. (Her paper is being published elsewhere, see reference 1). Major uncertainties remain; estimates depend crucially on the assumptions inherent in the extrapolations to the low dose range and the ways of projecting risk beyond the empirical data base (C. Muirhead).

Modeling risk is also a highly debated issue in the interpretation of the data on lung cancer in miners and exposure to radon-daughters (W. Burkart); the question of how to extrapolate to the risk of domestic radon is far from being solved. The epidemiology of thyroid cancer (L. Holm) poses another problem, i.e. the comparability of doses from different radiation types; incorporated iodine-131 has been shown to be less efficient in humans than external radiation in inducing thyroid cancer.

The next two papers give some guidelines for the practice of epidemiology. The difficult question of how to proceed with a presumed cluster is dealt with by M. Gardner, taking his study on childhood leukemia in Sellafield as an example. Study designs in radioepidemiology and problems of achieving comparable dosimetric information were discussed with special reference to the planned international study of IARC on nuclear workers (E. Cardis).

IARC is also coordinating the European registry-based study on the frequency of childhood leukemia before and in the aftermath of Chernobyl. The six cancer registries of Switzerland are participating in this study (L. Raymond). This leads us to the last topics, namely the availability of data for radioepidemiological research in Switzerland and future research strategies.

Radon is the most conspicuous source of ionising radiation from the natural environment, with a wide range of measured domestic radon concentrations (H. Loosli). Loosli is rather skeptical about the feasibility of epidemiologic research on domestic radon and lung cancer in Switzerland. As for artificial radionuclides, yearly measurements in young people in Geneva have shown that the values of incorporated Caesium-137 have returned to practically unmeasurably low levels after a transient increase following the accident of Chernobyl (A. Donath).

As for occupational exposures, the new Swiss National Central Dose Registry will considerably improve the availability of dosimetric information from occupational exposures (M. Moser). It is primarily intended for occupational monitoring and radioprotection, and not for epidemiological purposes. Former doses and doses from retired workers are only partially covered. Another potential source of information in Switzerland is the Swiss National Accident Insurance Fund (SUVA, Schweizerische Unfallversicherungsanstalt), which is legally responsible for medical prophylaxis for all workers. U. Weickhardt from the Division of Occupational Health spoke about the medical radiation prophylaxis programme of the SUVA. The examinations are required by law, and are quite comprehensive. Workers are only examined as long as they stay exposed to radiation. Results are stored until the workers have reached age 70. Neither the SNDR nor the SUVA make a systematic follow-up of retired workers and of those who have left their jobs, nor do they document the address(es) of the workers in their central files.

This leads to our primary question: How can Switzerland contribute to radioepidemiological research? The working group commissioned by the Swiss Federal Office of Public Health, which initiated the meeting at Feusisberg, has extensively discussed the conclusions to be drawn from the workshop. Its recommendations are given in the German and French versions of the editorial.

The general intent of these recommendations may be summarised as follows. Radioepidemiological research in Switzerland would not have to begin from point zero. The data collected by the SNDR and the SUVA, although incomplete, could be used as a starting frame for epidemiologic studies. But it is also evident that more data are needed, especially a systematic follow-up of workers, with ascertainment of date and cause of death. Legal infrastructures should achieve compatibility with the requirements of data protection regulations.

International cooperation on both the practical and the theoretical level is essential for the future of radioepidemiology in our country. Switzerland is in need of more experts knowledgeable about the facts and methods of radioepidemiology. The practice of radioprotection should be guided by knowledge of its epidemiological and theoretical foundations. Finally, such expertise is strongly needed in view of the fact that the dangers of ionising radiation are a subject of constant public concern and controversy.

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#### Reference

- 1 *Darby SC*. The Contribution of natural ionizing radiation to cancer mortality in the US. In: Brugge J, Curran T, Harlow E, McComick F, eds. *The Origins of Human Cancer*. New York: Cold Spring Harbor Laboratory Press, 1991.