spheres. M. Reiner has obtained the Kelvin and Poynting effects in fluid flow by retaining the second order terms in the stress-strain velocity relations. R. S. Rivlin showed that for incompressible bodies very general forms of the strain energy function can be successfully used. He has also obtained some exact solutions of the general equations for incompressible bodies.

BIOLOGICAL HAZARDS FROM A- AND H-BOMBS

IN the course of his Presidential Address* to the Pacific Division of the A.A.A.S, Prof. A. H. Sturtevant of the California Institute of Technology referred to the two possible types of damage through irradiation from the A- and H-Bombs: damage to the exposed individual and damage to the genes in his germ cells.

The first will be more or less immediate in its manifestation whereas the latter will have detectable effects only in future generations. This, however, is not the most basic distinction. Irradiation has a gross effect on tissues, resulting in the burns and other symptoms recognized as direct effects of heavy dosages; there is also an effect on the genes, leading to mutations.

The former, tissue effect, appears to be substantially absent at low doses, recovery from moderate effects is possible, and doses spaced well apart in time have little or no cumulative effects. It is on the basis of these effects that the "permissible" dose, to which it is supposedly safe to expose individuals, is calculated. But there is reason to suppose that gene mutations, induced in an exposed individual, also constitute a hazard to that individual—especially in an increase in the probability of the development of malignant growths, perhaps years after the exposure. There is, in fact, no clearly safe dosage—all high-energy radiation, even of low intensity and brief duration, must be considered as potentially dangerous to the exposed individual.

Let us now turn to the effects of irradiation on the genes of exposed individuals. Here again we are handicapped by the special difficulties of dealing with the genetics of man, for the quantitative determination of the genetic effects of irradiation requires much more refined techniques than are possible with man—a point that becomes obvious when one tries to evaluate the data available concerning the survivors of the Hiroshima bomb. There is sufficient evidence that quantitative results obtained with one organism cannot safely be applied to a wholly different kind of organism. However, there are certain general qualitative results that have now been so widely confirmed that we may confidently assert that they apply to all higher organisms, including man. These results are:

(*i*) High-energy irradiation produces mutations.

(*ii*) The frequency of induced mutations is directly proportional to the dosage of irradiation. There is almost certainly no threshold value below which irradiation is ineffective.

(*iii*) The effects of successive exposures are cumulative.

(*iv*) The effects are permanent in the descendants of the affected genes. There is no recovery.

(*v*) The overwhelming majority of these mutations is deleterious—that is, they seriously affect the efficiency of individuals in later generations in which they come to expression. These deleterious genetic effects may lead to early death or to any of a wide variety of defects, often gross ones.

There is a store of such undesirable genes already present in any population. What irradiation does is to add to this store.

* "Social Implications of the Genetics of Man", reported in *Science*, 1954, **120**, 405.

PROFESSOR M. OLIPHANT TO VISIT INDIA

PROFESSOR M. OLIPHANT, Director, Physical Laboratories, Australian National University, Canberra and President, Australian Academy of Sciences, will be visiting India during the months of March-April 1955, during the course of which he will deliver the Rutherford Memorial Lecture, at a few centres in India. The lecture at Madras will be delivered under the auspices of the Department of Physics, University of Madras, at the Senate Hall on 26th March 1955.