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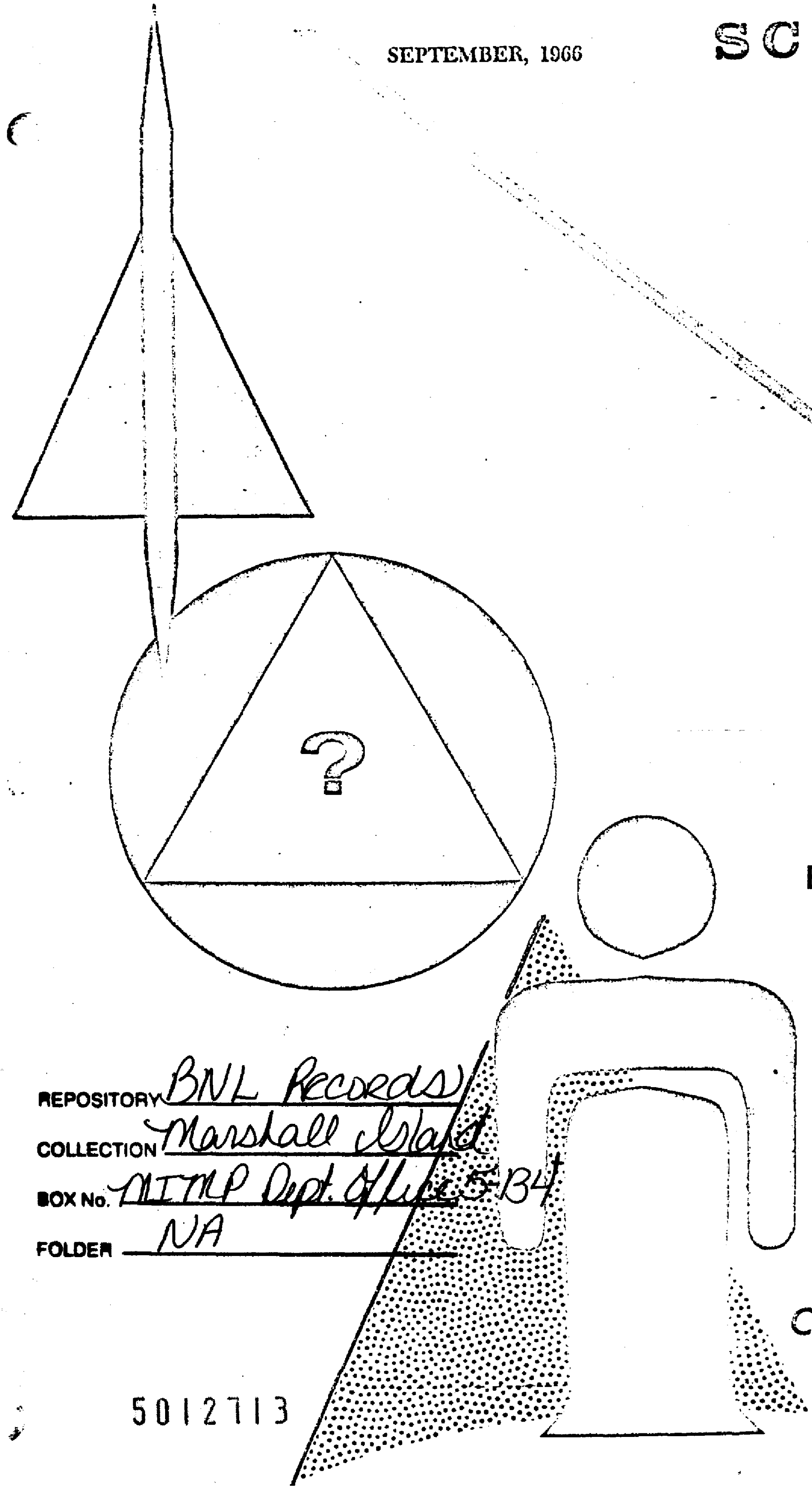

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Comment and Controversy

How much irradiation did children receive from atomic testing in the fifties? What were the effects of this irradiation?

The discussion in the following pages of "Thyroid Irradiation in Utah Infants Exposed to Iodine 131" by Charles Mays, which appeared in our last issue, centers around these two questions and the problems involved in trying to answer them.

Obviously, it is desirable to find and treat any malignancies that might develop in any of these children. It is also important to find answers to the questions because of the light this could throw on the more general questions: How much iodine 131 produces thyroid damage of any kind? Thyroid cancer? In what proportion of exposed children? These questions are important, not only for past exposure, but for the evalution of possible future exposure from underground testing, atmospheric testing by other nations, Plowshare projects (nuclear explosions for peaceful purposes) or from reactor accidents.

How much?

A recent paper from the Lawrence Radiation Laboratory (reviewed on page 4) presents new estimates of the size of the dose and the number of children exposed; estimates which underscore the need for expanding the search for radiation effects. A procedure for checking these estimates, proposed in the Appendix to Dr. Mays' article last month, would use the long-lived iodine 129 as an indicator of the amount of iodine 131 originally present. This proposal is discussed further by Dr. Tamplin on page 3.

The question has been asked: If iodine 129 has a half-life of millions of years, why aren't we concerned about its biological effects? Doesn't it do more damage than the short-lived iodine 131? The answer is "No." Because it decays slowly, iodine 129 gives off much less radioactivity in a given amount of time than does iodine 131. Also, although it takes about seventeen million years for half the radioactivity of iodine 129 to decay (a physical half-life of 17,250,000 years), it is excreted from the body fast enough to make its *biological* half-life (the time it takes for half of it to disappear from the body) only about three months.

In pathological tissue from autopsy, the excretory process would have ceased with death. Because there is a known ratio of iodine 131 to iodine 129 at the time they are created in a nuclear explosion, the iodine 129 still present in the tissue can give a clue to the amount of iodine 131 that was formerly present. This is not unlike the use of another long-lived isotope—carbon 14—as an indicator of the age of archeological findings.

Tissue preserved after autopsies performed on people who died shortly after nuclear tests in the fifties could therefore be tested for iodine 129. This would tell us how much iodine 131 was in the same thyroids prior to death, and the approximate level of iodine 131 exposure to others still living, who were subject to fallout in the same locality in the same year. Autopsy tissue is probably available in Salt Lake City, if not in the smaller towns (CNI has not checked with Salt Lake hospitals, but such tissue would be available in St. Louis, and presumably also in other metropolitan medical centers). Such a study would not have to cover the whole geographical area of high exposure in order to serve as a check on estimates—such as those of Tamplin and Fisher — based on external radiation measurements.

What effects?

Dr. Conard, who has been studying the Marshall Islanders exposed to fallout from the Bikini test of March 1, 1954, summarizes the thyroid abnormalities found in these people (page 1). With one exception, all the abnormalities found have been in the group exposed to 700 or more rads of radiation from iodine 131. The children exposed to the lesser doses, and showing no abnormalities are too few in number, as Conard points out, to establish a threshold dose (a dose below which no abnormalities would be produced). They are also too few to draw conclusions from the Marshall Island experience that are applicable to the Utah-Nevada experience.

Six children in the Marshall Islands were exposed to 300-600 rads. On the basis of the assumption used by Mays (35 cancers per million children exposed to one rad of x-rays), one would expect only one case of thyroid cancer per hundred children exposed to 300 rads, or one case per 50 children exposed to 600 rads. If iodine 131 is one-tenth as effective as x-rays in producing thyroid damage, one case of thyroid cancer per thousand children exposed to 300 rads would be expected, or one case in 500 children exposed to 600 rads. It is therefore not surprising that no cancer has been found in the six children exposed to doses in this range.

Forty children were exposed to 55-125 rads. In this exposure range, one would expect a maximum of one case of thyroid cancer per 230 children; a minimum of one case in five thousand children.

Not unless many more children in the Marshall Islands had been exposed to iodine 131 fallout would the absence of cancer or other thyroid abnormalities there suggest that cancer or other thyroid abnormalities would be unlikely in the Utah children.

The comments from Dr. Wolff of the Radiological Health Department of the U.S. Public Health Service (p. 2) describe what is currently being done and what is planned in the search for pathological effects. The small expansion of the present field study in southern Utah and the collection and analysis of Utah and Nevada records of thyroid surgery are both useful steps. Whether "extensive epidemiologic studies" should be designed on the basis of Dr. Mays' dosimetry is questioned by Dr. Wolff because the present field study is difficult and costly, with "no characteristic clinical picture that can be reliably screened out of a 'well' population without recourse to intensive study."

The problem is certainly a unique, complex and difficult one, but it is of such importance that neither difficulty nor cost should be allowed to stand in the way of expanded and, if necessary, intensive studies.

Dr. Wolff does not comment on the possibility of improving the dosimetry. If this could be done and small areas of high dosage identified, the intensive studies might first be concentrated in those areas.

In looking for thyroid damage within the "well" population, new and unorthodox methods may have to be tried; new screening procedures sought. If the questions now being asked are not yielding the answers, other questions may have to be asked; other studies designed. This is a challenge, not only to the Public Health Service, but to all members of the scientific community who have an interest in the problem and a competence in one of the related disciplines.

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The studies of the Utah children proposed by Dr. Mays are worthy of consideration. However, the task of reconstructing the thyroid doses in this population due to fallout from detonation of different nuclear devices over the past years would appear to be extremely difficult, if not impossible. Also the logistics of instituting retrospective and prospective studies in this population of children are formidable. The diagnosis of radiation-induced thyroid lesions would be extremely difficult to separate from thyroiditis and other prevalent thyroid conditions in this population without careful pathologic and other studies. The Salt Lake City population of children is quite large for the thorough studies that would be necessary. Perhaps concentration of efforts on the more heavily exposed Washington County children would result in more meaningful information.

In our studies in the Marshall Island people exposed to fallout in 1954, twelve years ago, we have noted over the past few years the development of thyroid abnormalities in fifteen of nineteen children exposed at less than ten years of age (thirteen with benign thyroid nodules and two with hypothyroidism).[1] One adult developed cancer of the thyroid. It should be pointed out that the incidence of thyroid disease is quite low in the Marshall Islands. Although dose estimates are not precise, it was calculated that the thyroid glands of the young Marshallese children received in the range of 700-1400 rads from radioiodines internally absorbed and in addition 175 rads from gamma radiation (similar to x-rays). These doses are considerably higher than those received by the Utah children. More pertinent is the absence thus far of any thyroid abnormalities in 40 other Marshallese children, on a different island, exposed in the same age range, who received an estimated 55-125 rads to their thyroid glands, and also lack of thyroid abnormalities in six children, on still another island, that received an estimated 300-600 rads to their glands. These doses are probably also higher than those received by the Utah children. Therefore, based on the Marshallese experience, it does not seem likely that an easily detectable increase in thyroid abnormalities will be found in the Utah children. However, it should be pointed out that the number of exposed Marshallese children is too small to establish a low or threshold dose of induction of thyroid abnormalities. If thyroid dosimetry proves satisfactory and thyroid studies could be effectively pursued in the Utah children, the data collected, even if of a negative nature, would be valuable.

REFERENCE

1. R. A. Conard, J. E. Rall, and W. W. Sutow: Thyroid nodules as a late sequela of radioactive fallout in a Marshall Island population exposed in 1954. New England Journal of Medicine 274: 1392-1399, June 23, 1966.

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Dr. Mays has covered the problems relative to reassessing the hazard to children in the Utah area admirably, and my comments will be concerned with the ecological factors that have to date not been taken