University of Adelaide

WAITE AGRICULTURAL RESEARCH INSTITUTE

FOUNDED 1924

BIENNIAL REPORT 1976-77

The University of Adelaide

BIENNIAL
REPORT

of the

WAITE AGRICULTURAL RESEARCH INSTITUTE

SOUTH AUSTRALIA

1976 - 1977

This book wholly processed in South Australia –

Typesetting and Artwork by:
Deverson Typesetters Pty. Limited
19 Kauri Road, Hawthorndene, S.A. 5051

Printed by: L.P.H., Adelaide.

For: Waite Agricultural Research Institute,
The University of Adelaide,
Glen Osmond,
South Australia 5064.

Cover:

View of the Waite Institute from the north-west showing the Ranson Mortlock Wing (1937), John Darling Wing (1930), John Melrose Wing (1928) and the South Wing (1947).

Inset: Urrbrae House, the home of Peter Waite built in 1891 – reputed to have the first tiled roof, electricity and refrigeration in South Australia. Urrbrae House is classified by the National Trust.

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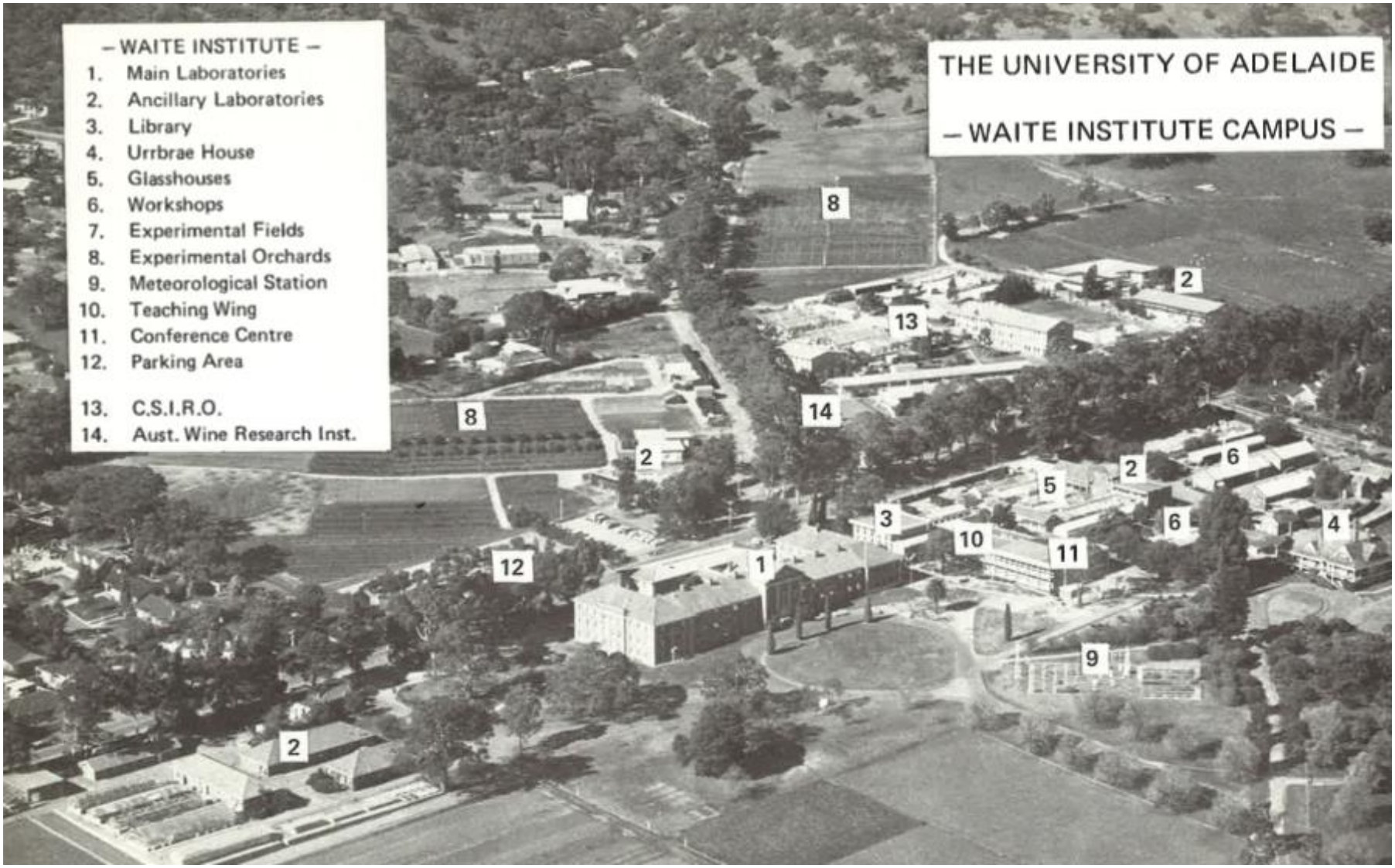
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EARLY WORK ON PLANT VIRUSES BY DR. R. J. BEST AT THE WAITE AGRICULTURAL RESEARCH INSTITUTE

R.I.B. Francki
Department of Plant Pathology

It is seldom that new concepts in science result from the work of one or a small group of researchers and even if an individual does crystallise a new idea, usually it had been nurtured by the results of work from other laboratories. Concepts about viruses assumed new dimensions in the mid 1930s following the isolation of tobacco mosaic virus (TMV) in pure form for which the Nobel Prize was later awarded to Wendell M. Stanley. It is now amply clear that numerous other researchers contributed to the changing ideas about viruses at that time and that some very significant work was done at the then recently established Waite Agricultural Research Institute by Rupert J. Best.

At the turn of the century, it had become clear that TMV differs fundamentally from bacterial pathogens. Although as early as 1892, Ivanovskii in Russia observed that TMV could pass through a bacterial filter (1), he seemed unimpressed by the discovery and it remained for Beijerinck six years later in Holland (2), to repeat the experiment and draw attention to its significance. The nature of viruses was the subject of much speculation during the four decades that followed. Even after TMV was isolated in pure form, erroneous conclusions were drawn by Stanley who wrote the following as the last sentence of his now classical paper (3) 'Tobacco-mosaic virus is regarded as an autocatalytic protein which, for the present, may be assumed to require the presence of living cells for multiplication'; a notion which took nearly two decades to dispel completely. Stanley (4) failed to detect any phosphorous in his preparations of TMV, an error which had to be corrected independently by the Rothamsted-Cambridge group (5) and by Best in Australia (6). Although both groups confirmed the observations by Stanley (3, 4) that TMV preparations contained mainly protein, they both avoided the conclusion that TMV was a protein. Soon after the appearance of Stanley's papers (3, 4) expounding the protein nature of the virus, Best (7) wrote 'The virus of tobacco mosaic virus may best be regarded as a protein complex with a prosthetic group or groups, these latter being inactivated in weakly alkaline solutions to a definite extent, the magnitude of which is a function of the hydroxylion concentration.' This statement was made only a few weeks before the submission of a paper by Bawden *et al.* (5) in which RNA was identified in TMV preparations; however, no comment was made as to its possible significance. In a subsequent letter to Nature published a few months later, Best (6) wrote 'There is evidence to associate the acid prosthetic groups deduced by me (ref. 7) on the basis of the pH activity curve for this virus, with the nucleic acid demonstrated by Bawden and Pirie.' Thus the foundations were laid for the most significant change to the concept of plant viruses as being 'nucleoproteins' rather than 'autocatalytic proteins' and it is significant to note that as early as 1937, Best (6) entitled his paper to Nature 'Artificially prepared paracrystalline fibres of tobacco mosaic virus nucleoprotein'. However, the misconception about the importance of the protein for biological activity of viruses was not completely rejected for the best part of two decades, until the classic experiments of Fraenkel-Conrat on the reconstitution of TMV

(8) and those of Gierer and Schramm demonstrating that deproteinised TMV-RNA was infectious (9); work which led to our present concept of simple RNA viruses having an RNA genome surrounded by a protective coat of protein.

When considering the work of Best during the 1930s, there seems little doubt that it contributed very significantly to the development of modern concepts of the nature of viruses. His achievements are all the more praiseworthy as they were made by a lone worker in a very isolated academic climate at a time when communication between researchers was far from that which is taken for granted today. Best was a trained chemist, whose interest in viruses resulted from an invitation by Samuel in 1933 to join him and Bald to collaborate in investigating tomato spotted wilt virus (TSWV); a project which they had been working on at the Institute since 1926. Although the collaboration was fruitful, resulting in the publication of three significant papers (10 - 12), it lasted for only a few months, after which both Bald and Samuel left for England. Thus, having been barely introduced to viruses, Best remained to work alone, yet by the end of 1937, twelve papers on TMV and TSWV had appeared in the literature under his sole authorship (13, 14). Several of these publications must now be considered as classics which helped to mould the early concepts regarding the nature of viruses; concepts from which emerged a new discipline which we now call Virology.

Rupert J. Best (right) and Geoffrey Samuel (left) at work during their brief period of collaboration at the Waite Institute in January 1934.

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