disease, the bacilli afterwards losing their infectivity for the rat with adaptation to the human tissues.

Work on biological standards, under the direction of Dr. Hartley, is also conducted at the National Institute, and various standards already established are maintained there. A British standard for a gas-gangrene antitoxin (*histolyticus*) has now been made available, and the British standard for diphtheria antitoxin has been placed on regular issue. Much work has also been done on the standardization of tuberculin, various other antitoxins, vitamins and insulin. The work of producing, standardizing and distributing bacterial

suspensions and sera for diagnostic purposes has been continued at the Standards Laboratory, Oxford.

The work of clinical research units, of external staffs, wholly or partly financed by the Council, and of individual research workers receiving grants, are summarized in the report, and many valuable contributions have been made to medical knowledge.

It is the intention to move the National Institute at Hampstead to Mill Hill, in association with the Farm Laboratories there, but this has been delayed by the war emergency. Some of the ancillary buildings are, however, ready for occupation, and the shell of the main building is nearing completion.

OBITUARIES

Prof. J. H. Michell, F.R.S.

THE death on February 3 of Prof. J. H. Michell, at the age of seventy-six, is a severe loss to Australia, and the great value of his work both as mathematician and teacher cannot be easily overestimated. His modesty was such that proper appreciation of his real worth was often confined to the fortunate few who were in close contact with him, either through his undergraduate lectures or some research problem.

After an early education in Melbourne, Michell proceeded to Cambridge, where his performance at the Mathematical Tripos and afterwards led to his early election as a fellow of Trinity College. Here he devoted himself to research in elasticity and hydrodynamics, and a remarkable number of important papers in both subjects resulted. He was largely responsible for the introduction of stress equations of equilibrium of an elastic solid which did not involve explicit introduction of the displacement-equations and provided a formal solution of the equations for an isotropic solid with a plane face under given surface tractions. The important theory of that type of deformation known as dislocation was first developed by Michell and he was also one of the first to make use of inversion in solving problems of plane strain and the bending of plates. His work in elasticity included very valuable discussions of the general theory of bending of beams and plates under various loads, besides the detailed solution of a number of special problems such as the elastic equilibrium of conical bodies, the calculation of strains due to concentrated loads, the deformation of naturally curved rods, etc. On the dynamical side of the subject Michell was responsible for the theory of the vibrations of a helical rod and of a circular ring. Perhaps his most interesting contribution to hydrodynamics is the theory of the 'highest' wave in water, but he also published work on discontinuous fluid motion and on wave resistance to ships.

As a just recognition of this excellent work, Michell was elected a fellow of the Royal Society in 1902. A few years later he was appointed lecturer in mathematics in the University of Melbourne and began a long career of devotion to the teaching of the subject. In 1923 he was appointed professor of mathematics and his influence became still more pronounced. To his honours students, among whom I had the privilege to be numbered, Michell was the very personification of mathematical erudition. An hour's lecture by him was an intellectual treat and a whole course of lectures something to look forward to with keen anticipation.

Michell was a great exponent of vector methods and was remarkably facile in their manipulation. He was undoubtedly one of the few mathematicians of his time who really thought in terms of vectors, and he was at pains to educate his students also to think in this way, which is, after all, the natural one for mathematical physics. His influence in spreading a proper appreciation of vector methods represents alone a very important contribution to applied mathematics.

When Michell retired from his chair in 1928 his valuable services were partly retained as honorary research professor. Despite the heavy calls on his time from his academic duties, Michell kept well abreast of all developments in his special subjects and gave several courses of lectures on modern hydrodynamics after his retirement. In 1937 he also published, with his colleague, Mr. M. H. Belz, a treatise on the elements of analysis which is an excellent illustration of the combination of vigour and clarity which characterized his approach to all mathematical problems.

Prof. Michell's modesty and good nature, combined with his remarkable intellectual qualities and willingness to assist in the smoothing-out of difficulties, however trivial, endeared him to his students, all of whom will remember him with affection and admiration.

H. S. W. MASSEY.