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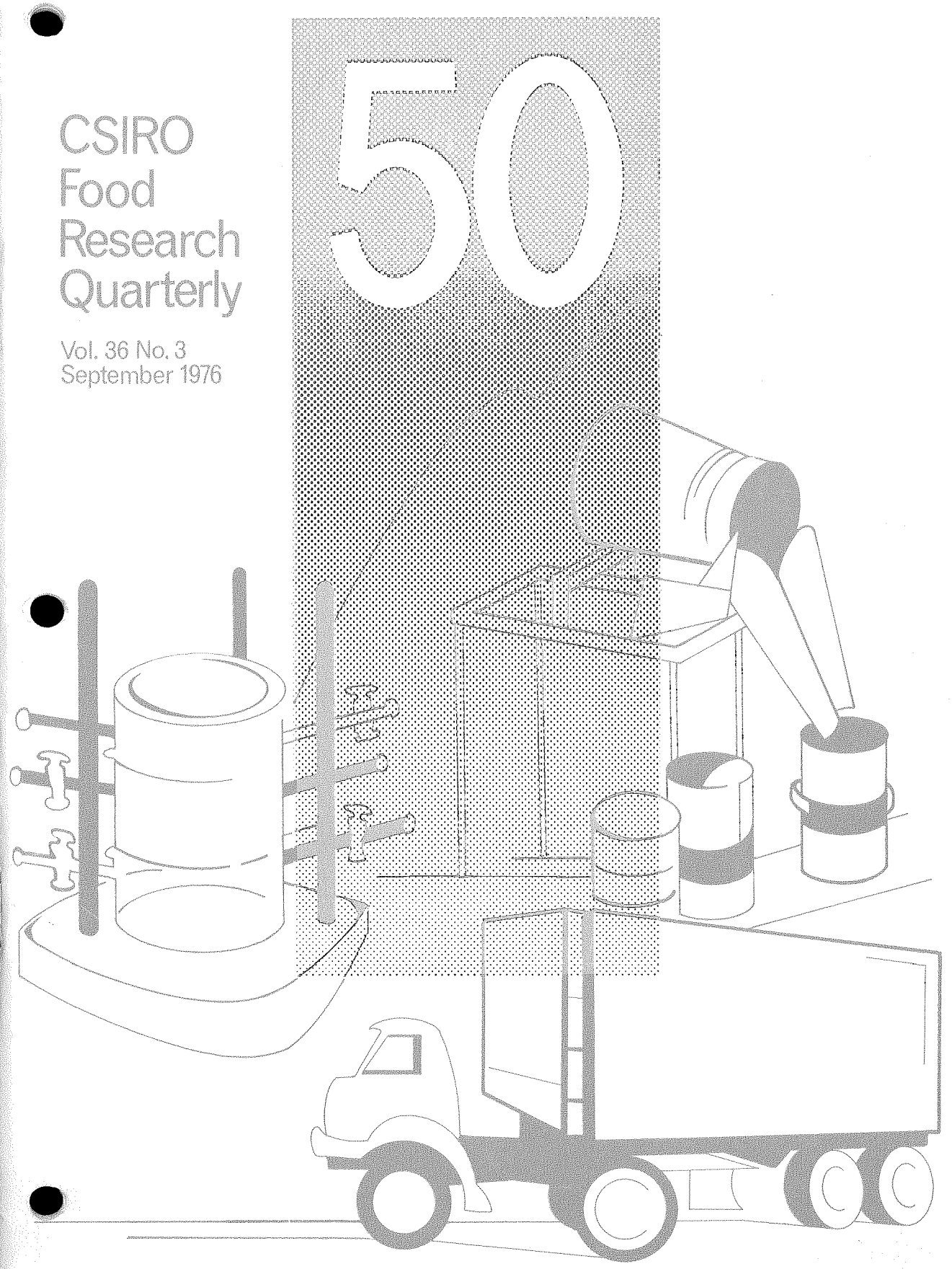

Fifty years of food research. Part I

By Josephine M. Bastian

CSIRO Food Research Quarterly, Jubilee Issue

Division of Food Research
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Responsibility for opinions and for the accuracy of facts presented in the book is mine and I will welcome comment and criticism from readers.

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Fifty years of food research. Part I

By Josephine M. Bastian

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The year 1976 marks the Jubilee of CSIRO's work in food research. This account traces the story of the Division of Food Research from its origin in a few isolated investigations designed to help the export industry and follows its development, through the Divisions of Food Preservation and Dairy Research, into one of CSIRO's largest sections and the main centre in Australia for research on problems of food science and technology.

Introduction

On 14 April 1926, at its second meeting, the Executive of the Council for Scientific and Industrial Research (CSIR, later CSIRO) drew up a list of its priorities in research:

> '*Concentration of Effort.* It was decided provisionally that the field of work should initially be limited to investigations in the following fields:
> (a) Plant pests and diseases;
> (b) Animal pests and diseases;
> (c) Fuel investigations;
> (d) Food investigations, especially cold storage; and
> (e) Forest products investigations' (*CSIR, Mins Exec. Comm.* 1926).

Problems of dairying were also considered for immediate attention but the Executive decided first to arrange for a report on the industry.

Three months later, on 17 July 1926, Dr A. C. D. Rivett, Chief Executive Officer of CSIR, was able to inform Sir Frank Heath, his opposite number in the British Department of Scientific and Industrial Research, that the first group of CSIR research students for advanced training had been chosen. One of the three selected was Mr J. R. Vickery, M.Sc., holder of an Exhibition of 1851 Scholarship: would Heath make arrangements, Rivett requested, for Vickery to carry on his research work in England.

That the newly appointed Executive was able to proceed with such assurance was, in the case of food research at least, the direct result of more than a decade of inquiry into and clarification of the ills of the Australian food industry, and of a much longer period during which the necessity for research on a national scale had become increasingly obvious.

Chapter 1. Before CSIR

Beginnings of a food export trade

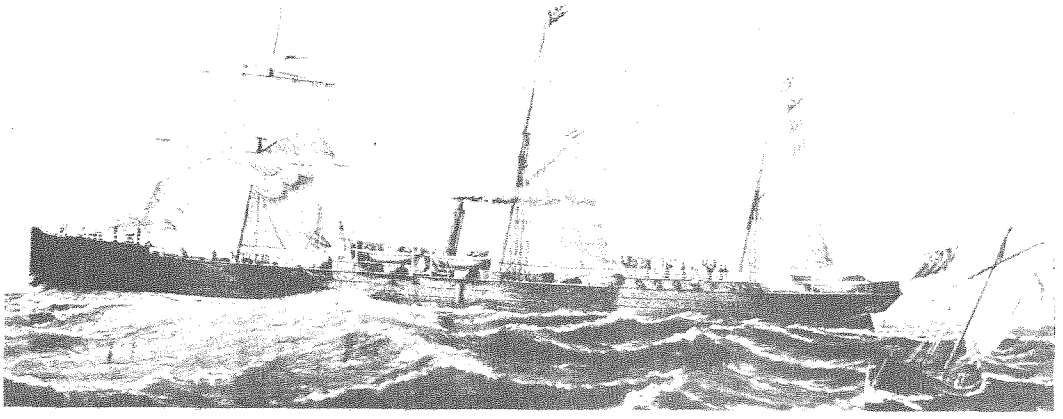
Within 60 years of being colonized, Australia in a flush season was producing more of some foods, in particular more meat, than her small population could be induced to eat. By 1850 there were 1·7 million cattle in this country, 13 million sheep and only 0·405 million people. Ways had to be found of preserving surplus food for year-round use or else—happy inspiration—of exporting it to Britain, in part payment for the products of secondary industry that Australia needed in abundance from 'The Mother Country'. As an English settler of the period expressed it, 'I believe there are in Australia very many millions of acres that will perhaps never be useful for anything but growing timber and feeding cattle; and that there are corresponding millions of ill-fed stomachs among our own countrymen at home craving for the fresh carcasses of such cattle' (Bleasdale 1873).

The first beef to be exported from Australia was 'tinned' beef, in 1847, and the first customers were captains of American men-of-war and American whalers. By the late 1860s a regular trade with Britain had been established in canned meats.* That decade also saw the first attempts to export food in more perishable form; a trial shipment of butter was sent to England in 1865 and shipments of fruit and frozen meat in 1873; in 1894 the first, unsuccessful, attempt was made to send beef to England chilled, rather than hard-frozen. These practical experiments had little to go on, in the way of basic scientific information concerning the storage requirements of the products, and they ended all too often in complete failure.

Since early in the nineteenth century the individual colonies of Australia had been exporting commodities to one another: New South Wales sent butter and cheese to Victoria and Tasmania; Tasmania sent jam and berry fruits to Victoria. The customary use of the term 'export' for this trade was quite correct, in view of the independent status of the colonies, but its incongruous ring brings home the fact that even in local trading, long journeys and harsh transitions in climate were hazards Australian food growers and processors had to face.

Such a situation discouraged complacency, and the enterprise of individual Australians made possible early progress in the techniques of refrigerating and drying foodstuffs. Indeed, one of the greatest Australian contributions to food technology was made by James Harrison in the 1850s; Harrison held the first British patent for 'Production of Cold by Evaporation of Volatile Liquids in Vacuo' (1856), and he developed general principles for a

*The first *food* to be exported from Australia to another country was probably the shipment of flour that New South Wales sent to the Cape of Good Hope in 1819; it arrived in good condition but failed to fetch an economic price.



S.S. *Strathleven*, which in 1879 carried the first successful shipment of frozen meat and butter from Australia to England.

refrigeration compressor that have virtually remained unchanged to this day.

Full development of the techniques of refrigeration towards the end of the nineteenth century made possible an enormous expansion of the export trade in perishable foods. By 1926, when CSIR was formed, Australia was exporting to Britain frozen meat to an average value of $11 million a year, butter to the value of $12 million and fresh fruit, mainly apples, to the value of $1·2 million; food came second in importance, after wool, in Australia's total export trade of $123 million annually. (Throughout this text, pounds have been converted to dollars by the simple reckoning £A1 = $A2.) Some idea of the importance to Britain of the refrigerated shipping trade may be gained from the fact that by the 1920s 80% of the fresh meat eaten in London was imported, mainly from Argentina and Australasia, and London was the greatest overseas meat market in the world. The vital role that cold storage could play in the life of a nation had become clear to Britain during World War I, when she provided imported frozen meat for all allied troops fighting in continental Europe and when she herself was heavily dependent on imported perishable foods held in the public cold stores.

Nevertheless, there is something quixotic about conducting a trade in perishable commodities with an important customer—almost one's sole customer—who is 50 days' journey away and who has many better-placed trading partners. Australia's early jubilation and optimism dwindled before the massive problems that, by early in this century, were seen to confront the export food industry. The fruit trade was the worst hit. There was gross wastage in pome and citrus cargoes; occasionally whole shipments of apples were lost through the development of brown-heart and bitter pit, whether through the fault of the growers or of the shippers no one knew; soft fruits such as plums and grapes, which were often in glut supply in Australia, would have commanded a ready market in England but could not be exported unless better methods of storage were developed. Consignments of butter which Australian State Government graders labelled 'Choicest' before leaving Australia were consistently downgraded by English examiners, leaving the States with the dilemma of either disbelieving their own graders or recognizing that the butter had deteriorated during shipment.

The meat export trade was potentially more valuable than any other, but only if Australia could break into the market for chilled beef which had been dominated since the turn of the century by South America. Although a great advance over the original canned product, frozen meat, on thawing, produced an unattractive drip, and this single difference from chilled meat meant a discrepancy in price of from one cent to 10 cents per kilo. There was much speculation about the cause of the drip, how it could be avoided, what difference it made anyway; but the discrepancy in price remained and cost Australia many thousands of dollars yearly. Experiment in ways of sending chilled meat to Britain had never been abandoned, but it had proved impossible to establish a permanent trade because of the high risk of bacterial slimes and moulds growing on the meat during the 6- to 8-week journey.

Need for research on a national scale

By the time of Federation in 1901 the potential of the food export industry was clear, as also were its technical handicaps. Individuals had made heroic efforts to overcome the difficulties and had advanced technical knowledge considerably, sometimes at the cost of their life's savings.

With New South Wales and Victoria in the lead, the States had embarked independently on extension work to improve the standard of hygiene in the dairying industry and were contemplating some experimental work in their newly built public cold stores. But the gravest problems spilled over State boundaries and required long-term systematic investigations: they were virtually beyond the resources of the States or of individual industries. The problems were also complex, needing the use of knowledge in many branches of science for their solution. From this point of view they seemed particularly well suited to a national effort, to a centre where scientists from many different disciplines could work together in an integrated approach.

It is not surprising then that almost as soon as there was a Commonwealth Government in Australia, those concerned with the food industry were amongst the strongest voices urging the need for the Commonwealth to sponsor scientific research,

either by undertaking research itself through a national institute or by acting as a coordinator of investigations carried out in the State Government Departments and the universities. The food industry was the location of perhaps the earliest recorded instance of a cooperative effort by the Commonwealth and the States to solve a serious national problem by systematic scientific research. In 1911, Commonwealth and States began a 4-year investigation of the storage disorder of bitter pit in apples, with each party contributing $2000 annually. At the end of four years, however, the investigations were suspended for lack of any very definite results.

The full story of the painful struggle of Australian scientific research to develop on a national scale is told by Currie and Graham in 'The Origins of CSIRO' (1966). Although the Australian movement began independently, it had counterparts in Britain and Canada and was, indeed, just one evidence of the very widespread realization about the time of the first world war that scientific research was both too valuable and too expensive to be left to individuals, if a country intended to acquire all the practical benefits and prestige it had to offer. Britain formed the Department of Scientific and Industrial Research in 1915, with food and the control of wastage in imported perishable foods as one of its important concerns.

This new outlook had a particular urgency in Australia, where many accepted that the nation's development depended greatly on its ability to apply scientific methods to industry. Such a conviction led to the formation in turn of the Advisory Council of Science and Industry (1916), the Institute of Science and Industry (1920) and, finally, it culminated in the formation of CSIR in 1926. Neither the Advisory Council nor the Institute had an adequate budget for research, but through their efforts data were collected and a slow start was made on some problems.

The Advisory Council

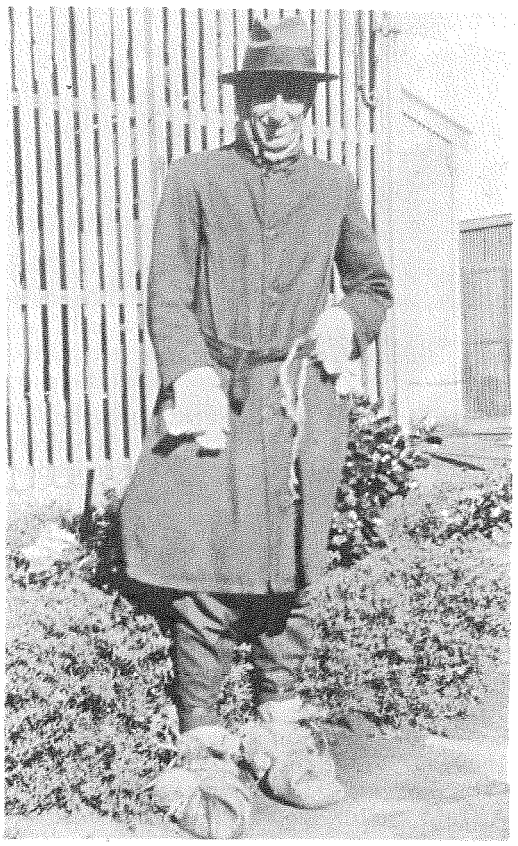
For reasons set out by Currie and Graham (1966), the Advisory Council lacked most of the basic needs of research—money, staff and facilities. However, an important part of its brief was to 'begin to collect data for the formulation of a scheme of research' (*Advisory Council Ann. Rep.* 1917–18). It was probably from this patient interviewing of men in industry and commissioning of reports that the Council's greatest contribution emerged, for it was able to identify the problems that were most urgent and most likely to respond to technical intervention. In the past, the problems of food research that drew attention most forcibly were those confronting the export trade; now the Council looked at the faults in food sold on the local markets. It considered that research was urgently needed to improve the keeping quality of milk and butter, to seek a remedy for squirter disease of bananas, and to find ways of overcoming rots in eggs and fruits placed in cold storage to meet out-of-season demands in Australia.

The Council shelved the whole problem of cold storage, recognizing that no systematic research could be done until a permanent institute was established; it did, however, look into the possibility of 'the electrical sterilization of milk, a matter of great importance to the public health, especially of the children of Australia' (*Ibid.*). Other work done during the Council's term included limited investigations on some aspects of viticulture and on fast-rising doughs, which were looked on as providing a possible way out of the industrial discontent stemming from the long hours of the bakery trade.

The poor keeping quality of milk was felt keenly in Sydney and Melbourne as the cities increased in size, and it was also important to passenger liners, on which it was impossible to keep a sufficient supply of refrigerated fresh milk. The Special Committee of Investigation appointed by the Council reported that electrical sterilization was of no help with this problem but looked very promising for 'the cure of wounds received in warfare and of certain diseases met with in returned soldiers' (*Ibid.*). The Committee asked for a further grant to follow up this lead. It is of some historical interest that the Advisory Council rejected this submission in the same terms as any Chief of Division would have heard, from the founding of CSIR until almost the present day, if he had taken a similar request to the Executive: 'Medical research', so the judgment ran, 'is entirely outside the scope of the Advisory Council' (*Ibid.*). It was only with the establishment of the Division of Human Nutrition in 1975 that CSIRO became directly involved in the sphere of human medicine.

The Institute

The Institute of Science and Industry had only a little more money than the Advisory Council and a less satisfactory brief, for instead of simply gathering information it was expected to begin systematic research on certain projects—a notoriously difficult thing to do without money. Each year, for instance, from 1922 to 1926 the Institute asked Treasury for money to commence cold storage investigations, but none was ever forthcoming. In 1922 the Institute was able to set aside $1000 for some outstanding problems of citrus research and in 1926, Gerald Lightfoot (Executive Officer of the Institute and, subsequently, the first Secretary of CSIR), in submitting his Retrospective Report on the activities of the Institute for the guidance of the CSIR Executive, was able to record that it 'was interested both financially and otherwise' in the Citrus Research Station at Griffith (N.S.W.) and the Viticultural Research Station at Mildura (Vic.); the Institute also distributed grants to investigate the Bullôt process for preserving meat and the possible use of fruit cannery residues to produce alcohol by fermentation.



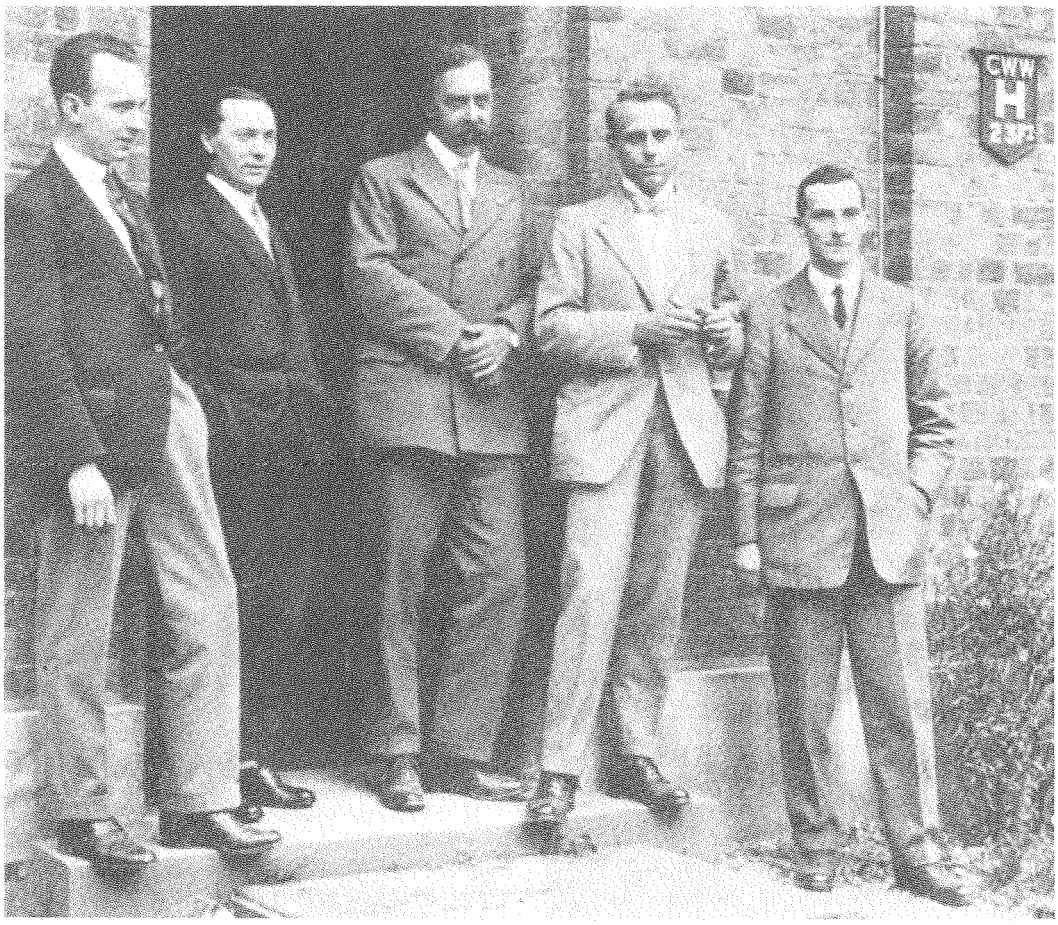
J. R. Vickery in 1924, warmly clad for his experimental work in the cold chambers of the Victoria Dock Cool Stores.

Both within and outside the Institute increasing attention was being paid to the need for work on cold storage. In 1921 the Australian National Research Council (ANRC) had appointed a Committee to investigate rapid freezing of beef as a possible way of improving its quality. The 'Investigator' designated for the laboratory work, which was supported by a grant of $200 from the Institute, was a new Melbourne graduate who had been a Chemistry student of A. C. D. Rivett's and was now working for his M.Sc. in the Biochemistry Department: his name was James Richard Vickery. Working in cooperation with scientists in the Department of Scientific and Industrial Research (DSIR) in England, Vickery and a young engineer, G. A. Cook, began their experiments in 1924 and published a substantial paper on the subject (Cook *et al.* 1926).

In 1923 the Victorian State Government equipped a block of eight experimental cold rooms at its Victoria Dock Cool Stores, in order to begin preliminary observations on the storage behaviour of fruits; the first man appointed to the work found he could not stand the cold (at that time it was believed that all experimental procedures had to be carried out inside the cold rooms) and another worker was transferred from the Science Branch of the Victorian Department of Agriculture. The man transferred to the job was George B. Tindale, who was to be one partner in the team of Tindale, Trout and Huelin that carried out an outstanding series of fruit investigations between 1931 and 1941.

Link with British food research

As a consequence of Britain's symbiotic trade relationship with the Empire countries, many of her technical problems concerning foodstuffs mirrored theirs. Alarm at the gross wastage in imported perishable foods had been one of the main factors leading in 1917 to the establishment of a British Food Investigation Board (FIB), with Sir William Hardy as its first Director. The Low



The original scientific staff of the Low Temperature Research Station, Cambridge (U.K.); *left to right:* T. Moran, J. J. Piqué, W. B. Hardy, F. Kidd, C. West.

Temperature Research Station (LTRS) was set up at Cambridge in 1922 and, a few years afterward, the Ditton Laboratory in Kent and the Torry Research Station at Aberdeen —three laboratories which were to play a key role in the food research efforts of Britain and her dominions and colonies.

The LTRS was one of the first institutions in the world to be devoted to food research, in this case to the study of the causes of spoilage in foods and the use of cold as a means of preservation. Hardy realized how much the success of its work would depend on close collaboration with the Empire countries and did all he could to assist the establishment of similar bodies there. In letters to the Institute and the ANRC he disclosed his hopes: 'In my opinion it is most important that you should have a Research Station at your disposal. It has been my dream for a long time that each geographical unit of the Empire should have its Research Station or at least its Research Organisation and that they should keep in close touch with one another by interchange of workers. The fundamental scientific problems involved are one, but of course they differ in detail in different places' (Letter to ANRC, 8 July 1925).

At Australia's request, the FIB sent out two 'expeditions', one in 1923, the other in 1925, to investigate disasters that had occurred in the shipment of apples to England. While such expeditions were helpful in elucidating some causes of wastage, A. J. M. Smith, the Cambridge scientist who led the second party, took it upon himself to point out that research could not come from one direction.only: he said bluntly that 'in future it was the work done by Australia

herself that would decide the future of the industry'.

Pressure on Government

The Commonwealth Government was coming under increasing pressure to do away with the Institute of Science and Industry, which was paralysed almost as much by grandiose ambition as by lack of Treasury backing, and to replace it with a well-funded, practical-minded body capable of planning and undertaking research on basic scientific problems of national importance. There is little doubt that the Government's prognostications were hastened by the work of the Imperial Economic Conference (1923), and the decisions of its working committees. The Conference made it clear that Britain was prepared to make 'Buy Empire Goods' her policy, but only if the quality of Empire goods improved. A committee was set up, in London, 'To consider the possibility of improving the methods of preparing for market, and marketing within the United Kingdom, the food products of the overseas parts of the Empire, with a view to increasing the consumption of such products in the United Kingdom in preference to imports from foreign countries, and to promote the interests both of producers and consumers' (quoted from *J. CSIR* 1927).

One of this committee's recommendations was 'That we regard a scheme for coordinated research into the production and preservation of foodstuffs as of prime importance'. Furthermore, Britain was prepared to back its words with money; from the recommendations of the Conference there emerged the Empire Marketing Board (EMB), charged with the disbursal of $30 000 yearly among the Empire countries for research on problems of primary industry, including food preservation.

Clearly Australia needed to have a vigorous instrumentality for scientific research before it could take the best advantage of such funds. We may note here, for the sake of completeness, that Australian food preservation studies actually had little direct aid from the EMB before it was disbanded in 1934, but the Board's generous support for the British food research laboratories indirectly benefited many cooperative studies carried out by CSIR and FIB scientists.

Sir Frank Heath Reports

Recognizing the urgent need of a plan to reconstitute the Institute of Science and Industry, the Commonwealth Government invited the assistance of Sir Frank Heath, the man who had been most instrumental in forming the British DSIR and who was now its Secretary. Heath was prepared to survey Australian science and industry and make recommendations for a similar body here.

Before submitting his full report, Heath expressed his feelings on the necessity for food research in a letter to the Minister for Markets and Migration (18 Dec. 1925): 'Among the possible lines of investigation which have been brought to my notice there are two or three which appear to me to be both urgent and promising. The first is a more intensive study of the problem affecting foodstuffs. Cooperation has already begun between Australia and the mother country in this field, and two missions from Home have visited this country, but better trained men than are at present available are undoubtedly needed for any effective cooperation to be possible, and I suggest that funds should be provided . . . which will enable one or two scientific workers to be selected and sent forthwith to study for a year or two at the Low Temperature Research Station at Cambridge' (quoted from Lightfoot 1926).

Heath's full and clear-sighted 'Recommendations for the Reconstitution of the Institute', presented to the Prime Minister in January and published in March 1926, spelled out the country's most urgent needs and sketched the administrative framework that would allow them to be tackled with vigour and efficiency. The Heath Report, as it came to be known, provided the basis on which CSIR was set up, in April 1926.

In his list of research groups that should be formed as soon as possible, 'An Agricultural Section, attached to which there shall in the first instance be formed a Dairy Research Institute' and 'A Food Section', were placed first. The purpose of the new body, as Heath saw it, must be to provide for the training of young men and women in scientific research; to conduct scientific investigations to benefit 'the whole industrial activities of the Commonwealth' or 'the interests of Australian consumers as a whole'; and also to help individual States in solving particular

problems.

Heath emphasized that trained men were a much greater need at present even than money: 'Everywhere I have found promising and useful work going on, but without exception I have found on closer enquiry that, while the work has often been hampered by lack of funds, the fundamental difficulty has been to find well-trained men for the work'. Above all, he stressed that 'In matters of research it is safe to say that both in the interests of science and of the national finances, it is better not to begin an investigation at all than to begin it with second-rate men'. So completely was this feeling shared by the three men who comprised the first Executive of CSIR that it formed their guideline in establishing each of the Divisions.

Chapter 2. Struggle to organize food research

When we look at work in food research between 1926 and 1931, the year in which the Section of Food Preservation was established, we come across a splendid paradox. At the time, Dr A. C. D. Rivett and his fellow members of the Executive, Sir George Julius and Dr A. E. V. Richardson, were convinced that in this aspect of their work they had got nowhere: 'Though we have gone ahead fairly steadily with work in such directions as animal nutrition, entomology, economic botany, animal health and to some extent forest products, we have done comparatively little in connection with food investigations. One might invent excuses for this but they would hardly amount to anything more than a confession that we have quite failed to see a definite road before us' (Rivett to H. T. Tizard, 13 Mar. 1929, E30). In retrospect however, the period shows up in a decidedly more favourable light; during these years several outstanding men were recruited who would become the nucleus of a permanent Section, an excellent relationship was opened with the LTRS, and several valuable applied investigations were carried to a conclusion.

The key to the paradox probably lies in the Executive's driving wish to see its chosen leaders established in their own laboratories as soon as possible, and in a preconceived notion it held about what should be the central concern of food research. Matters were not helped by the fact that the Executive received two setbacks during these years in its efforts to organize a group for food investigations.

Dr Franklin Kidd

As a final but essential step before forming any research divisions, the Executive arranged to secure the services of a group of experts, mainly from Australian universities with a couple coming from overseas, to review each particular field. Dr Franklin Kidd of the LTRS was invited to survey the Australian food industry in order to ascertain the most pressing problems, define their economic importance and find out whether they were already being attacked by existing institutions and, if so, in what way these efforts could best be supplemented; he was also asked to review available facilities, particularly laboratories, equipment and staff.

There is an old military maxim that 'Time spent in reconnaissance is never wasted'

Dr Franklin Kidd in 1947, at the time that he became Director of the British Food Investigation Board.

but Kidd's visit and his Report could be seen as an exception to the rule. Franklin Kidd was an ebullient character with a vigorous flow of ideas and a puckish sense of humour; he and his partner, C. West, formed a brilliant research team which made a number of contributions to the knowledge of post-harvest plant physiology. But Kidd was wasted in the role of adviser. He could not or would not shackle his visions to the meagre realities of the Australian rural industrial scene.

Fresh off the ship in mid 1927, Kidd ruffled Rivett (whose name he consistently misspelt) with a suggestion that 'there might possibly be time to commence some collaborative work on citrus fruits this year', and he proceeded to rough out a plan for an experimental shipment of citrus which would have required the cooperation of four States and the acquisition at short notice of 10 000 cases of fruit of uniform quality. Rivett demurred politely, saying the Executive could hardly give the scheme a high priority; he was only too well aware that the whole fruit industry was in considerable disarray and that the States were still touchy about any Commonwealth trespassing on what they considered their private preserves.

When the Report came in, it was thoroughly impractical. It contained virtually no specific suggestions and no order of priorities in which problems should be tackled; concerning meat research, for instance, the Report stated that 'In regard to the flesh of animals, fundamental work is needed in the study of the effect of heat, of cold, of desiccation and of nutrition upon its structure, the physical and chemical state of its components and upon the course of subsequent changes in these. There are unsolved problems in connection with *rigor mortis*, the solution of which may have a considerable bearing upon the preservation of the flesh.'

While such ideas were sound they were so general that Kidd might have proposed them without troubling to leave England. The Report put forward an ambitious scheme that would have made the industries themselves, through an array of Industrial Research Associations, responsible for applied and short-term research, while CSIR would undertake background research of a fundamental nature through a National Food Research Laboratory. Such a scheme would have cut CSIR off from day-to-day contact with industry; more serious at the time, it would probably have condemned to failure several struggling industries which were in danger of foundering unless CSIR could provide a solution to just those short-term technical problems that Kidd felt they should be tackling for themselves. Even today, 50 years later, few Australian food industries are sufficiently centralized or powerful to run their own research institutes.

Kidd's Report is generally given some credit as having influenced the Executive in its decision to establish the Section of Food Preservation, but the evidence indicates that it set the Report aside as irrelevant. Nor was the Report used when the Section was being formed. In 1931, Vickery was shown Kidd's work before being sent out to make his own survey of the problems confronting industry. When I asked him recently if he thought the Report was grandiose, he replied, 'Of course: that was Kidd all over! Full of bright ideas but hard to pin down on details.' He found it of general interest, but with no specific practical application.

Dr W. J. Young

The Report had been proposed as a joint effort by Kidd and Dr W. J. Young, the Australian worker who accompanied him throughout his inquiries. Although Young's signature appears beneath Kidd's, he seems to have had little hand in composing this Report and he submitted a supplementary report of his own—an action that rankled with Kidd, who pointed out that he and not Young had been called in as the expert in the case. Young's supplementary report was a pretty humdrum affair beside Kidd's and it did not attempt to cover the whole subject; yet it was probably more useful as it took into account investigations already in progress and suggested what the future priorities should be. Young noted what laboratories were needed and where they should be placed, and he listed some pressing problems not needing too much equipment that could be handled at once.

W. J. Young, Professor of Biochemistry at the University of Melbourne, was a figure of some importance to the early development of food research. As Adviser to CSIR on a retainer of $500 a year, Young supervised most of the food investigations carried out between 1921 and the time when a Section was formed, and took an active part in many of them. With the cooperation of Professors

W. A. Empey on his return from World War I. Empey was the first permanent officer appointed by CSIR to work on food preservation.

L. S. Bagster and E. J. Goddard of the University of Queensland, he guided and planned in detail investigations on meat, fish, bananas and citrus and provided room for the laboratory work in his Department.

It was in Young's laboratory that Mr W. A. Empey, the first permanent appointee to CSIR's food research staff, conducted experiments designed to throw light on the causes and means of avoiding drip in frozen meat and fish. Preliminary recommendations to avoid squirter disease in bananas were made as a result of work carried out under Goddard at the University of Queensland. Between 1927 and 1932, E. W. Hicks and F. E. Huelin, under the general supervision of Young and Bagster, carried out investigations that led to a virtual revolution in the techniques of ripening bananas and carrying them by rail to the southern Australian cities.

With such a background, Young appeared a natural candidate for the position of leader of any Division of Food Preservation. It is not known whether he himself was interested in the prospect, but the Executive certainly considered him—only to conclude at length that he was not the right man to organize and lead such work. Young continued to act as an adviser to CSIR and he assisted Vickery to plan and supervise the Section's Melbourne fruit investigations during the 1930s. His position was dispensed with in 1938 when almost all the fruit work was centred at Homebush; at that time his honorarium was a rather generous $600 annually whilst Vickery's salary, before reclassification in mid 1938, was $1600.*

Rivett spoke of his disappointment in Kidd and Young in a letter to Hardy (28 Feb. 1929, E30): 'We had, as I think you know, some idea that Dr W. J. Young might have been a suitable head for a Division, particularly after the experience provided by his tour with Dr Kidd. We think, however, that Dr Young's strength lies in laboratory rather than in organizing work and so we have given up the original idea. Then, too, while we appreciated Kidd's report immensely and realized that as an ultimate aim it had a great deal to commend it, yet we felt that it hardly gave us the guidance we required in laying down the lines for immediate action.

'I fear that the consequence has been that we have rather drifted.'

How should food research be organized?

At the start of 1929 Rivett examined the headway CSIR had made in its major projects, and was appalled at the lack of progress in general food preservation studies: 'Probably the strongest criticism that could be launched against us at the present time is our apparant indifference to these very serious problems of food (especially fruit) preservation and transport' (Rivett to Julius and Richardson, 8 Feb. 1929, E30). What were they going to do about it?

The difficulty they were in stemmed largely from their inability to find a leader. The Executive's method of setting up a Division was first to seek out 'a chief of outstanding capacity' and then to leave the program of research largely to his judgment. If no chief was found, the research program dangled. Although CSIR was kept informed of J. R. Vickery's progress at the LTRS and used him from time to time to get reports on

*Salaries of staff members are quoted from time to time to provide the reader with a further, sharp point of contact with some particular period. All the figures quoted are 'nominal': a cost-of-living adjustment was made before payment. As we shall see when the Section of Food Preservation was formed, for several years the adjustment was downward and could lead to a severe cut in actual salary.

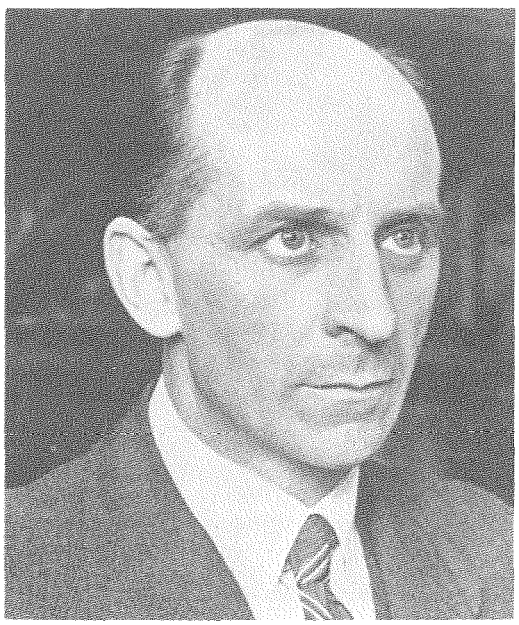
shipments of beef preserved by the Rayson Patent process, it did not yet see Vickery as a possible leader. Nearly all the Chiefs of Division up till then had been men of established reputation drawn from laboratories overseas; CSIR's Endowment Fund Scholars, on completing their advanced training, were expected to enter the organization at a lower level.* Moreover, Vickery was 'a meat man', whereas to the Executive's way of thinking research on the very complex and difficult problems of fruit was to be the central task of the Division; all along, 'the fruit problem' had been represented as more acute than 'the meat problem'.

At all events, when CSIR's correspondent in England, F. L. McDougall, tried to find out for Vickery what his future prospects might be, he got short shrift from Rivett (9 Aug. 1928, E30): 'Your enquiry . . . is soon answered; we have no plans for launching out with ambition nor do I think we shall attempt anything big for some time. . . . We do not see any man of sufficient ability to justify us in making him the chief of a Division of Food Preservation. . . . Vickery has his next 12 months well provided for. It is impossible to say what may be before him out here at the end of that time.'

Dr Rivett proposes

After devoting much thought to the question of organizing food preservation work in Australia, Rivett came to an astonishing decision. He concluded that the only wise course was for CSIR and the British Food Investigation Board jointly to set up a food research organization, to be run by an officer from the FIB. 'I want to make the definite proposal', he told Julius and Richardson (8 Feb. 1929, E30) 'that we should ask Sir William Hardy to agree to the appointment of a first-class man, thoroughly familiar with all that Hardy is doing, and with his present facilities can do, at Cambridge, to be appointed jointly to his staff and ours . . . The officer I have in mind would come out here with plans well developed from the Cambridge standpoint. He would then as our officer take charge of the local work required to develop them. Periodically he would return to Britain, maybe as officer in charge of some experimental shipment. He might, if he were the right man, become the Chief of a Food Preservation Division under us; but the point I want to make is that as things stand at present it looks to me as though it would be very unwise to start a division on the same lines as those we have followed before. We do not exactly want to put ourselves under Hardy's Board [the FIB], but I do feel that our best work will be done if it comes practically very close to that.' Julius and Richardson agreed to Rivett's plan.

The scheme was a curious one. It jars with the general impression of Rivett as dedicated to the policy that Australia should be self-reliant in science (see Currie and Graham 1968). Rivett seems to have felt on the defensive and tried to ward off such a criticism, not altogether successfully: 'No doubt we should be subjected to the criticism that Australian work was being largely handed over to you, but personally I should not worry about that since I honestly believe that the sooner we reach the stage at which there is something very close to Imperial



Dr A. C. D. (Sir David, after 1935) Rivett, Chief Excecutive Officer of CSIR from 1926–45, and then its Chairman until he retired in 1949.

*Vickery's Cambridge studies were supported mainly by an Exhibition of 1851 Scholarship awarded a short time before his selection by CSIR; however, his acceptance of a CSIR Scholarship, while bringing him little additional money, gave CSIR an option on his services at the completion of his studies.

unity in the organization of applied scientific research the better' (Rivett to Hardy, 28 Feb. 1929, E30). He was on stronger ground when he argued that food research was a special case: 'The association between Britain and the other parts of the Empire is undoubtedly close in matters of animal health, animal nutrition and so forth, since the problems are to a great extent the same. In food preservation, however, not only are the general subjects of study similar, but in a great many cases the actual material for observation and experiment is identical. I mean, of course, that you may work on the actual apples which we grow, and pick and pack out here. The case for intimate association is therefore stronger in fruit and meat matters than in any other sets of problems being faced at home and in the Dominions' (*Ibid.*). Such a joint arrangement would have helped Australia in the short term, but Rivett appears not to have considered fully the limitations it might put on the later growth of a CSIR Division of Food Research and its range of interests.

Sir William Hardy, Director of the British Food Investigation Board and Superintendent of the Low Temperature Research Station from their beginnings until his death in 1934.

Sir William Hardy disposes

No offer of marriage from a raw youth to a well set-up older woman was ever discussed more kindly, or turned down more roundly, than was Rivett's proposal of 'a very intimate association' with the FIB. It formed the subject of conversation at a number of luncheon têtes-à-têtes between members of the political and scientific Establishment in London. Long before Rivett heard from Hardy himself he knew he was to be let down, lightly but definitely. Over lunch with the ubiquitous McDougall, H. T. Tizard seized the opportunity to affirm that Australia must seek its own salvation in food research since it had so much more to lose in the whole question of the transport of food in satisfactory condition and at economic rates; the matter was 'of maximum economic importance' to Australia but 'not of major importance' to England (McDougall to Rivett, 2 May 1929, E30).

Hardy's rejection, when it came, was on grounds of practicality:

'Dear Rivett,

'I have considered your suggestion carefully and sympathetically and have been driven to think it would not work. We are too far apart to have staff in common. A man owning direct allegiance to both of us would be bewildered. Your problems in food really are not the same as our problems, though there is a common scientific basis' (Hardy to Rivett, 21 May 1929, E30).

In a long letter that is not always cogently argued but is full of interest and good judgment, Hardy went on to expound three themes—his concept of how a scientific research establishment should grow and of the particular problems Australian food research must face, and his conviction that the leader Rivett is looking for is already in view and will prove equal to the task. The problem foremost in Hardy's mind is not fruit research but meat research: 'What mode of transport of meat to Europe is open to you? Are you limited to freezing? Is chilling possible? I am pretty confident that the scientific answer to this second question would be given by one year of intensive work. The new chambers here were designed for this kind of enquiry and if you were willing to leave Vickery here to do the actual experiments we will have the answer ready for you by the time you are in a position to make use of it.' Hardy comes back several times in his letter to mention Vickery and he

concludes: 'Vickery would be ready to return to you then in the spring of 1931, an Australian with wide experience. By then you should know the possibility of producing meat, and of transporting it chilled, and Vickery would be ready to carry on further work for you. Both Moran* and I are certain he will make good.'

A fresh breeze

This letter of Hardy's tipped the balance in favour of research on chilled beef as the first major effort of the emerging Section and gave J. R. Vickery his chance of proving his ability as a leader. Against the opening sentences Rivett pencilled the words, 'fresh breeze'; he had the utmost faith in Hardy's judgment and the letter gave him the fresh appraisal of the field that he had needed. Hardy reinforced Rivett's own suspicions that fruit research was bedevilled by a multiplicity of areas of work and of self-interested organizations, a sea in which, as Rivett stated, 'we find it extraordinarily difficult to determine the best path' (Rivett to Hardy, 15 Aug. 1929, E30), while all that Hardy said about meat research revealed the prospect of success within a foreseeable time.

Here was an excellent project around which to build up a research organization. 'It is most encouraging to hear from you that a laboratory answer to the question of whether or not chilling is possible could probably be given after one year of intensive work. . . . If all goes well and we get Vickery back here in May or June of 1931, we shall be only too ready to give him his chance to carry on as thoroughly and enthusiastically as your inspiration and his own vigour demand' (*Ibid.*).

Valuable relationship with FIB

The idea of a condominium for food research was never revived but there were other means of building up a special relationship between CSIR and the FIB. Many of those who became leading figures in the Section of Food Preservation received their higher training, as Science and Industry Endowment Fund Scholars, at the LTRS or occasionally at the Ditton Laboratory or the Torry Research Station: J. R. Vickery, S. A. Trout, F. E. Huelin, N. E. Holmes, E. W. Hicks, W. J. Scott, C. C. Kuchel, J. F. Turner; more recently, J. H. B. Christian, J. J. Macfarlane and J. B. Davenport worked in the LTRS before it was closed down in the general reorganization of national scientific research that took place in Britain in the 1960s. In the years 1931–39 there was close cooperation and consultation between the Section of Food Preservation and the LTRS; in some projects the two laboratories were able to dovetail their programs, making complementary experiments. Such cooperation extended the range of Vickery's small group in fundamental research whilst he was able to carry out large-scale tests for which the LTRS had no facilities.

A further link in those years was provided by the Consultative Group of the FIB with which CSIR collaborated in an extensive series of experimental shipments of meat and fruit. Determining the best shipboard storage conditions for individual commodities was a huge task in which close cooperative effort was essential. Although circumstances never favoured the formation of an 'Empire team', that 'Imperial scientific service' of which CSIR and DSIR both dreamed at various times, the group of scientists who worked on these shipments formed an *ad hoc* Empire team as they went about the business of supervising the loading and unloading of cargoes, checking readings that had been taken by partners thousands of miles away, exchanging by airmail vast tables of values, working out objective standards for such subjective qualities as bloom and colour of beef, pooling information that would enable recommendations to be made to growers, processors and shippers, and would eventually lead to improved commercial practice.

Depression hits Australia

Rivett's uneasiness about the delay in organizing food research was, as events proved, only too well founded. By the time that Vickery got back to Australia in March 1931 the Depression had hit the country and CSIR was struggling to keep going. There was no longer any prospect of establishing food research on a comprehensive scale. During the first three years after CSIR started, six Divisions were formed for work in three out of the five areas originally set down for immediate attention: plant pests and diseases, animal pests and diseases and forest products investigations. In the next nine

*Dr Thomas Moran, Director of Meat Investigations at the LTRS, with whom Vickery worked very closely.

years no further Divisions were formed. For several years the existing investigations could be saved only by infusions of money from outside sources, chiefly from the Empire Marketing Board (EMB) and from the Rural Credits Development Fund of the Commonwealth Bank of Australia, the organization that godmothered the infant Section of Food Preservation through its first comfortless years.

If a Division of Food Preservation had been formed in the 1920s with workers of suitable potential, it seems likely that it would have contained a powerful section working on 'fundamental analysis of the living system of fruits' (Kidd's phrase), an area that demanded years of specialist study; a section studying the physical engineering problems encountered in shipboard conditions of transport; and sections working on chilled and frozen beef and mutton, on pig meat, fish and eggs. As it was, when Vickery arrived home in March 1931 only a truncated program could be contemplated and it was not clear where money or a laboratory would come from. It would take a number of years to make up the ground lost through failure to consolidate the separate projects in food research before 1930.

Chapter 3. Officer-in-Charge, on $18 a week

'I met the Executive . . . and discussed plans for the future with them. . . . I was led to understand that, although it was not proposed as yet to establish a Division of Food Preservation, I would be responsible for some time to come for the future investigations in all sections of this field' (118/A4a). So Vickery wrote to Moran, his Cambridge friend and colleague, in early April 1931. He had cause to be pleased with his job in every respect but one: the pay kept getting smaller and smaller. While still in England he had, as he says, 'grabbed CSIR's offer' of a position at $1000 a year; now he was home, the importance of his job had grown but not the pay. As a result of the financial crisis the Commonwealth Government made a 20% cut in the salaries of all Government employees; shortly afterward a further 7½% cut was made in all salaries over $800. By the time that Vickery had been hard at work for six weeks he found he was earning exactly $14 a week. However, at the end of September 1931 the Executive appointed him formally as Officer-in-Charge of cold storage investigations and successfully recommended that his salary be increased to $1300 p.a.—$18 a week, after 27½% had been deducted.

A new survey

For the first six months back in Australia, Vickery had his headquarters in a small room at CSIR Head Office in Melbourne, but most of his time was spent moving from State to State, repeating the survey that Kidd and Young had made when the financial climate was very different. His object was 'to obtain first-hand knowledge which will be of use to me in subsequent work and also to formulate a scheme for the most urgent investigations required in the field of cold storage' (Vickery to Kidd, 28 Apr. 1931, 118/A4a). The findings were published as 'Refrigeration Applied to the Preservation and Transport of Australian Foodstuffs. A Survey and a Scheme for Research' (Melbourne 1931), a narrow dun-jacketed booklet that contrives to give a suitably austere impression. Vickery's survey provided the foundation for all work done in the Section up till 1939. However, despite their very practical nature, the projects envisaged were never fully implemented; in the worsening economic situation of the next few years some of the investigations given high priority had to wait whilst others were not done at all, being overtaken by the higher priorities of World War II.

The gist of Vickery's recommendations was contained in a one-page summary. He listed two areas of work as most urgent: firstly, investigations to test the possibility of exporting hindquarters of beef in the chilled condition rather than frozen and secondly, extensive investigations on three aspects of the storage and transport of apples and pears—orchard conditions affecting the subsequent life of the fruit, the influence of conditions of transport and storage, and the complementary biochemical studies designed to determine the relationship between the physical and chemical constitution of the fruit and its storage life. Next in priority, he considered that the work on citrus and passionfruit already being carried out by CSIR should be continued and extended and that work should be directed towards finding better varieties of grapes for export and improving the methods of exporting them.

Moran

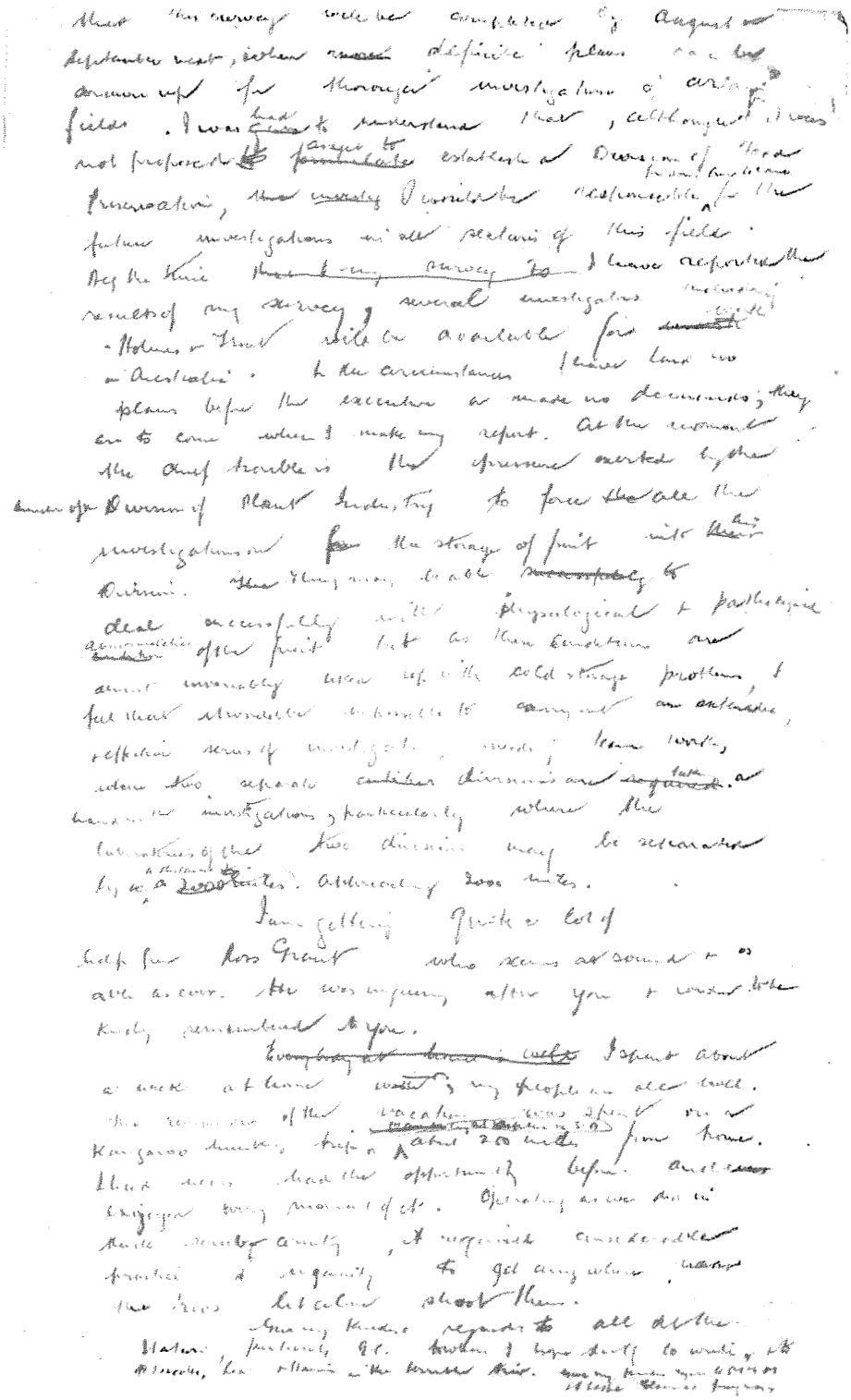
A4a

1. Herewith the first of the series of news-letters which I hope will be (regular) [illegible].

I am afraid, however, that there is but little to report at present, as of the three weeks elapsed since I arrived in Australia, two have been spent at home and the work has been [illegible] chiefly by the production of memoranda, short reports etc for headquarters, and by establishing contacts with various people in the trade.

You have undoubtedly heard about the parlous state of affairs in which Australia finds herself. Many self-appointed prophets ~~have arisen~~ shown up with hot-air, have arisen, but their plan of salvation consists chiefly of such vague plans as the "required restoration of confidence". The few level headed people in the community, of whom Dr. Rivett is one, advocate the greater efficiency of, greater productivity of primary produce combined with a more intense and systematic search for these markets. Several men in the present Govt. apparently believe likewise and have faith also that the C.S.I.R. can play a very important part in the ~~restoration~~ re-building of Australia. The money ~~has~~ has been such that the C.S.I.R. have now sufficient funds to carry on their activities until June 1932, ~~if the [illegible] after [illegible]~~ ~~& the circumstances, I believe that the action of food preservation [illegible] will be able to go forward in the quiet but perhaps [illegible]~~

A few days ago I met the Executive consisting of Dr. Sir George Julius, Dr. Rivett and Prof. A.E.V. Richardson, and discussed plans for the future with them. It was decided that until I had become thoroughly acquainted with local conditions ~~[illegible]~~, no definite plans could be formulated. I am, therefore, shortly to commence an extended tour of ~~Queensland, N.S.W., Vic., Tasmania, S.A.~~ the various 'states.' It is hoped



On his return to Australia in March 1931, Vickery was placed in charge of CSIR work on food preservation; he drafted this letter to Moran with news of his job and general observations on Australia after four and a half years overseas.

Two important problems of interstate trade claimed attention: the carriage of tropical fruit to the south and the carriage of Tasmanian apples and pears to the north. Work that would be required in the near future included improvement of the methods for exporting edible offal and the development of a technique for exporting baconers for curing in England; and studies on lamb, fish and some tropical fruits. Finally, Vickery recommended that efforts be made to set up an Empire Refrigeration Transport Survey Team for work on shipboard. The idea of a shipboard team was never fully realized and the obstacles it met with drew a sour comment from Rivett: 'it is one of those things which must be indefinitely postponed; in other words it goes into a steadily increasing group of Australian scientific investigations' (Rivett to McDougall, 5 June 1931, E30).

We see from this modest program of research, closely tied to the immediate needs of industry, that the utilitarian appearance of Vickery's booklet is not misleading. So the disciple of Sir William Hardy—Hardy who believed in scientific work in the spirit of pure inquiry and argued that 'The paradox of science is that the short cut to utility is to forget it'—now planned to start food research in Australia by going straight for utility.

Here Vickery is closer to the Hardy who stated, 'In the first five years [of the FIB] I thought the most important thing was to get to work at industrial problems, to get the "practice" going (borrowing the medical term)'. Hardy rounded out that statement by contrasting his state of mind in 1929, after the LTRS had been operating successfully for seven years: 'Now I am fanatically convinced that the practice will look after itself if the science is done as it should be for the love of knowledge. Possibly I have gone too far the other way!' (Hardy to Rivett, 21 May 1929, E30). Although Vickery never went so far 'the other way', we find that as soon as he moved to larger laboratories at Homebush he determined to expand the Section's activities in order to embrace basic food science studies—a resolve that was temporarily foiled by the coming of the War. Where Vickery always remained close to his research training under Hardy was in analysing his practical scientific problems in their most fundamental terms so that none of these early investigations were mere 'fence-mending exercises' of the sort that Rivett deplored. His comprehensive view of the scope of food science and the thoroughness of his attack on some of its problems bear out his statement that 'When I was given the opportunity to set up food research laboratories in Australia, Hardy's ideas were the basis of their organization and have continued so ever since' (Vickery 1964).

Laboratories for food research

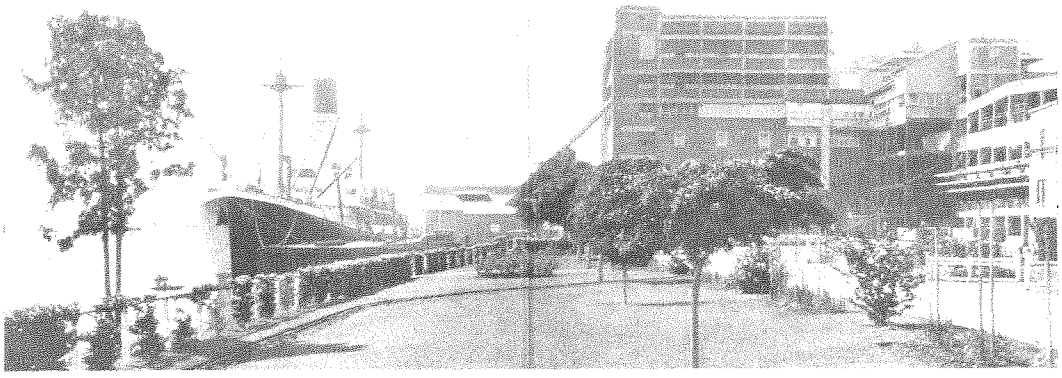
Vickery ended his survey by pointing out the immediate need for two laboratories. Centralization of experimental work, however desirable for economic operation, was hardly practicable for food research under Australian conditions; laboratories must be situated close to the chief source of supplies of experimental material, and these were widely scattered. Brisbane was a natural centre for meat research as Queensland had about half the total number of cattle in Australia, including by far the greatest proportion of beef cattle. Melbourne, being close to large areas of production of apples, pears, citrus fruits and passionfruit, was an excellent centre for work on non-tropical fruit.

There was a good case for setting up both laboratories but one hurdle must be surmounted: where was the money coming from? There was no prospect of CSIR providing capital for building, or equipment, for at least two years.

Headquarters are found

What might have been the harder task, that of finding a base for the chilled beef work which would also serve as the Section's headquarters, turned out to be unexpectedly easy. Queensland had just established a State Abattoir at Cannon Hill, a suburb on the eastern outskirts of Brisbane, under the control of the Queensland Meat Industry Board (QMIB). Making a realistic assessment of the best way to help the industry at a time when frozen beef had become almost unsalable on the London market the QMIB, under its progressive Chairman, Mr E. F. Sunners, offered to provide CSIR with all the facilities needed to carry out research on the problems of exporting chilled beef.

Sir George Julius outlined the proposal, with his usual zest, for the benefit of Rivett and Richardson: 'Sunners has put the following proposition to me. He is convinced that the major problem to be faced, so far



Queensland State Abattoir with a ship alongside loading meat for Britain. CSIR Section of Food Preservation had its headquarters on the seventh floor of the building.

as primary production is concerned, is the question of efficient food transport, of meat and fruit. Twopence per lb more on meat would make all the difference in the world to the primary producer, and Sunners is of the opinion that the transport problem is more important, as a single problem, than any of the disease problems.

'Sunners is very anxious that some form of cooperation should be established between the CSIR and the Queensland Meat Board, for the purpose of carrying on research into the transport problems in Queensland. He believes that it will be possible for the Board to assist in the following way—to make available without charge, all laboratory space, office and equipment, and also all raw material in the way of meat, etc., on which to work. The Board would also supply refrigerating space, fixed up as required for the various experiments. They would also supply, at such time as we would require them, the services of their chemists, to do such things as our workers might require. All this they would do, provided that we would locate in Brisbane, to take charge of the work, our experts, such as Vickery and company.

'I told Sunners that quite early in the history of CSIR, we had decided that transport problems were of major importance, and that for that reason we had set about to secure the adequate training of a team of workers with the intention of forming a Division of CSIR to deal with this work. Now that we have the men trained, we are faced with the difficulty of finding funds to establish the Division' (26 June 1931, Julius Letters).

After negotiation between Sunners and Vickery the offer was accepted. A measure of its generosity may be gained from the relative cost to CSIR and the QMIB of setting up the laboratory. Vickery collected and took up to Brisbane 'an adequate nucleus of apparatus for cold storage investigations' costing a total of $153. His most expensive purchase was a Wheatstone bridge at $44; many of his other items, which largely consisted of a variety of thermometers with leads and a galvanometer, had come second-hand from the FIB. Admittedly these were not CSIR's only expenses in setting up the laboratory—for instance, in Vickery's first Estimates a sum of $600 is earmarked for 'Maintenance (Apparatus, Material, &c.)' for 'Meat, Fish & Dairy Produce Investigations' and 'Engineering Problems'—but the scale is still very small by comparison with the expenses of the QMIB; the Board estimated that the laboratory would cost $5600, and the final costs exceeded this by $2400.

The Section of Food Preservation was provided with a laboratory, an office and cold chambers suitable for pilot-scale experiments. It also had access to the eight large commercial chillers belonging to the abattoir. 'We have no station for meat comparable with the Ditton Laboratory for fruit. Vickery has one at Brisbane', Hardy told Rivett (19 Apr. 1933, 113/A13). In accordance with the original agreement, the abattoir staff did all purchasing and procurement of current supplies for the Section, thus relieving it of a considerable financial and administrative load.

Julius,

Culwulla Chambers,

SYDNEY.

Reply meat transport work. Consider investigations desirable, location suitable and tentative proposals satisfactory for negotiation, stop. Advantages no capital cost coresearch, little expense other than salaries already committed, ~~and~~ possibilities considerable help outside. ~~and~~ work ~~particularly~~ of great importance cattle industry Writing.

Richardson,

2/7/31.

Draft of a telegram from A. E. V. Richardson in Adelaide to Sir George Julius, expressing his approval of the plan to start food research in Brisbane with the help of the Queensland Meat Industry Board.

A Melbourne base

It proved harder to find a home for the Melbourne investigations on non-tropical fruits. In the end CSIR came to an agreement with the Victorian Department of Agriculture to collaborate and share facilities at the Victoria Dock Cool Stores which would be extended and the equipment modified at CSIR expense. Related work in fruit chemistry would be carried out in Professor Young's Department at the University of Melbourne.

The first Estimates

The Executive asked Vickery to put in Estimates for the year 1931/32 in much the same spirit of casting his bread upon the waters as he had submitted suggestions for a program and laboratories: although CSIR had Government backing for the general concept of food investigations, CSIR itself had no money to meet the Estimates.

Vickery's 'Approximate Estimates for Investigations into Cold Storage Problems and Order of Preference for the Reduction of Expenditure' (June 1931) came to a total of $6980. As the staff envisaged was only five and the provision made for work in each area was extremely modest, the Reductions offer us the intriguing spectacle of a snake swallowing its own tail. The Third Reduction contemplated 'eliminating' either Empey or Vickery himself, the Fourth Reduction the abolition of the meat investigations and by the time we are down to the Seventh Reduction the whole Section has been abolished and we are back with the original part-time Adviser, W. J. Young.

It was at this time that the Rural Credits Development Fund (RCDF) made its first vital contribution to food research in Australia.* CSIR had already, in the previous year, received support from the RCDF for capital works in the Divisions of

*More information about the RCDF and its importance to CSIR is given in Anon. (1970) and Currie and Graham (1974). The Reserve Bank will soon publish a full history of this beneficent institution.

Plant Industry and Entomology. Now Julius and Rivett again approached the Governors of the Commonwealth Bank, using information supplied by Vickery on the objectives and economic importance of cold storage research as one of the strongest cards in their hand; as Richardson said, 'this is precisely the kind of work which would make an appeal to the Bank Board'. As a result of this submission the RCDF gave $30 000 to assist CSIR in the financial year 1931/32, including the whole of Vickery's original Estimate for cold storage investigations.

The Section is established

The Section of Food Preservation (SFP) was officially established in August 1931. Vickery with W. A. Empey and N. E. Holmes, a physicist–engineer who was later (1934) to become the Section's permanent Liaison Officer in England, went to Brisbane in January 1932 and were able to start experimental work in August; the Cannon Hill Laboratory had its official opening on 26 July 1932. S. A. Trout, who had received his Ph.D. and returned from Cambridge shortly after Vickery, was already working closely with Tindale at the Victoria Dock Cool Stores. The fifth member of staff, 'an able young graduate named Hicks' (Vickery's description of him in a letter to Hardy), who had been a central figure in translating laboratory techniques of banana-ripening into satisfactory performance under commercial conditions, was seconded for a year to the Queensland Committee of Direction of Fruit Marketing to operate newly installed ripening facilities in Sydney.

Chilled beef project successful

When Moran of the LTRS first learnt in 1931 that Vickery's group was launching an attack on the problem of exporting chilled beef he warned Vickery, 'Frankly, Vickery, chilled beef is dull stuff to tackle'; Moran's section had been working on it for some time without any worth while progress. Within a few months, however, the tone of Moran's letters was transformed. 'I mean this to be a long letter', he begins, in April 1932 (118/A4a), and proceeds to tell Vickery the great news. Experiments at LTRS showed that the use of low temperature and an atmosphere containing a slightly increased concentration of carbon dioxide (CO_2) doubled the storage life of beef; 'I am enthusiastic about the possibilities of small percentages in the carriage of chilled beef. Frankly, Vickery, I can't help feeling somewhat thrilled about it.' This discovery was to revolutionize the pre-war beef industries of Australia and New Zealand because it would make possible, for the first time, the export of large quantities of chilled beef from these countries. It was still, however, a long way from commercial development. 'The papers have got hold of the story', Moran complained (20 July 1932, 118/A4a) 'and talk as if the problem was solved, which it certainly isn't. Nevertheless I am very enthusiastic about the possibilities.' As the Cambridge group was not equipped to carry out pilot-scale trials, it had to be content to watch and advise as scientists in Australia and New Zealand worked to translate the discovery into commercial practice.

There were many arduous stages in the development of a method that would give an adequate margin of safety for the long Australia–U.K. run. Vickery had first to satisfy himself that an alternative, more economical method using 'conditioned air'

Inside the Section's laboratory at Cannon Hill.

Dear Vickery

I mean this to be a long letter. ... congratulate you on your ...

2.

... E.C. did some work on mouldy meat in one of these days ice boxes when he saw very low counts. What is in mind ... spraying meat with spores of ... 2 strains and one or two similar expts. — spraying mouldy meat often with a piece of mouldy meat ... Hammersmith or smearing it ... what is how this latest effort started. ... staying in CO_2 atmosphere. ... Hardy fell for it. Frankly Vickery I went for it very quickly ... what I tell you in this letter is confidential to yourself — all ... Let me quote ... self feeling somewhat thrilled about it. ... of lamb from 3 animals ... 1) ... Russell.

3.

Conc. may be all that is required to ~~keep~~ keep it free from mould over the journey from Australia to Great Britain.

In talking like this you will see I am adopting an optimistic attitude but please "water down" all I say if you yourself knock the bottom out of it — all ~~the~~ don't be too hard on us.

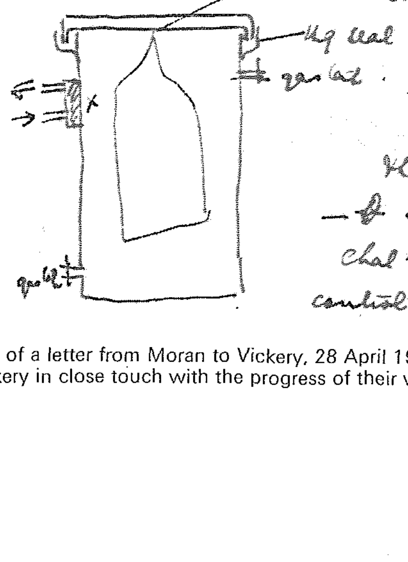
Heywood — I told him about it — emphasised that it was just a possibility. Unfortunately I fear he will go off the deep end over it. Already he has made arrangements with Borthwicks

~~I suggest Vickery your plan to come to~~

also if & when actual shipment is justified!

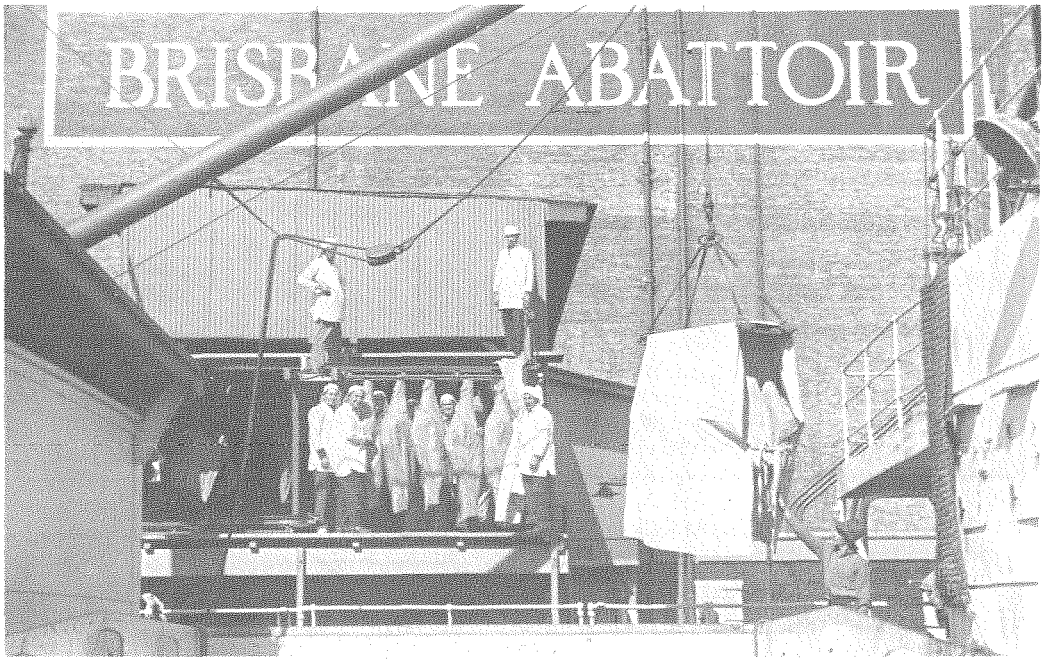
I suggest you plan to come expts. straight away & assuming no difficulties develop it would certainly be worthwhile trying a small shipment under the supervision of yourself or Holmes.

We are going to try hindquarters of beef but you know our place with quarters. We are having a box made (see fig.) rectangular. also a special cupboard ~~at~~ later cold brine — this to serve as a humidity control



That's all I have to say at the moment — I very much wish we could have a chat about it. The main point is — humidity control alone is going to be a difficult job

Part of a letter from Moran to Vickery, 28 April 1932; Moran, Hardy and others in the Cambridge group kept Vickery in close touch with the progress of their work on carbon dioxide as a preservative for chilled beef.



Loading the second experimental shipment of chilled beef, May 1934.

would not work adequately. Then his storage trials showed that the addition of CO_2 still did not prolong the storage life of the beef sufficiently unless its initial load of micro-organisms was very low. This led in turn to the necessity of identifying the sources of contamination in meatworks and then of launching an education program to enable the industry to achieve the rigorous levels of hygiene required.

In July 1933, CSIR released the news that Vickery's group had completed trials on a semi-commercial scale—the first laboratory in the world to do so—that confirmed the efficacy of CO_2 in prolonging the storage life of chilled beef. New Zealand had a parallel success when later that same month the first shipment of gas-stored chilled beef, sent from New Zealand aboard the *Port Fairy*, arrived in London in satisfactory condition.

The importance of the Australian group's contribution was its recognition of the vital role played in storage life by pre-storage factors; in situations where a particularly long storage life was required, they were almost as important as the use of CO_2. Vickery's thorough experimental approach enabled him to predict closely the maximum storage life of a particular shipment of meat under a given set of conditions. In February 1934 when the Section dispatched the first experimental shipment from Australia on board the *Idomeneus*, Vickery was able to predict its storage life accurately to within three days, as reckoned by a check experiment at Cannon Hill. The meat turned out excellently on arrival in London. The Section had just one regret: as a gesture of appreciation to the Blue Funnel Line that had provided the ship, the various primary industries of Queensland had made it their business to give the *Idomeneus* a heavy loading; the result was that she scarcely needed to call at any other port and made the voyage from Brisbane to London in 39 days, much faster than most ships on the meat run.

The first 18 months at Cannon Hill were a trying time. There were unexpected delays while the abattoir carried out alterations on the refrigeration plant; sometimes there was conflict between the policies of CSIR and the QMIB which inevitably led to tension. On a professional level, Vickery had to put up with considerable criticism of his slowness in getting down to experimental shipments and also the knowledge that in this respect he had disappointed his friends at the LTRS.

Throughout these months Rivett's frequent letters to him were unvarying in their

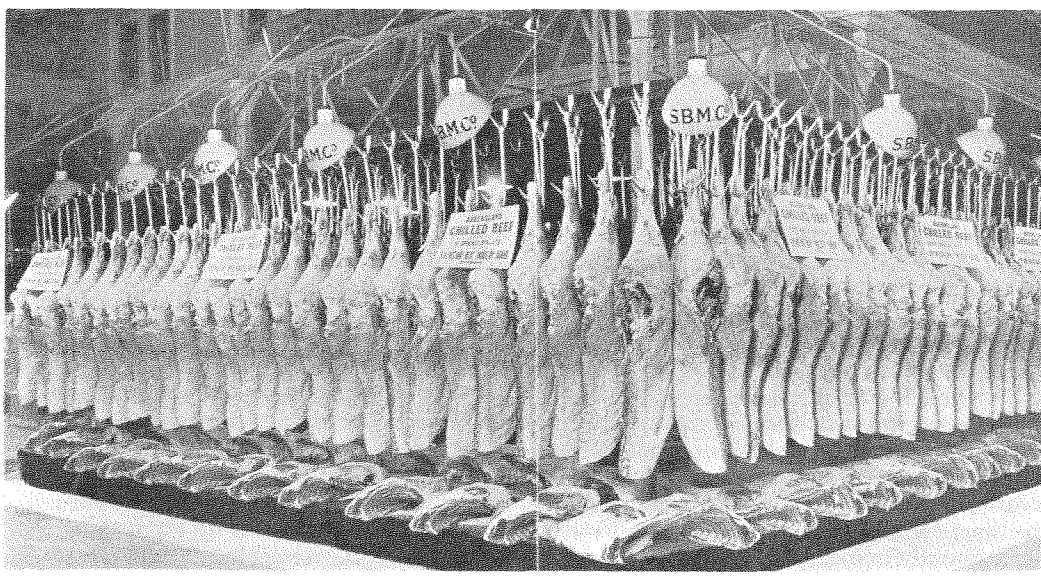
sympathetic interest and their faith in his decisions. At a time near the beginning of the project when Vickery was discouraged by the lack of progress, Rivett consoled him, 'I assure you that any such feeling of depression, while very natural, is quite unwarranted. As a matter of fact I regard a period of despair as being an essential part of the normal development of any scheme' (11 May 1932, 113/A13); and when Vickery felt the need to justify the time he had spent in examining all aspects of the CO_2 method before embarking on an experimental shipment, Rivett said firmly, 'As a matter of fact I understood the position quite well and I still feel that you were thoroughly justified in your determination to tackle the matter systematically and to build up from a sound basis rather than to jump into what at the best would be a haphazard empirical test' (26 July 1933, 113/A13). Rivett's encouragement during this time cemented a long-lasting relationship between the two men that was based on mutual trust and liking. They were similar types, tenacious and self-reliant and without any liking for frills.

The hard-won success of the work on chilled beef was significant for the new Section. It showed dramatically how much science could help the food industry and, since it was directed to an extremely interested industry willing to take advantage of new information, it led to the transformation of Australia's export meat trade. By 1938/39 one-third of Australia's beef exports were chilled and in that year the value was $1·6 million. In 1932 the price for beef in the stockyard was $20 a head, whereas by 1938 it had risen to $50.

A further, scientific outcome of the chilled beef project was the fact that it awakened the interest of W. J. Scott in the influence of water activity and other variables on the rate of growth of microorganisms. During the 1930s he published three articles on the subject in the CSIR Journal. In the late 1940s he was to return to it with further important results.

Strenuous time

The official working week was five and a half days but the Section's staff frequently worked over the weekends, for then they could have undisturbed use of the abattoir's large chiller rooms. There was often a need to study values for the cooling of a carcass over a three-day period, as this was the normal cooling time for an export consignment. By using the weekends they could work without any pressure from the abattoir management to have the chiller unloaded the following day. It was a remarkably useful arrangement. After he had left Brisbane, Vickery summed up the position of CSIR at Cannon Hill: 'With the



Some of the first consignment of Queensland chilled beef on display at Smithfield Market, London, March 1934.

technical staff at the Abattoir our liaison has been most happy and fruitful, and by avoiding those people at the top of the tree I have in the past managed to get practically everything I wanted without any difficulty. In certain of our large-scale experiments whole sections of the works were virtually transferred to our control for days at a time, and I have yet to find another organization where similar conditions could be obtained by scientific workers' (Vickery to Rivett, 9 May 1938, 113/A13).

As soon as the success of the *Idomeneus* shipment became known, the Section was overwhelmed with requests to furnish technical assistance in preparing various meatworks for the chilled beef trade. In March 1934, for instance, Vickery was reporting that he and Empey had visits to Sydney, Gladstone and Townsville ahead of them, as well as 'a considerable amount of work at this laboratory always in hand'.

The hardest request for technical help that they responded to, came from Wyndham in the north-west corner of Western Australia, a round trip of 16 000 km from the Laboratory; it was 33 days' journey from London and almost as far from Cannon Hill. Wyndham had some advantages for the development of a chilled beef trade and the Executive considered that its request for help should not be ignored: 'We are, as you know, pretty hard up', Rivett wrote to Vickery, 'but it would be worth a bit of a struggle to find the £50' needed to send an officer (11 Jan. 1934 113/A13). Scott, who had joined the Section only eight or nine months earlier, was selected to go. Every March or April a steamer left Perth for Wyndham loaded with the entire staff of the meatworks, going up to open it in readiness for the start of the season; the same boat would bring the whole staff back in August when the season was over and the works shut down. Scott took a train from Brisbane around half the continent to Perth, and then joined the boat with the rest of the meatworks contingent. For the two and a half months that he stayed at Wyndham helping to prepare a first shipment of chilled beef, Scott doubled as microbiologist and laboratory assistant, physicist and engineer: all the experimental work had to be done on the spot. Then he made the long journey home. This time he flew the first leg, Wyndham to Perth, but it still took five days; the pilot flew only during daylight hours and so each afternoon he would land at a different station homestead where he and Scott would receive bed and lodging for the night.

Such journeys may be quicker now but are still very much a part of the 'practice' for the food scientist. Members of this Division have recently visited the same area of Western Australia in the course of investigations on prawns and on distribution of fruit and vegetables in the tropics.

Cannon Hill

On the whole, the Section could have done a lot worse than to win space in the Brisbane Abattoir for its first home. In the massive brick building on the waterfront the CSIR laboratory and office were on the seventh floor, with a magnificent view over the Bay and well above the dust and sound and smell (factors that were to prove a bugbear at Homebush) of the animals being prepared for slaughtering. It was cold in the wintertime as the floors were of linoleum laid on concrete, and the lift broke down frequently—and of course never operated over the weekend.

The real stumbling block about Cannon Hill—as with many CSIR sites when a car was a rare possession—was its isolation and the difficulty of reaching it by public transport. In subsequent years when the centre of food research had shifted to Homebush, isolation heightened the impression Cannon Hill gave of being a back-water and increased the difficulty of attracting workers. After World War II, CSIRO became resigned to the necessity of providing transport of some kind in order to keep staff; it bought a covered utility truck. The truck made two passes through Brisbane's suburbs, 'the Valley run' and 'the Coorparoo run', and the members of staff were picked up at designated spots along the route.

Fruit investigations

Of the fruit investigations listed as urgent in Vickery's 1931 survey, the Section was able to initiate and carry out extensive research in all areas save those of the interstate carriage of Tasmanian apples and pears and the study of tropical fruits other than bananas. In the period we are looking at (1931–38), an astonishing amount of information was gathered about the storage behaviour of fruits and about the disorders

that may shorten storage life: it was found possible to provide an exact schedule of treatment that could ensure the successful export of pears and Jonathan apples, and to prescribe the conditions giving a maximum storage life for many of the important non-tropical fruits; to improve methods of export and long storage for citrus fruits by reducing mould wastage and cold injury; and to overcome most of the remaining problems in the local transport of bananas. Such work relieved the pressure of rapidly increasing production in the Australian fruit industry, by prolonging the season for local marketing and enabling growers to export more of their produce with little risk of heavy wastage.

Yet when the Section of Food Preservation was formed, the 'fruit group' numbered one and a half—S. A. Trout and W. J. Young, part-time—and in 1938 it numbered only four. The key to the exceptional productivity of the small group was no mystery: it lay in successful collaboration.

Strength of collaboration

All the successes in fruit research during this period were the results either of joint research or of research supported by a network of organizations. CSIR joined forces with the Victorian Department of Agriculture in work on the storage and transport of pome and stone fruits and, somewhat later, on the handling and storage of citrus fruits. The successful studies carried out by Holmes, Hicks and Huelin between 1932 and 1935 on 'boiling', chilling and mixed-ripe problems in bananas were assisted by the State Departments of Railways in Queensland, New South Wales and Victoria, by the Committee of Direction of Fruit Marketing and by State associations of growers and processors; work on squirter disease of bananas by Miss Shirley Hoette (1933–34) and by Mr R. S. Mitchell (1934–36) was done in cooperation with the Queensland Department of Agriculture and carried out at the Universities of Melbourne and Queensland. The bulk of the funds for the investigations was provided by the Commonwealth Banana Committee, out of money from a tariff imposed on Fijian bananas.

Early work by CSIR on citrus fruit (1928–34) was carried out mainly under the direction of the Citrus Preservation Committee and was limited to work on Victorian fruit. In 1934, however, CSIR was successful in persuading the Commonwealth Government of the need for a much more intensive attack on the problems confronting the citrus export trade, and as a result, the Government made available $20 000 to be spent over a period of five years. A Citrus Preservation Technical Committee was set up (1935) to plan and provide overall guidelines, whilst the Section of Food Preservation was made responsible for organizing the citrus investigations on an Australia-wide basis by coordinating similar work being carried out in New South Wales, Victoria and South Australia. The bodies cooperating with CSIR were the State Departments of Agriculture of New South Wales, Victoria and South Australia, the Waite Agricultural Research Institute and the Commonwealth Irrigation Station at Griffith. Here, too, growers and processors, both as individuals and in their associations, helped the investigators by giving their time and facilities and displayed a keen interest in the outcome of the work.

We may note that the man who took up the role of coordinator of the investigations was L. J. Lynch, a newcomer to the Section of Food Preservation who was soon found to have a particular bent for liaison work with industry. During his stint as citrus preservation research officer, Lynch pointed out the need for special facilities in the Gosford area for research on mould wastage (1935) and he started work in the Section on canning orange and pineapple juices (1938)—two initiatives that would be useful to CSIR at a later date.

That fruit storage research should have been an area singled out for collaboration arose from several factors, not the least of which was the sheer bulk of work needing to be undertaken. Coinciding with the establishment of the Section of Food Preservation, the Departments of Agriculture in the six States set up small groups to investigate the handling and storage of fresh fruit and vegetables; CSIR was sensitive to the need to avoid duplicating work or trespassing on the States' just preserves and close collaboration was a reasonable way of avoiding such pitfalls. This approach has continued and there has been a number of very effective CSIR–Department teams; the largest joint project to date is the Gosford Horticultural Postharvest Laboratory, operated with the New South Wales

Department of Agriculture.

Only a small fraction of the fruit research was carried out in Brisbane—none at all at the Cannon Hill Laboratory—and it certainly seems that J. R. Vickery would not have had a hope of organizing or controlling it to any extent, when he was strenuously engaged in experimental and extension work for the beef industry and also did all the administrative work at headquarters. However, he appears to have had no difficulty in directing policy and even kept in close touch with the implications and requirements of the research. With Professor Young, he sat on the controlling committees of the citrus and banana investigations and the two men composed the CSIR half of the Advisory Committee on Fruit Storage Investigations which supervised all the cooperative work with the Victorian Department of Agriculture. Young's high professional position and familiarity with earlier work in fruit research must have made him an invaluable associate.

Whilst Vickery's direction of policy in fruit research was thoroughly sound, such centralized control made administration slow and tortuous. One has only to look at, say, a file such as 'Melbourne Government Cool Stores—Construction Work 1931–37' (113/A5), to be appalled by the difficulty of administering a unit at such long range; the time span for actions, purchases and alterations was lengthened and once or twice a decision had to be reversed at a late stage, after a visit to the Stores had demonstrated that some proposed plan was impractical. Undoubtedly it would have been more efficient for someone on the spot to be responsible for all such calculations and decisions. But no one in the Melbourne group made any move to change things and Vickery seems to have regarded these details of administration as a legitimate part of his job—just as Rivett considered the examination of all appointments and items of expenditure throughout CSIR was a legitimate part of his. It would be a long time—some critics thought too long—before this style of personal administration would change.

Pleasures of collaboration

At the official level the joint arrangement between CSIR and the Victorian Department of Agriculture was a marriage of convenience, born of the inescapable fact that neither party had money or staff to set up a really effective fruit storage unit. I learnt from talking to Mr George Tindale, the Department worker in the team, of the pleasures and occasional hazards of what was from the start a most successful partnership.

After coming back from England, Sandy Trout had spent six months working on citrus fruit problems at the Biochemistry Department, where there was no one to set him on the right track and the only facility for cold storage trials was a single domestic refrigerator. Not surprisingly, he was tremendously impressed with Tindale's eight small experimental chambers. Tindale, for his part, was in his third year of work at the Victoria Docks and felt that he was now thoroughly familiar with all the Victorian fruits and the disorders to which they were susceptible. He knew the problems that should be attacked, but carrying out storage trials as a one-man show was a lonely and inefficient business and he welcomed the prospect of a partner as much as Trout did.

When they got together they were able to expand the work considerably. Now they had a double budget, a CSIR vote which they used for maintenance and a Department vote for the purchase of fruit. At the outset they used some CSIR money to change over the refrigeration system from manual to automatic, permitting more accurate control of temperature in the cold rooms. That in itself was a great advance. (As the source of cold for the new brine circulation system they pressed into service the large brine tank in which J. R. Vickery had carried out his meat-freezing experiments in the 1920s, and which had been standing unused since then.) When they began on storage trials, Tindale with his expert local knowledge and his car, would go out and obtain the fruit while Trout carried on the respiration work at the Cool Stores. In this way they pushed the work ahead with remarkable speed.

When F. E. Huelin, who like the other two had been in England on a CSIR overseas scholarship, returned at the end of 1932, they were able to add a very able chemist to the team. Huelin worked part of the time at the Biochemistry Department, bicycling down to the Docks at some risk to life and limb when he needed to retrieve his stored materials.

The first result of the association between the three was a much clearer understanding of the metabolism of pears after picking,

which enabled them to define precisely the conditions necessary for their normal ripening; this gave, for the first time, a scientific basis for the export of pears to England. Later the group was able to show how to obtain increased storage life for plums by using a dual temperature procedure, thus making it possible to deliver more varieties to overseas markets in good condition. During the course of a few years the group obtained detailed knowledge of the storage behaviour of all the main Victorian fruits, in air and in modified atmospheres. After the setting up of the Citrus Preservation Technical Committee it also carried out many of the analyses and storage trials on citrus fruits from New South Wales. The partnership broke up when first Trout and then Huelin was transferred to Homebush.

It was during this period in Melbourne that Frank Huelin first showed he had the defects of his virtues: he was a brilliant scientist, and absent-minded and unpredictable into the bargain. Throughout his career with CSIR anecdotes were to stick to him like filings to a magnet; none is more typical than the two exploits that date from his time with Trout and Tindale. When Huelin was working or thinking about his work he had deadly powers of concentration —sometimes too deadly for comfort.

The cold chambers at the Government Cool Stores had doors that could be unlocked only from the outside. Late one afternoon Huelin, Trout and Tindale were all working inside one of the chambers when Huelin must have decided to knock off for the day. Without warning his companions he dashed out, locked the door after him and immediately set off home. When the other two were ready to leave they discovered they could not get out. Trout hammered on the wall with a billet of wood but the two-foot-thick insulation deadened the sound: outside it was only the faintest tapping. Trout and Tindale had grown very cold indeed before a dock-worker, waiting for his train at the Station beside the Cool Stores, heard the noise and came to investigate. He was able to unfasten the door from the outside and release them. This episode must have stuck in Sandy Trout's mind. Many years afterward, he had the job of designing and supervising the erection of a laboratory and cold rooms in Queensland, later to be known as the Sandy Trout Food Preservation Research Laboratory. Trout's early experience had made him a 'belt *and* braces' man: he saw to it that his cold rooms all had fastenings that could be unlocked from the inside, and two escape hatches as well!

On another occasion Frank Huelin himself was the near-victim of his powers of concentration.

One day Tindale was at Doncaster, nine miles out of Melbourne, fetching peaches, when he noticed that the city was covered by a pall of smoke. It was a hot day, 38°C, with a howling north wind. As Tindale drove back towards the Docks he realized something big must be ablaze down that way, and by the time he reached North Melbourne he knew the Government Cool Stores were on fire. He hurried on, anxious about the fruit storage laboratory which was at one end of the quarter-mile-long building.

When Tindale got to the Docks the scene was spectacular. The Stores were surrounded by a cordon of police and every fire-cart in Melbourne was there. Whatever had started the fire, it was now in full career. Fifty cold chambers had been stacked with butter which had melted and then begun to burn as it poured out over the railway tracks that ran down the centre of the Stores: the railway line was a river of blazing butter that sent up clouds of smoke and stench. Great cheeses exploded like fireworks. Men were playing hoses onto the iron-clad walls of the buildings and when the water hit the hot galvanized iron it shot off again in jets of steam. The wind swept cinders into Victoria Dock, setting alight to the caulking in the decks of shipping tied up there. Tugs were going their hardest trying to get the ships out.

What with the noise and the heat and the darkness Tindale was nearly beside himself. He could see, however, that the fruit laboratory was still intact and firemen were spraying water over it: if he could manage to get inside and collect the files, that would be something saved. He told the fire chief that he wanted to get some important records out of the building.

'Alright', the man said, 'You can go in, but you'd better get in and get out as quick as you can. You never know when it might go up.'

Tindale groped his way in and went down the smoke-filled passageway counting the doors until he knew he was at the right one. He threw open the door. Inside, through the murk, he could just see a figure in the

corner of the room. It was Frank Huelin, lodged in the calm eye of the storm, doing some titrations.

'Good lord!' Tindale cried out, 'You're not going to stay here any longer, are you?'

'Why not?' said Huelin.

'Why not?! Because you'll get burnt to death—the place is on fire!'

'*Is* it?' Huelin eyed Tindale accusingly. 'Nobody told *me*!'

Chapter 4. Opportunity to expand

Somewhat to the surprise of overseas friends, the Section of Food Preservation (SFP) had no sooner got settled than it was planning to move again; 'I am sorry to hear you have to dig up the Brisbane lab. and replant it elsewhere', Eric Barnard of the British Food Investigation Board told Rivett in March 1935. What outsiders did not know was that such a move had always been on the cards and by 1935 planning for it had been under way for some time. It was only in the first flush of relief and optimism at obtaining reasonable temporary quarters that Cannon Hill had looked a likely centre for general food research—and perhaps even then, only to one of Sir George Julius's sanguine disposition. There was no room at Cannon Hill to increase CSIR activities; on the contrary, as the abattoir grew in size it needed most of the laboratory space for its own technologists. Moreover, it was not an ideal arrangement to have an industrial and a government organization so closely linked together; as a public-funded scientific body CSIR was bound to disseminate information even-handedly, whereas the Queensland Meat Industry Board (QMIB) chafed under the obligation to share with its business competitors the results of research that had cost it dear in money and cooperative effort. Eventually, Mr E. F. Sunners told CSIR that the Board was not prepared to go on giving the SFP the full use of its facilities under conditions as they stood.

Site for a permanent laboratory

Although the QMIB took the initiative in asking CSIR to leave Cannon Hill, the Executive had already considered the possibility of such a situation, which would inevitably have arisen as soon as it attempted to expand food research. Towards the end of 1933, faced by increasing difficulties in the cooperative arrangements at Cannon Hill and at the Victoria Dock Cool Stores, the Executive asked J. R. Vickery to formulate plans for the development of his Section and to recommend a site for a permanent laboratory. By concentrating most of its work at a centrally placed laboratory the Section could operate more economically and efficiently; some decentralization of effort would always be needed to cater for research on products growing in particular regions, but administration could be simplified and the pooling of resources and talents would enable the small staff to cooperate to the full.

J. R. Vickery was asked to weigh the pros and cons of establishing his headquarters in one of four cities—Melbourne, Sydney, Brisbane or Canberra. After consideration he recommended Melbourne as the most satisfactory general centre. He then undertook extensive discussions with the Victorian Department of Agriculture on the matter of a possible location for the laboratory, probably in one of Melbourne's outer suburbs. Although no formal proposals about a site were ever put forward it was more or less understood at the beginning of 1934 (and on record in the Executive Minutes) that the headquarters of food research should be established in Melbourne, the home of CSIR as of so much other Commonwealth Government activity of the period. Apart from the richness of its academic and intellectual contacts, Melbourne was a convenient centre for most major food industries and was ideally placed for research on the main commercially important fruits.

But the matter of a site was far from settled. Sir George Julius, with his eye for a bargain and his shrewd political sense, had been seduced by another offer from an abattoir, this time from that of the New South Wales Meat Industry Commission (later the Metropolitan Meat Industry Board) at Homebush Bay, Sydney. The offer seems to have been motivated by appreciation of what the Section had already contributed to the meat industry and by a healthy desire to be in on the ground floor in the event of any future developments.

The Metropolitan Meat Industry Board (MMIB) planned a change in the system of butchering at Homebush. Whereas previously, individual wholesale butchers had rented rooms on the huge abattoir site and

done their own slaughtering and selling, the MMIB now intended to centralize all operations under one roof, in order to supervise the handling and sale of meat to retailers. The new system would leave standing vacant a number of the former sheep-slaughtering rooms, gaunt cement-floored and cement-pillared brick buildings, separated from the sheep holding-pens on one side by a sunken roadway known as Ash Lane and from the carcass-hanging floors on the other by Mutton Lane, an asphalt road that carried heavy abattoir traffic. The Board proposed to lease several of these buildings to CSIR and to assist with the cost of converting them into scientific laboratories; the Commonwealth Government, however, would meet the major portion of the expense through a capital grant to CSIR.

It was Rivett who reported the development to Vickery (28 Feb. 1934, 113/A13): 'At our Executive meeting last week we had some discussion, at Mr Lightfoot's instigation, about the question of your future headquarters. I suppose it may be taken for granted that you will not want permanently to direct your Section from Cannon Hill and it would be well for us to look as far ahead as possible. There is a great deal to be said for Melbourne as a centre; but as Sir George Julius pointed out in the course of discussion there are possibilities in Sydney which should not be overlooked.

'Apparently the people at Homebush have made it clear that they would very greatly welcome your presence there; that they are in fact, prepared at any time to provide you with facilities quite equal to those at present available to you in Brisbane.'

The letter was written in good faith but was misleading, for the MMIB was not master enough in its own house to be able to keep any promises it might make concerning the date when the Homebush laboratories would be ready for CSIR. Nor was the site comparable with Cannon Hill—indeed it would be difficult to imagine a more unsuitable one. The premises offered to the SFP left little room for future expansion and they were buried in the middle of the abattoir, where scientists and scientific equipment alike would bear the brunt of its dust and noise. The attractiveness of the invitation had nothing to do with the purpose for which the buildings would be used but lay partly in the fact that, at a time when money was short, such an expedient would provide the Section's headquarters cheaply and partly in the conviction held by Julius that insufficient CSIR activity was taking place in New South Wales and too much in Victoria.

Rivett concluded his letter by inviting Vickery to give 'your views about Homebush as a headquarters'. But it was not a question of Vickery's views.

Although he was too much of a realist to make a crucial issue of the matter, J. R. Vickery continued for over a year to point out legitimate objections to the Homebush site and difficulties in choosing Sydney as a base for food research. Julius paid very little attention; there is evidence in a letter of April 1934 that even at that early date his mind was made up. Julius obtained the support of Mr G. D. Ross, the Under-Secretary for Agriculture in New South Wales, and the two of them were able to convince the Standing Committee on Agriculture that food research should be concentrated in Sydney. It would be fair to say that Vickery had no voice in the final selection of his own permanent headquarters.

In his general argument Julius was perfectly right; he had the good sense to see that there must be a balance in CSIR's activities between the different States, if it wanted to have broad contacts with industry and support from the general public. It is only a pity that his strategy was worked out at the expense of the Section of Food Preservation. Dr Vickery has said in conversation that he often found Julius helpful but knew too that he could be very ruthless; this overriding of the recommendation of an Officer-in-Charge is a sign of that high-handedness.

After the abattoir site was accepted, it proved to be a long and frustrating process extracting it from the MMIB, which itself was at the mercy of political delays and reversals. 'I am having a most unsettled time here at present', Vickery admitted to Barnard in a letter of December 1936, 'owing to the uncertainty in regard to the time of the proposed transfer to Homebush, and I shall be glad when the year 1937 is concluded since it promises to be a most difficult one.' The Section had at first expected to be in its new quarters by mid 1936 but the move was not accomplished until early in 1938. Costs proved equally hard to pin down, and the estimated capital cost of $20 000 for the conversion of the sheep-slaughtering

Sir George Julius, Chairman of CSIR, 1926–1945.

rooms into scientific laboratories fell short, by $20 000, of the final expenditure.

A reader accustomed to thinking that A. C. D. Rivett was the man who ran CSIR might well ask what Rivett was doing when a bad decision like the Homebush one was made. The answer that takes shape as one reads the early correspondence—between Rivett and Julius, Rivett and Vickery, Rivett and Hardy—is that David Rivett was by no means a masterful personality, able to enforce his ideas on others. The only power he possessed an inordinate share of was that of conciliation. He was an extraordinarily good mediator, candid and tactful, who did not hesitate to approach even the most aggressive opponents, to go on and on looking for common ground and narrowing the distance between them, until in the end he often secured a successful outcome. Whatever ascendancy he had on the Executive—and it rarely prevailed against opposition from Sir George Julius—grew out of his three great qualities, his integrity, his deep concern for his scientists, his unfailing attention to detail. 'I had a very warm relationship with him', Dr Vickery says of David Rivett, 'he was a most understanding man, very simple, patient, idealistic.' He was always within reach of his Chiefs, he knew what they wanted, he would fight for them—but he would not always win.

In the particular case of Homebush it is hard to judge how far Rivett sympathized with Vickery. He must have been aware of the difficulty of conducting experimental work under the conditions at the abattoir, yet he tacitly went along with Sir George's plans. Rivett had such a dislike of ostentation that, later on, when it became clear that the SFP could function efficiently even on the Homebush site, the unpretentiousness of the place began to please him.

In 1939 the Executive wanted to present Mr S. M. Bruce with an album of photographs of CSIR laboratories and activities to bring him up to date with the progress of 'his nearly 13-year-old child'. At the time, E. W. Hicks was Acting Officer-in-Charge of the SFP, in the absence of Vickery overseas; Hicks demurred at sending a photograph of the exterior of Homebush because 'we have the sewer vent and the abattoir boilermakers' shop immediately outside the laboratory and there is so much old iron and other junk near our front wall that it seems impossible to get a photograph of the building that would be at all presentable.' Nevertheless Rivett insisted: 'Despite what you say about lack of presentability of the building, I really think that something to give an idea of it would be useful. I would rather like Mr Bruce to get some idea of the way in which we try to fit in with other organisations, even though the resultant external appearance may be imperfect' (letters of Feb. 1939, 113/A13a). Thus, the fact that Rivett and Julius had not wrung from their Minister a decent set of premises, a failure that at a later more prosperous stage of Australia's development might be branded as a sign of amateurishness or lack of drive, was worn like a badge of good conduct.

The Homebush laboratory

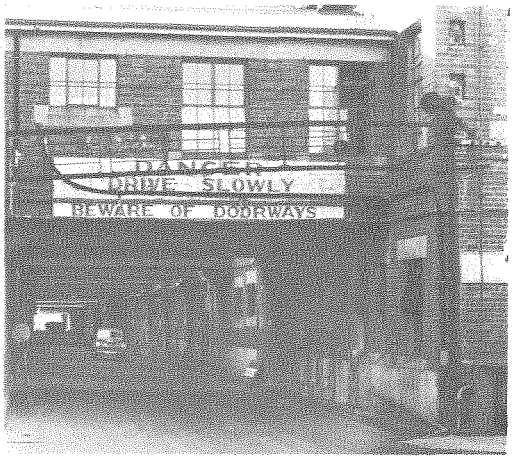
'At any rate, we lost that battle', Dr Vickery comments of the general low-keyed dispute over the site of a permanent food research laboratory. 'I couldn't say it was impossible being in Sydney—but it wasn't the most convenient.' The inconvenience of

Premises of the Section of Food Preservation at Homebush, N.S.W. (photograph taken February 1939, to present to S. M. Bruce): *1*, main building; *2*, workshop; *3*, library; *4*, office of Officer-in-Charge; *5*, General Office; *6*, Mutton Lane; *7*, Ash Lane; *8*, Section's utility truck.

Homebush was extreme; indeed it was officially recognized by the granting of a District Allowance or, in plainer terms, the sum of 15 cents per man per week, to help with the cost of transport. The Section was held in close embrace by the meat industry but was decidedly remote from other branches of the food industry and from other research contacts. A single bus operated two trips daily, one morning, one evening, to Homebush Station; only a few officers owned motor-bikes or cars. If a member of staff needed to visit a food-processing plant or the University, he generally walked the first mile or so to the nearest bus stop or railway station. The Section did own an official vehicle, a utility truck, but it was as a rule far too usefully engaged in other work to be employed ferrying people around. On one occasion Vickery did send the utility to Homebush Station to collect a passenger: it was to pick up Sir George Julius who was making an official visit to the laboratory. Julius later hinted rather strongly that a more dignified mode of transport was owed to the Chairman of CSIR.

Apart from the isolation of Homebush there was the problem of contamination by dust and interference from noise. Dust blowing across Ash Lane from the yards where live sheep were held awaiting slaughter settled everywhere and made it a perpetual battle to keep experimental materials clean. Vickery, who was not a man much given to

Main entrance.



Looking down Mutton Lane; the flight of steps leading to the main laboratory building is at the far left.

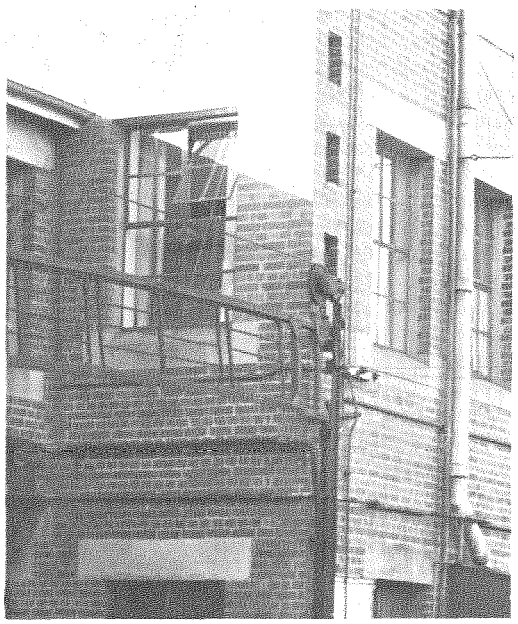
complaint, penned letters of unusual vehemence to CSIR and the MMIB, seeking relief from the noise of the boilermakers' workshop in front of the laboratory and the noise and vibration arising from the stream of motor vehicles, mostly heavy solid-tyred meat and skin lorries, which thundered along Mutton Lane as if through a tunnel, at an average rate of one per minute. Although these nuisances were diminished they were never entirely removed.

No one could say they had fallen on their feet, yet far from being demoralized by the surroundings the staff at Homebush developed great cohesiveness and spirit. Over the course of its 23 years' sojourn the Section was able to attract first-class scientists to work at Homebush and it maintained or even enhanced the high level of performance it had put up in earlier years. This would have been hard to accomplish if the laboratories had not been efficiently set up and adequate for their purpose.

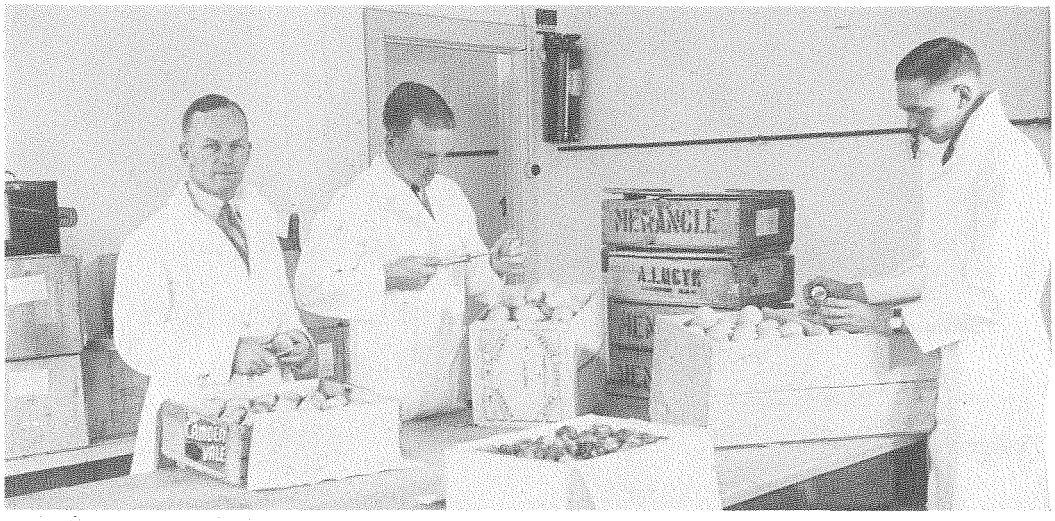
Conversion of the premises had followed designs drawn up by Mr William McDonald of the abattoir staff, working in conjunction with Vickery. The best use had been made of the space available, which at this stage consisted of one two-storey building, two closed-in bridges spanning Mutton Lane, and two sheds on the farther side of Ash Lane. The ground floor of the principal building, with six cold rooms, was equipped for meat and fish work and the first floor, with nine cold rooms, for fruit storage and engineering investigations. An office for senior scientists and the library were housed in the two fly-over bridges, which had originally been used to transfer carcasses from the slaughter floor to other processing areas in the abattoir. One of the two sheds was to be used as a fruit juices laboratory, the other as a workshop and to house the gas plant. In the same generous spirit as the QMIB, the MMIB made an agreement to supply water, steam and sewerage free and refrigeration at a reduced rate, as well as providing an annual grant towards the cost of the investigations.

A broader program

The Section occupied the new laboratories in March 1938. In order to satisfy Queensland agricultural interests, one scientist, A. R. Riddle, and his assistant D. F. Ohye, had been left at Cannon Hill to complete the remaining work on chilled beef—mainly an attack on the problem of loss of bloom, which was still causing Australian exported chilled meat to sell at slightly lower prices than its overseas competitors. As a result of this and other contingencies, the move to the New South Wales State Abattoir had the ironical sequel that no major investigations on fresh meat



J. R. Vickery's office; a boilermakers' shop was diagonally opposite until moved to another site in April 1942.



S. A. Trout (*left*), E. G. Hall and M. Martin (*right*) working in the fruit examination room.

were ever carried out there. The joint work on fruit in Melbourne continued, but S. A. Trout was transferred to Homebush to start collaborative investigations with the New South Wales Department of Agriculture. The man the Department assigned to work with Trout was a new graduate, Mr E. G. Hall, who later transferred to CSIR and became a valued leader in fruit storage research.

At Homebush, Vickery's aim was to build up staff and facilities to work on a much wider range of problems than had previously been possible. In order to restore balance to a program which up till then had consisted mainly of applied investigations, he intended to emphasize 'developmental rather than preventive measures'—research designed to provide fundamental data for the more efficient operation of all branches of the food industry. With this in mind he took the first steps towards grouping most of his workers under scientific disciplines—physics, microbiology, biochemistry and plant physiology—rather than as teams working on particular products. He also intended, particularly in meat and fruit investigations, to give more attention to problems of storage for local marketing.

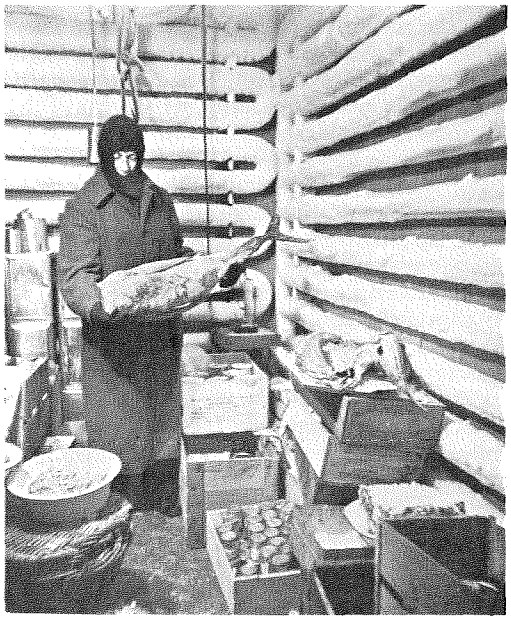
The Section started research on two further commodities, fish and eggs. In 1935 in response to a request from the Commonwealth Government, CSIR had undertaken responsibility for research on fish preservation and storage, which was by then acknowledged as an urgent national problem; a young South Australian graduate, C. C. Kuchel, had been sent to Torry Research Station, Aberdeen, for further training and experience. Provision had now been made in the new laboratories at Homebush for studies on the freezing and storage of the main commercial species of Australian fish, work which would be undertaken in collaboration with the recently established Section of Fisheries. In addition, the time was overdue for a comprehensive attack on the problems of egg transport and storage, as surveys of the out-turn in England of Australian eggs had revealed serious wastage caused by rotting.

For the rest, work would go on or be extended further in all the areas already being investigated; questions concerning the possible use of ozone as a preservative waited answers, and a study was needed of the physics of the cooling of a wet body, a topic that had general application to the cooling of meat.

Overall, the Section was now committed to extensive and potentially most useful investigations. It was still limited, however, by considerations of money and even of space. There was practically no room for expansion in the existing buildings and the accommodation so far made available would suffice for only about two years. The annual budget was still not generous, even in relation to other CSIR Divisions, and much of it still came from outside sources. According to official accounts, by the late

L. Brown (*left*) and W. A. Empey, working in a laboratory kept at −0·05°C, prepare samples of fish muscle to examine changes during frozen storage.

1930s Australia was emerging from the Depression; nevertheless, the individual found himself still fairly short of money,



Inside a frozen storage room. There were some 15 controlled temperature rooms at Homebush with temperatures ranging from −30 to +50°C.

whether for research or personal needs. After a round of reclassifications in June 1937, the Section's highest paid Research Officer earned $1096 a year, whilst the Junior Laboratory Assistant earned $324 and the typist $312. The salary of the Officer-in-Charge, who was a Principal Research Officer by now, was examined again in June 1938 and was advanced to $2000 a year.

In the light of these figures the monetary value of the Section's work to date, as quoted in the Executive's recommendation to the Minister on J. R. Vickery's salary, shows up favourably. The Executive stated that the value to Queensland alone of the investigations on chilled beef and on bananas was certainly not less than $1 million a year.

A larger staff

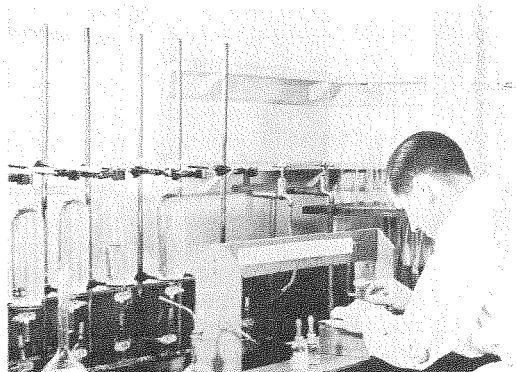
The research staff that came to Homebush in March 1938 numbered five, along with two or three assistants: Vickery, Empey, Hicks, Lynch and Trout; Scott had departed to study at the Low Temperature Research Station. It was the first time that most of these colleagues had worked together; some barely knew each other. E. W. Hicks was newly back from two years at Cambridge; L. J. Lynch had moved from the room he had been occupying at the New South Wales Department of Agriculture to take charge of

J. Moser (*left*), A. R. Prater and N. Watson (*right*) working in the eggs laboratory.

the fruit juices laboratory.

There was also an infusion of new blood. Within a few months, J. F. Kefford, C. C. Kuchel and P. R. Maguire had joined the Section. Kuchel, who came back from Torry to initiate fish investigations with W. A. Empey, stayed for only three years before going into industrial research, but Kefford and Maguire made their careers with CSIR. Kefford was engaged to work on the ozone project, but before long had gone over to citrus research and canning technology; he played a leading part in several new developments of the Section's work after the second world war. P. R. Maguire joined the Section as a mycologist, but he had a second string to his bow, that of scientific photographer, and gradually this role claimed much of his enthusiasm. In later years he became the official Photographer of the Division of Food Preservation. Maguire considered himself a maker of prints and transparencies on strictly scientific subjects; yet this present history would be much the poorer if he had been only that, for it is illustrated largely with his photographs. The excellent documentation he has provided of the years at the Homebush laboratories reflects his acceptance of the camera's role as witness and recorder.

While Hicks was still in England, Vickery had made up his mind to place him in charge of the Physics Group on his return, and to make him Deputy Officer-in-Charge.



J. F. Kefford determining the concentration of ozone in samples of air for his investigation of the use of ozone in controlling microbial growth on meat.

Annual expenditure ($) of CSIR's major Divisions and Sections, from the establishment of the Section of Food Preservation in 1932 until they were placed on a war footing in 1940*

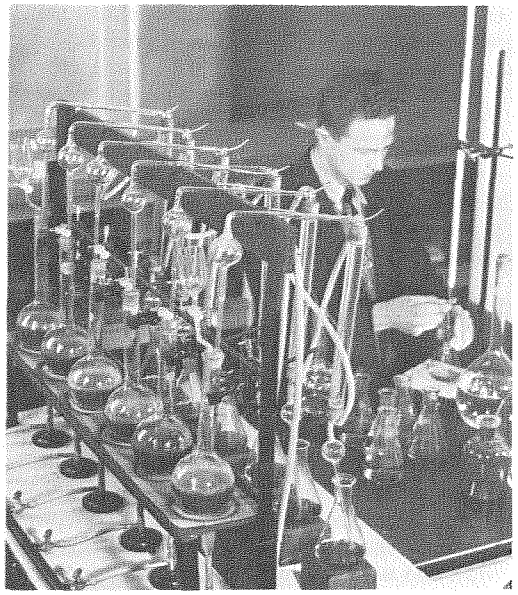
	1931/32	1932/33	1933/34	1934/35	1935/36	1936/37	1937/38	1938/39	1939/40	Av. over 9 yr
Plant Industry	29 260	31 750	34 180	48 280	53 040	59 050	61 800	65 395	76 015	50 975
Forest Products	15 865	18 890	21 070	27 795	40 680	43 020	48 440	50 495	65 500	36 860
Economic Entomology	30 955	28 160	24 580	27 730	33 150	36 370	38 695	42 815	46 160	34 290
Animal Health and Nutrition	21 815	22 430	19 105	25 940	25 910	24 620	55 300	35 880	48 720	31 080
Food Preservation	6 025	7 650	9 160	14 070	17 410	16 470	22 675	28 110	34 125	17 300
Soils	8 275	8 165	10 310	10 050	11 500	13 580	16 060	19 130	21 790	13 210
Radio Research	8 080	7 695	9 415	10 195	9 390	9 775	10 830	11 820	10 175	9 710

*From *CSIR Annual Reports*. Table includes monies expended from outside contributions, but it does not include capital expenditure.

Main contributions ($) from outside sources to the annual budget of the Section (later Division) of Food Preservation, from its establishment until the end of World War II*

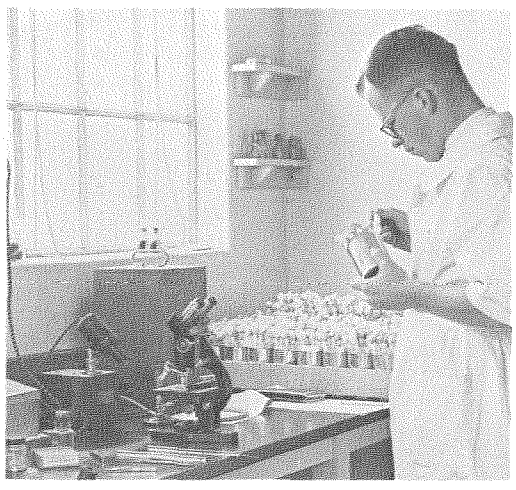
Contributors	1931/32	1932/33	1933/34	1934/35	1935/36	1936/37	1937/38	1938/39	1939/40	1940/41	1941/42	1942/43	1943/44	1944/45	1945/46
Australian Meat Board Metropolitan Meat Industry Board Queensland Meat Industry Board	140	872	438	500	878	580	4646	8258	3896	3516	3850	3700	3450	3450	3700
Commonwealth Department of Commerce and Agriculture (now Primary Industry)	—	—	—	—	—	—	—	—	—	—	—	1240	5760	5644	2460
Egg Producers' Council	—	—	—	—	—	—	—	900	1032	1330	1516	980	920	160	180
Miscellaneous	654	684	1456	3104	3372	710	—	—	48	152	1376	1570	20	424	690
N.S.W. Department of Agriculture	—	—	—	—	—	652	5060	786	2000	2000	2000	1600	1600	1600	1600
Rural Credits Development Fund	6980	5766	4000	4000	4000	4000	4000	4000	4000	4000	4000	9000	7500	7500	7500

*From *CSIR Annual Reports*.

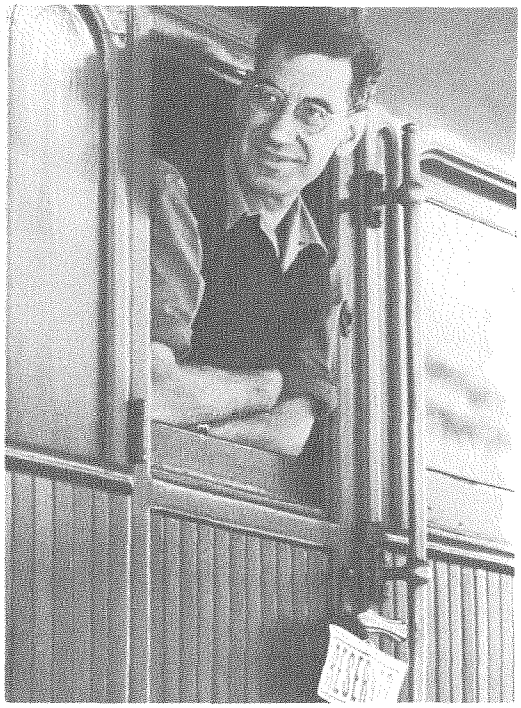


C. C. Kuchel working on Kjeldahl distillations as part of studies on fish preservation.

Physics was the discipline that Vickery regarded as most useful of all in solving the problems of food science. Given such a brief, which was related at some point to nearly all of the Section's investigations, E. W. Hicks was able to develop his exceptional talents for making cross-disciplinary connections that would be fruitful for solving problems in food science.



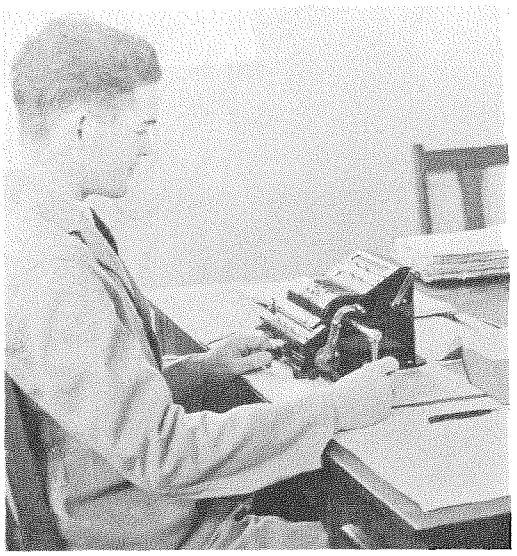
P. R. Maguire examining cultures for growth of fungi as part of the study of diseases in stored fruit.



E. W. Hicks photographed about 1947 in the Dynamometer Car, a specially fitted railway carriage used in investigations on rail transport of perishable foods.

Hicks stood out even in a Section that was noted for the versatility of its staff: he was physicist, engineer, mathematician, statistician, editor and general scientific adviser to his colleagues. Hicks treated mathematics like his mother tongue and often showed a disconcerting preference for figures over words. A fellow scientist told me of an incident that happened when he was in Hicks's room one day. The phone rang and Hicks picked it up. Muttering 'Hicks' into the mouthpiece, he put the receiver to his ear without another word and listened for a long time, not saying anything, to the caller on the other end, who apparently wanted some advice or reassurance about the design of an experiment. At length Hicks laid the receiver down and picked up his slide rule; he slaved over his calculations for several minutes, then he picked up the phone and spoke. 'Yes', he said with evident satisfaction. He set the phone back in its cradle.

Hicks must have been a gift to any frugal-minded Officer-in-Charge for he asked



J. D. Mellor using a Brunsviga calculator for work on statistical problems.

for neither an elaborate laboratory nor sophisticated equipment. He worked in the days before computers were in common use but it is doubtful if he would have seen the need of one: after all, he had a slide rule and a hand-cranked Brunsviga calculator. In later years Hicks was possibly the only scientist whose style was not cramped by the overcrowded conditions at Homebush; all he needed for his work was room enough for a table and a chair.

Women in food research

Until World War II, food research in Australia, like other branches of science, was almost entirely a male preserve. When the position to which W. J. Scott was appointed was being advertised in March 1933, Vickery reminded Gerald Lightfoot, Secretary of CSIR, that it was 'extremely advisable that the appointee be a male graduate', owing to the nature of the work involved at the abattoir. The only women to work on the scientific side were one or two graduate students from the University of Melbourne who assisted in fruit investigations, most notably Miss Shirley Hoette who helped to discover the causes of black end and squirter disease in bananas.

In the early years, however, two women did administrative and clerical work for the Section, one almost from the time that it moved into Cannon Hill; they were Miss Ella K. Todd and Miss Ellinor Archer. Miss Todd was one of a trio of amiable and efficient sisters, two of whom contributed to the development of CSIR; her elder sister, Hilda, who ran CSIR's Brisbane office, introduced her to A. C. D. Rivett. It was symptomatic of the times that Miss Todd had

Marjorie Brotherton (*left*) and Kit Todd in the General Office. Shelves around the walls held the overflow of books and periodicals from the library.

been out of work for three years before she obtained her part-time job with the Section. She began in August 1932 and for some years did all the typing on her own machine, a Royal portable. When the Section moved to Homebush Vickery asked Miss Todd if she would transfer. The move meant leaving her family to whom she was much attached, but Miss Todd thought of those three out-of-work years and told her boss that she would come to Homebush—if CSIR appointed her full time, on superannuation. CSIR agreed.

In the General Office at Homebush, of which she was for some months the entire staff, Miss Todd carried on the work of several people. She answered the telephone, did the typing, made the tea, purchased and wrote off stock, looked after the leave records and the issuing of permits to drive the truck. She was records officer and storeman, librarian and pay clerk. Over the following years the Section acquired people with specialized training to take over some of her multiple jobs, but Miss Todd remained in charge of the General Office until she retired in June 1953.

Miss Archer was involved with the SFP only in a minor role for her full-time job was as Librarian at CSIR Head Office, Melbourne. Nevertheless, she served also as Secretary to the Citrus Preservation Technical Committee throughout its existence. Miss Archer was a conscientious Secretary and not above voicing her own views when occasion seemed to demand it. Once, in November 1937, she was provoked to stick up for the equality of women. When J. R. Vickery needed to fill a technical position that carried a salary of $250 a year, which was all that the Citrus Committee's budget would run to, he suggested Miss Archer should advertise for a woman graduate. Miss Archer disapproved: 'I am afraid [it] is not a very good suggestion. I can hardly think it would be a fair thing to offer the very meagre salary of £130 per annum for work of this type. . . . In any case I hardly think it was necessary to restrict the recommendation to a "woman graduate" ' (Archer to Vickery, 23 Nov. 1937, 113/A17b). The cause of feminism won a Pyrrhic victory when, even at that salary, a man took the job.

The first female scientist to obtain a permanent position in the Section was a Melbourne graduate, Miss Lucey R. Alford, who worked on the egg investigations

Lucey Alford photographed in 1954, when Miss Alford was a microbiologist with the Metropolitan Board of Works, Melbourne.

between 1938 and 1940. She resigned with considerable regret when family commitments obliged her to move to Melbourne. Miss Alford was a popular addition to the staff at Homebush but her presence in the laboratories induced a change. At the time that she came to the Section, swearing was all the rage. Her fellow scientists decided they had better find a substitute for the more usual adjectives and Maguire suggested the word, 'fluffy'. Fluffy it was. For a while everything was fluffy and there was a real danger that a new oath, and a sham one at that, would enter the language. The fashion passed but the word then became attached to its originator, presumably as a terrible semasiological revenge: for years afterward Maguire had to bear the nickname of Fluffy instead of his usual ones of Maggie or Mig.

One woman contributed to the development of food research from a position that combined a training in science with a career in one of the professions traditionally reserved for women. This was Miss Barbara E. Johnston, the Section's Librarian from 1940 to 1975. Miss Johnston and Miss Archer, both women who built up excellent specialist libraries for CSIR, were qualified

in science when they took their jobs but needed to train themselves in librarianship. This was not such a perverse way of going about things as may appear, for even in 1939 when Miss Johnston joined CSIR, general training in librarianship was elementary and no tuition at all was offered for work in special libraries. The fact that Miss Johnston was scientist first and librarian second seemed to fit her uncommonly well for her job. Her scientific background gave her insight into what scientists wanted from their library and helped develop her knowledge of the extremely diverse literature of food research.

During the second world war the Section (by then a Division) acquired several female Technical Assistants and a senior female scientist, Dr Thelma M. Reynolds, who was seconded from the Division of Forest Products to lead the Section working on dehydration of foodstuffs. Dr Reynolds stayed with Food Preservation after the war and, in the 1950s, helped to elucidate the chemical reactions leading to non-enzymic browning.

Although women have become a familiar sight in the laboratories of CSIR/CSIRO, there has been little real change in their position since the 1930s. Few have achieved prominence and comparatively few have reached senior positions. In the Division of Food Research at present, out of a total of some 80 officers with the rank of Research Scientist or higher, five are women. In other Divisions the ratio is lower: in 1973/74, the last year in which staff lists were published in the *CSIRO Annual Report*, 27 women are listed out of a total of 800 scientists throughout CSIRO with the rank of Research Scientist or above.

Time runs short

The year 1939 marked the end of a period for the Section of Food Preservation, a period during which a creditable amount of useful work had been accomplished with very modest resources. Now many felt that war was imminent and were dubious about the role of the Section in such a contingency; might it not be better to disperse the staff so that its members could put their training in chemistry or physics or bacteriology to more direct use? In 1939 food research was not thought to have particularly high priority in the war effort.

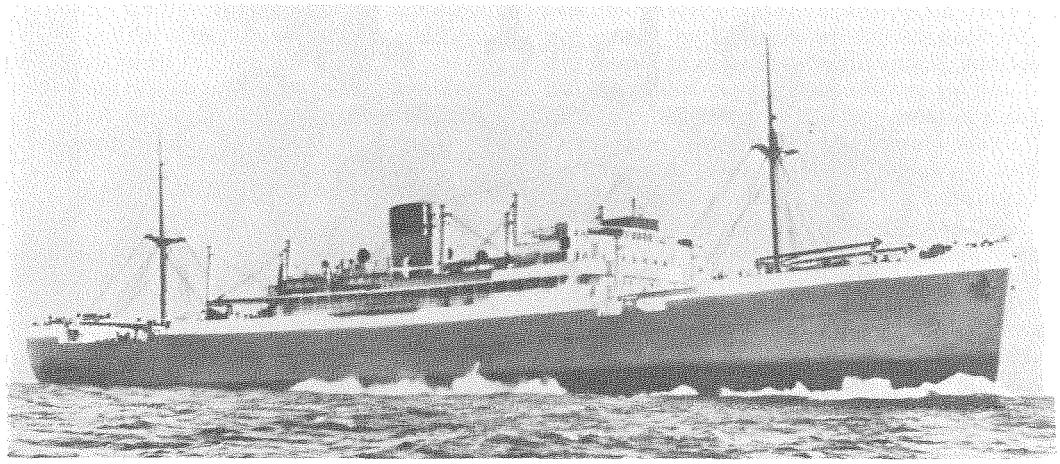
Two influences that had been powerful in shaping the Section were now on the wane, that of the economic Depression and that of British food science, as maintained through the Section's close relations with staff of the FIB.

The austerity of the Depression had made a deep and in some respects a lasting imprint on the Section. It meant that for a number of years no fundamental work could be carried out save that immediately needed for applied investigations. It also inured the Section to uncomfortable quarters on premises owned by others and often built for other purposes. No doubt that side of it was bad. On the other hand, the conditions of the Depression had provided the Section with major problems whose solutions were eagerly awaited by responsive sections of industry and had given members of staff the opportunity to develop adeptness in achieving results through collaborative effort, with the State Departments of Agriculture, with the universities, with industry—sometimes with all three at once. The Section was to retain this faculty.

Although the influence of British food research continued into war-time it became just one among many, whereas during the 1930s it had been paramount in shaping parts of the Section's program, its scientific attitudes and even, as J. F. Kefford has pointed out, the social atmosphere of its laboratories.

Collaboration with England had been particularly important to the Section in its transport studies. The isolation of Australia would have rendered them ineffectual, save that the Section could count on a working partnership with vitally interested colleagues in England and on the use of technical facilities at laboratories controlled by the FIB. Collaboration was so close that in 1938 Vickery was able to speak of 'the almost weekly new cooperative tasks our Section and the FIB undertake in problems of the export of apples, pears, citrus fruits, chilled beef and eggs' (Vickery to Rivett, 18 June 1938, 113/A13). It was as a result of the number of experimental shipments arranged by the partners between 1932 and 1939 that conditions were specified for the successful shipment of all the major perishable foods.

Fitting out the experimental ships was a colossal undertaking for the small staff of the SFP. The men could not set to work until the ship had finished discharging cargo and then frequently they had only 24 hours in which to accomplish the task. They



M.V. *Port Jackson*, which from 1937 until the 1960s served as a model for the design of ships carrying refrigerated cargo.

worked around the clock, crawling up and down ladders and through air tunnels, installing thermocouples and other equipment in the refrigerated holds and 'tween-decks. The ship would be due to sail before they emerged with all their gear and went ashore as the last gangway was pulled up.

The objective of all this effort was to apply science in the shipping industry to a degree and at a pace that had never been attempted before. It says a great deal for the cooperation of the shipping companies that the English and Australian team was able to achieve so much. Under the guidance of the British physicist–engineer, A. J. M. Smith, they recommended appropriate designs for ships' refrigerated holds and for the pattern of cargo stowage; the culmination of much of the work came in April 1937 with the successful voyage of the M.V. *Port Jackson*, carrying an experimental shipment of apples and pears. This ship, which embodied all Smith's ideas, established the design and operation of ships' refrigerated cargo spaces until the mid 1960s when containers began to revolutionize marine transport.

Chapter 5. Food research in war-time

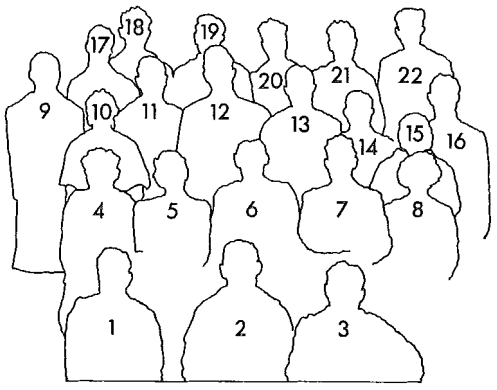
One important justification for the existence of a national scientific organization is that it should have the right skills at the right time, so that a country can rely on its help in any emergency, whether civil or military, where scientific expertise is important for survival. CSIR proved its worth during World War II. Although the reader may be more aware of the contributions of the Division of Aeronautics or the Radiophysics Advisory Board, food research played a part, mundane yet vital, in the war effort.

The second world war made exceptional demands on the food-growing and processing industries in this country; the situation became critical after Japan entered the conflict in December 1941, for this led to a vast expansion in Australia's defence forces and to the arrival of large numbers of American servicemen in the South-west Pacific area. Australia was required to produce enough food, over and above the requirements of her own population, to meet practically all the demands of the Allied forces in the South-west Pacific while continuing to send to Britain large supplies of meat, eggs, butter and cheese. Instead of feeding between 7 and 8 million people, Australia now found herself committed to feeding somewhere between 12 and 13 million (Mellor 1958).

New objectives

In August 1939 an experimental shipment of chilled beef which the Section of Food Preservation had on board the S.S. *Moreton Bay, en route* to England, was frozen down in mid voyage, following instructions from the British Ministry of Food that for the

Staff of the Division of Food Preservation stationed at Homebush, 2 May 1940.



1, G. Greethead; *2*, J. Hay; *3*, J. Lipscombe; *4*, M. Brotherton; *5*, B. Johnston; *6*, J. Vickery; *7*, E. Hicks; *8*, E. Todd; *9*, M. Martin; *10*, Mrs Mersh; *11*, J. Kefford; 12, W. Empey; *13*, C. Kuchel; *14*, M. Taylor; *15*, Mrs Walker; *16*, L. Lynch; *17*, S. Trout; *18*, P. Thompson; *19*, E. Fisher *20*, D. Ohye; *21*, F. Dickson; *22*, J. Mellor.

duration of the war all imports of fresh meat would be frozen in order to save shipping space and make distribution easier. It was a sign that the Section's long-time pre-occupation with problems of cold storage was now about to be challenged.

The full potential of cold storage had been revealed in World War I; then it had been the key to feeding the British nation, when England was virtually cut off from outside supplies, and had even enabled Britain to supply fresh meat for the rations of all Allied troops fighting in continental Europe. But cold storage would not answer the different problems of World War II. Loss of shipping through submarine warfare had led to a shortage of refrigerated cargo space, which was now quite inadequate for the normal transport of foods to Britain. Equally relevant, most of Australia's increased food output was intended for the Australian and American soldiers fighting in the tropics, in rugged and isolated regions

where the keeping of refrigerated supplies was out of the question. There would be an urgent need for new methods of preserving a wide range of foods including some that Australia had not previously considered preserving at all.

'Powerless until something went wrong'

The Section did not become involved in the war effort straight away; indeed, the declaration of war was followed by a lull that lasted for over nine months. The SFP received no directions from the Executive about any needed changes of program and it was ignored by the Government. The trouble was, as J. R. Vickery commented, that they were fairly powerless until something went wrong. A tendency to regard the food industry as expendable had so far prevented the Government from attempting to control it or seek any expert technical guidance; at this stage of the war, too, communication between the various parts of government was quite inadequate for technical information to flow freely between them. More than once, the SFP learnt about a particular problem, which it was competent to answer, only when a government department had already put in several months working on a solution.

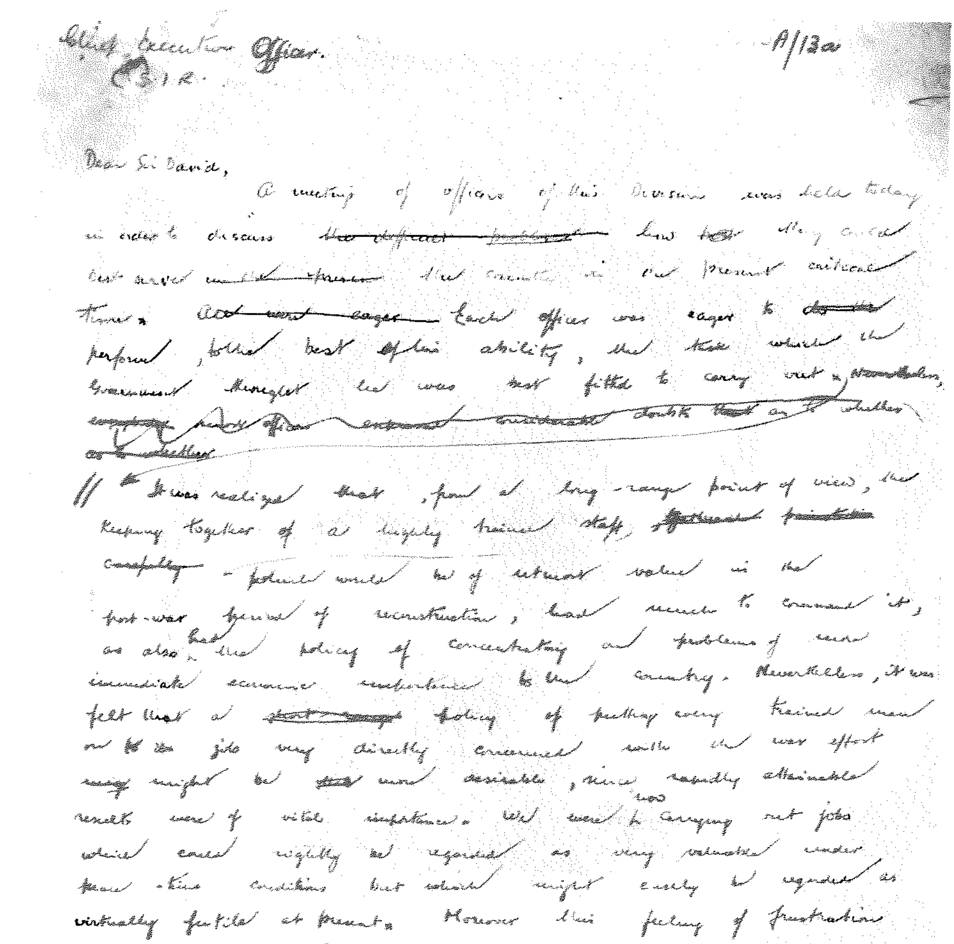
On 2 May 1940, no doubt anticipating the important part they would play in the forthcoming period, CSIR announced that the Sections of Aeronautics, Fisheries, Food and Radiophysics had been given the status and title of Divisions; J. R. Vickery was informed that 'The position which you occupy will therefore be known in future as "Chief of Division" .'

The officers of the newly fledged Division of Food Preservation (DFP) met a few weeks afterward 'to discuss how they could best serve the country in the present critical time' and to express their disgust at having been so little used in the war effort up till then. 'It was felt that a policy of putting every trained man onto a job very directly concerned with the war effort might be desirable, since rapidly attainable results were of vital importance. We were now carrying out jobs which could rightly be regarded as very valuable under peace-time conditions but which might easily be regarded as virtually futile at present. Moreover, this feeling of frustration was enhanced by the arbitrary rejection by certain Commonwealth Government bodies of scientifically and practically sound schemes put up by the Division on matters such as the saving of shipping freight space, and also by the almost ostentatious neglect by the same Departments, of the resources of this Division in consultation concerning the preparation, handling and transport of food intended for consumption by the fighting services and by British civilians. The Commonwealth authorities controlling these matters may be doing a perfect job, but judging from what little we have heard, we have rather serious doubts and so we believe that even on a very modest scale, we could be of some value' (Vickery to Rivett, n.d., 113/A13a; letter drafted but not sent). Their Chief passed on the drift of these sentiments in a somewhat milder letter (7 June 1940, 113/A13a) in which he also expressed the Division's resolve to exercise strictest economy in expenditure and staff, to work longer hours without additional pay and to forego the forthcoming rise in the cost of living allowance. With the approval of Government, the Executive gladly accepted each of these offers except that of foregoing the increased allowance, as such a step would involve administrative difficulties.

Within two years the staff of the DFP was certainly getting all the extra hours of work it wanted but the resolve to economize had become a dead letter, overtaken by the need to raise expenditure and increase staff in order to deal with the problems being loaded onto it by both Government and industry.

Food as a weapon of war

With the outbreak of war in the Pacific (December 1941) and the arrival in Australia of at first thousands, then hundreds of thousands, of American troops, the Commonwealth Government's attitude to food supplies underwent a radical change. Overnight, it seemed, the food industry had become a war industry. In addition to her undertaking to try to keep the British larder full, Australia had a much more complex task ahead, that of adequately feeding armies in tropical climates and under adverse physical conditions in jungles. The Government had agreed to act as a supply base for all the Allied forces in the South-west Pacific, and would need to fulfil over 90% of the varied and large-scale ration requirements of the Dutch, Free French, British and American military forces in the area as well as providing for the Australian military forces.



Chief Executive Officer.
C.S.I.R.

A/13a

Dear Sir David,

A meeting of officers of this Division was held today in order to discuss ~~[illegible]~~ how they could best serve ~~[illegible]~~ the country in the present critical times. ~~[illegible]~~ Each officer was eager to ~~[illegible]~~ perform, to the best of his ability, the task which the Government thought he was best fitted to carry out. ~~[illegible]~~

It was realized that, from a long-range point of view, the keeping together of a highly trained staff ~~[illegible]~~ – which would be of utmost value in the post-war period of reconstruction, had much to commend it, as also had the policy of concentrating on problems of more immediate economic importance to the country. Nevertheless, it was felt that a ~~[illegible]~~ policy of putting every trained man on to jobs very directly concerned with the war effort might be ~~[illegible]~~ more desirable, since rapidly attainable results were of vital importance. We were ~~[illegible]~~ carrying out jobs which could rightly be regarded as very valuable under peace-time conditions but which might easily be regarded as virtually futile at present. Moreover this feeling of frustration was enhanced by the arbitrary rejection by certain Commonwealth Government bodies of scientifically, & practically, sound schemes put up by the Division on matters such as the saving of shipping freight space and also by the ~~other~~ almost ostentatious neglect by the [illegible] Departments of the resources of this Division in connection concerning the preparation, handling & transport of food intended for consumption by the fighting services & by British civilians. The Commonwealth authorities controlling these matters may be doing a perfect job, but judging ~~by information~~ from what little we have heard, we have rather serious doubts & so we believe that [illegible] work [illegible] very modest scale, would be of some value.

The question also arises as to whether we might more profitably be engaged directly in the war industries & fighting services as physicists, chemists, chemical [illegible], bacteriologists, radiologists etc.

Draft of a letter from Vickery to Rivett, early June 1940, expressing the Division's sense of frustration in its attempts to contribute to the war effort.

Apart from a vast expansion in food production, a task whose difficulties do not concern us here, the agreement entailed an urgent increase in the production of foods processed by canning and dehydration, since it was only by these methods that nutritious foods could be supplied to the troops in forward areas. Such a prospect was daunting for it focused attention on areas where the Australian food industry was weak. The canning industry, for instance, had canned and exported meat quite satisfactorily for almost a hundred years, and had developed a flourishing trade in canned fruits and jams since late in the nineteenth century; but it was quite inexperienced in the canning of fruit juices and the even more exacting technology of canning low-acid vegetables, an area where faulty processing could endanger public health (and, before a year was out, would do so). The dehydration industry in Australia had virtually originated in 1941, with the filling of an order from India for 450 kg of dehydrated potato.

In this situation, the laboratories of the DFP—and of the embryo Section of Dairy Research, whose war-time activities will concern us in a later Chapter—formed the only centre in Australia where there was a group of people who could advise on problems relating to the preservation of food.

Credit for the fact that the Division was moderately well prepared to meet the exigencies of war must go largely to J. R. Vickery, who with Rivett's help had established a balanced group of scientists, skilled in fundamental research and in technical liaison, even though the range of subjects they had so far tackled was quite limited. It must be admitted, however, that there was an element of sheer luck about the way in which, several years before, L. J. Lynch had become interested in the canning of citrus juice as an answer to the periodic gluts of citrus fruits, and had set up processing equipment to study its possibilities: J. F. Kefford has recorded that in 1942 when the U.S. armed services came to Australia and placed demands for canned orange juice, the only plant in existence in Australia was the pilot plant in the Homebush laboratories.

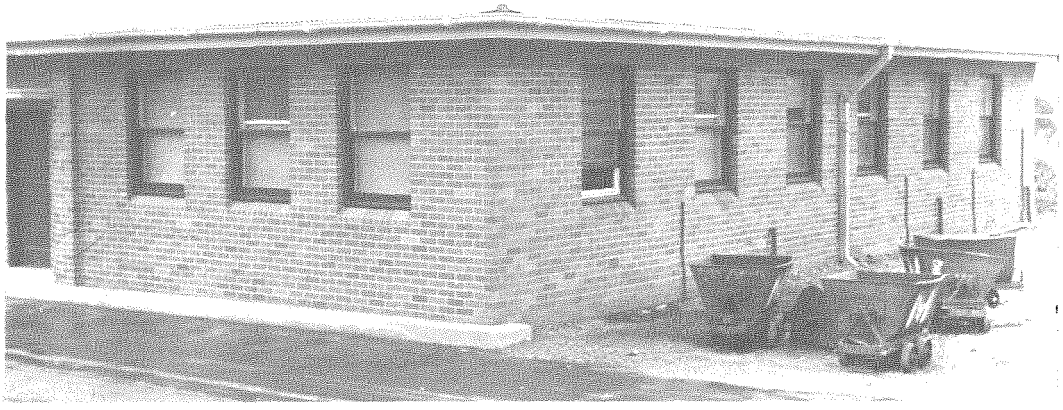
Vickery was appointed to the Scientific Advisory Committee (Foodstuffs) of the Food Council, a Commonwealth Government body formed to organize food on a national scale, and from this time on, together with some of his Section leaders such as Lynch and Thelma Reynolds, he acted as the Government's principal scientific adviser on foods. Industry had been quicker than the Government in seeking technical advice and since mid 1941 the Division had been dealing with many requests for assistance with unfamiliar products and processes.

In March 1942 the Executive was able to inform the Minister responsible for CSIR, the Hon. J. J. Dedman, that the reorganization of the Division's work was complete and that all its officers were now engaged on problems of direct importance to the war.

Much of the work on cold storage had been temporarily abandoned; certain investigations such as those on fish preservation and some aspects of fruit storage were at first curtailed and later stopped. The Division managed with some difficulty to keep on with the long-term coordinated program of egg investigations that was being carried out simultaneously in several States and was already showing important experimental results. Increasing attention would be paid to the preparation and storage of dehydrated eggs, meat and vegetables, the preparation of fruit products, the search for substitutes for tinplate containers, and general problems of canning. CSIR's participation in work at the Victoria Dock Cool Stores ceased in 1941 when first F. E. Huelin and then his successor, H. S. McKee, were recalled to Homebush. Research on frozen and dried beef and on meat extract was done at Cannon Hill throughout the war but the staff there was not increased; the Division's forces were concentrated at Homebush.

New order at Homebush

There then began several years of intense and many-sided activity. In the course of the war, the Division's numbers grew from 14 professional officers of whom 9 were stationed at Homebush to 34, of whom 31 were at Homebush. If the accommodation had seemed barely adequate before, it was now decidedly cramped. In almost every year of the war, further urgently needed laboratory space was contrived. Buildings went up piecemeal: first a small brick fruit-products laboratory; next a temporary hut; then a dehydration laboratory, obtained by filching another sheep-slaughtering bay from the MMIB; then, in another year, yet another brick building to house a cannery and a library. W. J. Scott has aptly described the whole process of



The fruit products laboratory which was completed early in 1940.

building as 'a seemingly endless series of encroachments on abattoir space, all rushed in construction and of substandard materials.'

The Division of Food Preservation was never harnessed so closely to the urgent needs of the armed services that its officers plumbed the depths of war-time strains and frustrations as did, for instance, their colleagues in Radiophysics, who developed radar in Australia: but they worked long hours and assumed responsibilities outside their normal role. On many occasions, too, shortage of time forced commercial production ahead of experimental work and officers were faced with the difficulty of making recommendations or even providing specifications for industry before having had time to solve some of the important fundamental problems.

The load of administrative and committee work got almost out of hand. In 1942 Vickery is asking for more clerical assistance, partly in order to relieve him of having to do a good deal of the clerical work himself; he points out that 'The office staff here, and in particular Miss Todd, cannot cope with the increased amount of work which has become particularly severe in the last few months owing to the large number of forms which have regularly to be filled in as required by various war organizations (such as the Department of Labour and National Security, applications for priority to Ministry of Munitions, etc)' (Vickery to Rivett, 17 June 1942, 113/A13/1). At a late stage of the war, in mid 1944, he is inclined to rebel against 'the ever-growing burden imposed by committees', which by that time were consuming many of his evenings. Committee meetings of those involved in food control and scientific liaison were usually held at Victoria Barracks, Melbourne. They began invariably at 7 and did not end until after 11 p.m., when the committee men would find themselves spilled out into the black-out, free at last to catch a taxi or tram if they could find one, or else to walk the distance back to their hotels.

Amidst the new stresses of war-time, one familiar worry disappeared. For the first time since 1931, the Division was not short of money. The same committees that kept on allotting his Division further tasks and responsibilities made available all the money Vickery could want, for buildings, maintenance and equipment. But there was a catch. Materials were desperately scarce, whether the equipment being ordered was the most advanced food-processing machinery available only from America under Lend-Lease agreement, or such everyday items as glass bottles and flasks. Money was fairly worthless currency. Permits and Priorities were what determined how long you must queue for what you wanted; battling with forms became a part of everyday routine, first to apply for a Permit to place an Order, then to obtain a Priority, finally to submit the Order with Permit and Priority attached. Food research ranked high behind

munitions and essential services but Vickery still did his share of waiting; sometimes an order would arrive in a matter of weeks, once or twice he waited for as long as a year.

'A fund of good will'

The close war-time relationship between Australia and America gave the DFP an unusual opportunity to become familiar, quickly and on mutually favourable terms, with the world of American food science and technology. As J. R. Vickery wrote after visiting America, 'there is at present a fund of good will towards Australia' that rendered easy the processes of making personal contacts and exchanging information. Vickery and Lynch, and also N. E. Holmes, the Division's Liaison Officer stationed in England, made visits of several months' duration to America in 1943 in order to establish good relations with some of the principal laboratories and to obtain at first hand as much detailed information as possible on many aspects of food processing and storage, to help them in the war-time necessity of bringing better technology to Australian industry. The National Canners' Association of America, in a particularly generous gesture, made all its technical literature available to the Division for the duration of the war; the American Institute of Food Technologists wrote seeking closer liaison.

Vickery was so impressed with what was being achieved in America that on his return he urged CSIR to station in Washington a scientific liaison officer for food, even if it meant taking a man off scientific liaison in London. Although it did not prove feasible to send someone to Washington immediately, no one was in any doubt that the most important developments in food technology, both in processing and design of equipment, were now taking place in America rather than in England.

In addition to contacts with laboratories in the United States, the DFP enjoyed the unusual experience of having a group of American scientists working right on its doorstep and of liaising with them on many aspects of food control. In order to help Australia achieve the phenomenal increase needed in her production of processed foods and at the same time to ensure the safety of foods supplied to the American forces under Lend-Lease, the United States Army authorities had recruited a remarkable team of agricultural and technical specialists to be stationed in Australia. The food technologists in the party included some whose names were almost household words to anyone familiar with the international literature: Maynard Joslyn, Carl Fellers, Myron Powers; these men who now held the rank of major or captain in the army were teachers and researchers from some of the most respected American universities. The Americans established their headquarters on premises lent them by a Sydney brewery and there set up a quality-control laboratory on behalf of the American defence forces. Their opposite numbers at Homebush were carrying out a similar service of quality control for the Australian forces.

The two groups were soon on friendly terms. The Americans were more experienced in the particular techniques the war demanded, whilst the DFP had greater knowledge of local conditions and products: the combination was extremely profitable in hastening the adoption of uniform high standards by the canning industry and helping to organize the food industries for efficient production. Australian and American food scientists sat together on committees and shared the same work of trouble-shooting in the factories. When the DFP had the task of drawing up the Australian Food Council Specifications for many processed foods it consulted freely with the Americans; in particular, the specifications for canned foods, which were based on American standards, were worked out in close collaboration. The Dehydration Section had the advantage of similar aid in preparing sets of notes on vegetable drying (1942), and again a couple of years later when the notes were rewritten as a Factory Manual for operators of dehydration plants.

Foods, canned or dried

Very little research went on at Homebush during the war that was not related in some way to the production of canned or dried foods. The Section of Canning and Fruit Products expanded from one officer to a staff of seven in the course of a couple of years whilst a new Dehydration Section was formed in early 1942, with a staff of eight under the leadership of Dr Thelma M. Reynolds. Every other Section contributed a major portion of its time to the investigations; Microbiology and Physics, for instance, played an integral part in working

A taste panel, made up of members of the Dehydration Section, testing reconstituted dried potato. *Left to right:* D. McG. McBean, J. Shipton, H. S. McKee, A. Howard.

out heat processes and developing equipment and in examining processed foods for microbiological safety; Chemistry made the important analyses of ascorbic acid content of canned foods and carotene content of dried foods; Fruit Storage developed dehydration of tree-fruits as an improvement on the traditional sun-drying techniques.

L. J. Lynch's Section of Canning and Fruit Products had been the first in the Division to be precipitated into war work. The abrupt cessation of the export trade with Britain in apples and other fruits, coupled with heavy fruit crops in the 1940 season, had saddled industry with the problem of disposing of large surpluses; for apples alone it amounted to some five million bushels. Lynch's Section was considerably overworked as a result of the number of inquiries it was receiving on the production of fruit juices and the treatment of fruit by-products. This was just the first trickle of the flood of work that was to follow.

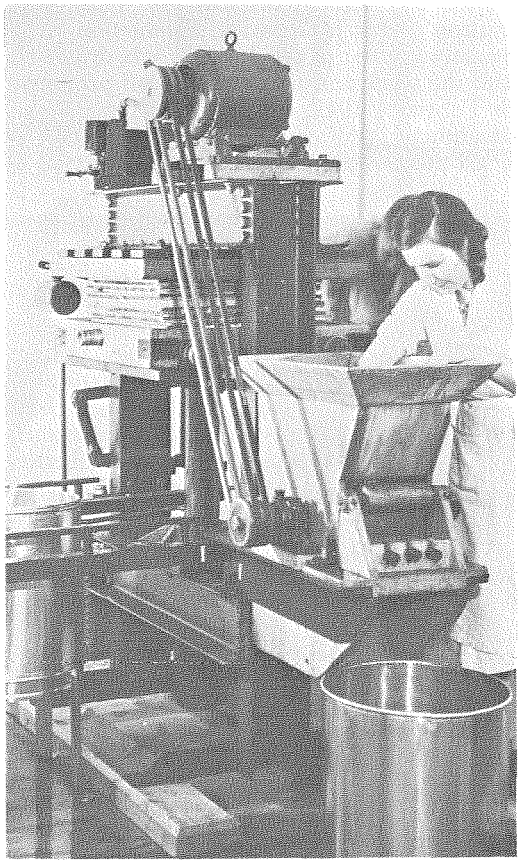
By April 1942 the newly formed Food Council was gravely concerned that the food-processing industry might fail to meet its obligations in fulfilling the first large-scale orders from the Army authorities. The Division of Food Preservation was requested, as a matter of urgency, to give whatever technical assistance was necessary 'to increase the quantity and raise the quality of canned and dehydrated foods', particularly of vegetables (Vickery to Rivett, 6 May 1942, 113/A13/1), to meet the Army's requirements. Much of the responsibility for this difficult job rested with Lynch, who was now appointed technical adviser to the Controller of Defence Foodstuffs. The Council asked for an officer to go immediately to Leeton (N.S.W.) to improve the output of canned and dried vegetables from the irrigation area, and for Lynch himself to be seconded for a month to Western Australia, 'where the vegetable canning program is very severely affected by ignorance and inefficiency in the local canneries' (*Ibid.*). 'It is difficult to see how Lynch can do all that is required of him', Rivett commented, 'and do it within a reasonable time.'

Lynch was not the man to be put off by the magnitude of the task. Extroverted, enthusiastic, straight-talking, he was well suited to guide the development of the canning industry, which was to be one of the Australian success stories of the second

L. J. Lynch (*left*) and F. Dickson in the office of the fruit products laboratory.

world war. He had for some years been especially keen to promote a citrus juice industry in Australia and now the need of the defence forces for rations with antiscorbutic properties gave him the opportunity. Lynch's Section organized the commercial bottling and canning of orange juice and later of fortified apple juice in several States. Soon he had manufacturers using processes and operating plant that had been developed and successfully tested within the Division, much of it far more sophisticated than any they had handled before. In 1943 officers of the Canning Section helped to set up 20 citrus juice plants with an estimated output of 6·8 million litre and the DFP recorded with satisfaction in the *CSIR Annual Report* that 'Army demands thus brought into being in a few months an industry which the Division had endeavoured to stimulate for some years.' In association with Maynard Joslyn, with whom he became close friends, Lynch also helped to organize industry for large-scale canning of vegetables and many other products demanded for war-time supplies.

The DFP did a thoroughly useful piece of work in the technology of dried foods even before a Dehydration Section was formed. Following up a lead from the Low Temperature Research Station, about September 1941 Vickery had begun investigating the production of dried mutton-mince, as mutton was readily available and the cheapest meat in Australia.



Mrs Walker operating a press for extracting juice from apples and pineapples.

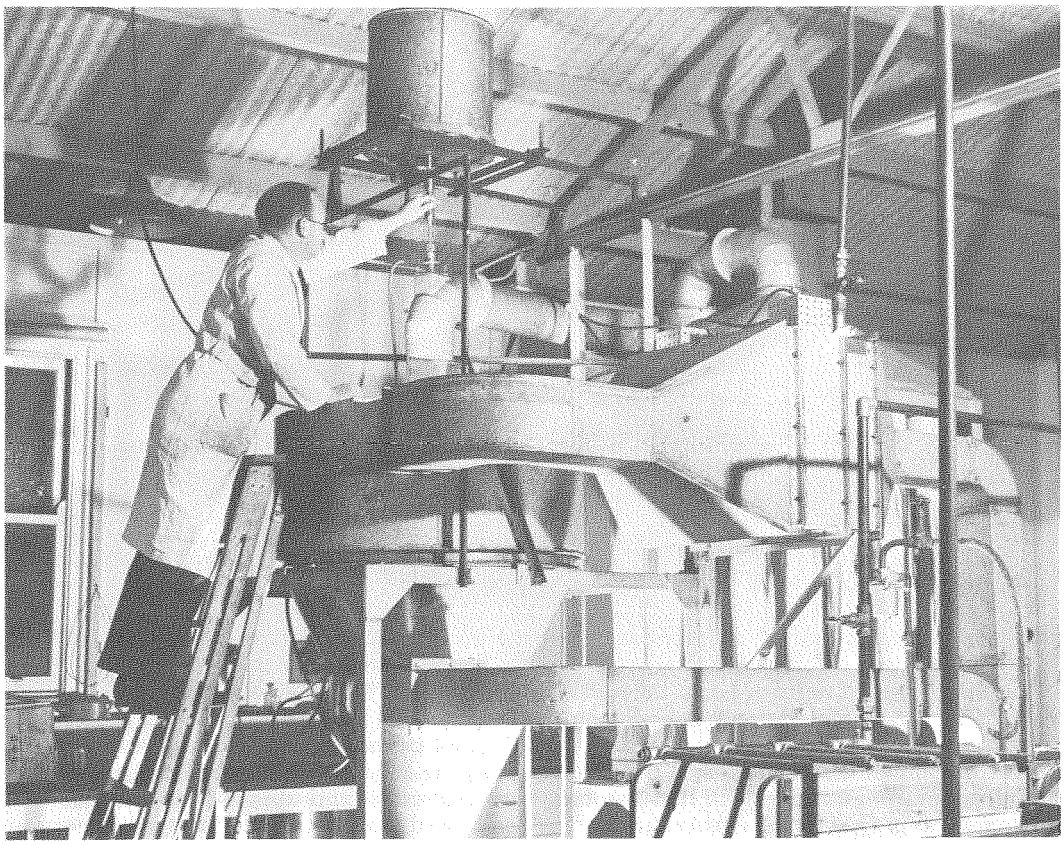
Increase in Australian production of canned vegetables over the war years (unit: cases of 24 cans, 99 × 118 mm)*

Vegetables	1939	1943	1944	1945	1946
Asparagus	51 200	67 700	65 500	60 800	51 900
Beans	55 400	233 500	136 400	280 000	223 500
Beetroot	†	†	184 000	386 000	260 000
Cabbages	†	†	316 000	24 000	45 700
Carrots	†	†	304 500	926 000	426 000
Cauliflower	4 700	6 600	4 800	†	†
Peas	44 300	85 500	222 500	400 000	548 000
Silver beet	†	†	42 700	178 500	58 400
Tomatoes	37 600	216 500	170 000	177 000	97 600
Other vegetables	47 100	1 104 000	814 000	396 000	810 000
Total	240 300	1 713 800	2 260 400	2 828 300	2 511 100

*Norton, C. E. (1951). 'Technological and economic advances in the Australian canning industry since 1938'. 2nd Int. Congr. on Canned Foods, pp. ix–5.
†Included in 'Other vegetables'.

(In consequence, all war-time Australian dried meat reaching the DFP's friends at Cambridge went by the name of 'Vickerised mutton'.) Mr J. Creswick, Production Superintendent of the MMIB, was drawn into the work and they made good progress. By February 1942, despite primitive equipment, they could produce 20 kg of dried mutton per day. On 19 February, Japanese aircraft bombed Darwin. The same night, Food Control in Melbourne rang Vickery and asked him to send 100 kg of dried mutton by air to Darwin, immediately. The DFP had only 25 kg on hand when the request came through, but by dint of working day and night for 48 hours, it was able to send the full order to Darwin within three days of the bombing.

P. C. O. Thompson (*left*) and an assistant preparing cabbage for canning.



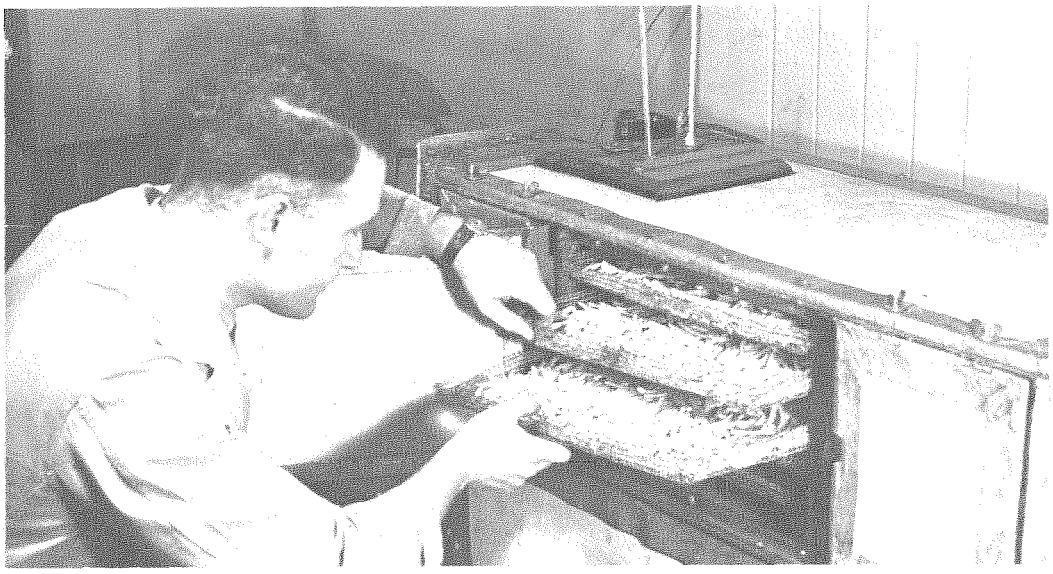
M. C. Taylor inspecting a Gray-Jenson spray drier.

Soon afterwards, the Australian Army set up its own production unit at Homebush, with the technical direction of the DFP's newly formed Dehydration Section, and operated it for some time before large units were built at other meatworks.

The Dehydration Section started out as a band of tyros, new even to food research. Several had been seconded from other CSIR Divisions—Thelma Reynolds and A. J. Watson from Forest Products; A. Howard from the Irrigation Research Station at Griffith; H. S. McKee also had come from Griffith to join the Section after first working for a few months at the Victoria Dock Cool Stores. Nevertheless, dehydration was a subject in which only limited advances in technology had yet been made; a fortnight of reading (and a good general grounding in chemistry) made the Section leader modestly confident in her new speciality.

Between 1942 and 1945, with the help of E. W. Hicks and M. C. Taylor of the Physics Section, the Dehydration Section provided technical direction in the setting up of some 32 plants in New South Wales, Victoria, South Australia and Tasmania. Australian production of dried vegetables alone expanded from 1 million to 12 million kg. The new dehydration industry drew heavily on American technology, but the development needed to suit local products and conditions was virtually all done by the DFP, which also helped to solve day-to-day technical problems.

The DFP investigated, first, the technology and storage behaviour of egg powder, then of dried beef-mince (at Cannon Hill) and of a wide range of dried vegetables; later it introduced dehydration of tree-fruits. At the request of the Army it tested and improved the concentrated Emergency (02) Ration. The Division's work demonstrated that dried products, particularly vegetables, of good initial quality could be produced, although careless storage brought about rapid

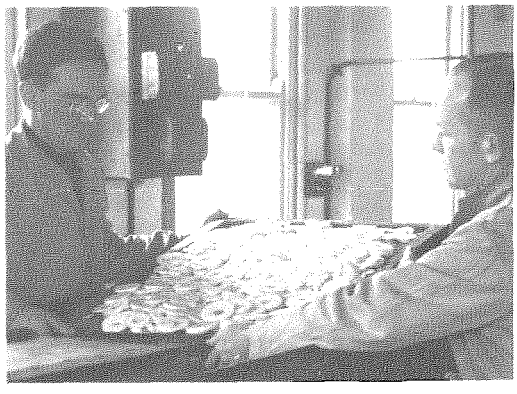


S. M. Sykes positioning trays of carrot strips in an experimental drier.

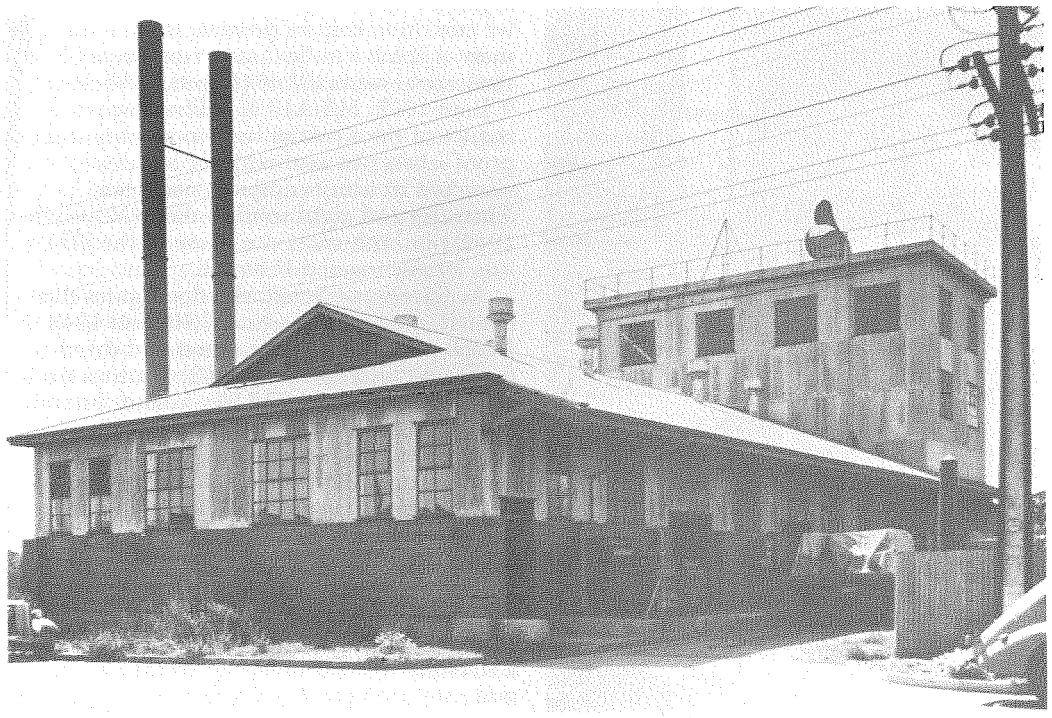
deterioration. The Australian dehydration industry, like that in other countries, dwindled almost to nothing when the war ended and the DFP's extensive dehydration program was curtailed. It continued into peace-time only the work on dried tree-fruits and dried mutton-mince which had become an important project for the Australian Army.

Work on canned and dried foods had many ramifications. Individual officers spent weeks at a time in factories, particularly when new equipment was being installed or a new factory was starting production. At such times they might work for 12 or 14 hours at a stretch as they followed a product through all the unit processes. They might be sent to track down the cause of sometimes serious outbreaks of spoilage or to improve quality and efficiency of production. Such operations had an undercurrent of urgency, born of the fact that there were still many details of processes, some minor and some not at all minor, needing experimental work for elucidation. 'I regard the continuance of the research program as essential', Vickery asserted in 1942, at a time when they were getting so involved in extension work that the research programs seemed threatened, 'because we still lack a great deal of experimental data without which much of the extension work cannot be carried on, e.g. blanching procedures for dried vegetables and sterilization data for a wide range of canned goods, to name only a few problems' (Vickery to Rivett, 6 May 1942, 113/A13/1).

In the laboratories at Homebush the Physics and Microbiology Sections collaborated in working out heat processes for new canned products or unusual sizes of can; the Physics Section designed experimental spray- and tunnel-driers. Canned and dried foods constituted the major portion of a soldier's rations for months on end and some cases of scurvy had occurred in the Australian Army; hence the Division investigated losses of ascorbic acid from canned foods and of carotene from dried foods, and how such losses could be minimized. It also made general recommendations designed to improve the nutritive value of canned foods.



R. Bitmead (*left*) and S. A. Trout lowering a tray of apple rings into a drying cabinet.



War-time factory in Adelaide that produced spray-dried egg powder; the Division of Food Preservation provided technical staff to start the plant and initiate quality control of the product.

Since tinplate cans are an integral part of canning technology and because food spoilage resulting from leaky cans was a serious problem during the war years, the Canning Section studied the properties of tinplate and the cause and prevention of leaky cans. It investigated lacquers and coatings for application to cans to minimize problems arising from the corrosion of tinplate. Then as tinplate became scarce, just as it had in the first world war (for Australia still did not make any herself), considerable time was spent in searching for substitutes. Some products were modified—for instance, jams were made 'solid'—so as not to need encasing in tinplate or in glass; a recipe for 'mould-proof' fruit-cake, first developed for use by the Australian Army, was sent to confectioners who were receiving complaints about the keeping quality of their Christmas cakes, now that these could not be marketed in tins.

A service laboratory

At the same time as the Defence Controller of Foodstuffs asked the Division, as a matter of urgency, to assume technical responsibility for improving processed foods, he also requested it 'to provide laboratory facilities and staff for checking the quality of canned [and, it was implied, of dried] foods produced in N.S.W. and Queensland' (Vickery to Rivett, 6 May 1942, 113/A13/1).

Both Vickery and Rivett felt reluctant to comply; a principle of CSIR since its inception had been that its job was research and investigational work and that quality control did not fall within its province.

Rivett was quick to reiterate this basic position: 'I think it is advisable for CSIR, as far as possible, to avoid responsibility for routine testing. Once we let that flood burst in on us we shall, I fear, have to abandon a great deal of our proper function as research men. That would be a tragedy because there is no one else in the country to take it up' (Rivett to Vickery, 26 May 1942, 113/A13/1).

Tragedy or no, it was a case here of *force majeure*. Lynch had seen enough of the practices accepted by inspectors in some canneries to be alarmed. He and Mr J.

Margaret Clark preparing dehydrated cabbage for estimation of ascorbic acid content.

Douglas of the Australian Directorate of Agriculture talked to Rivett and Vickery and convinced them that, for the present, CSIR must assume responsibility at least for testing canned vegetables, as the inspectors of the Department of Commerce had not been trained for the work: 'Many of them are meat and jam men and . . . are very much at sea when it comes to dealing with vegetables' (Rivett quoting Lynch, 9 June 1942, 113/A13/1). A sound system of routine examination should be instituted immediately; Homebush should take the initiative in laying down the standards for such examinations and should itself carry out the tests for New South Wales and Queensland at least for a short period.

Such arguments, based on evidence of what Lynch and Douglas had seen, could not be resisted. Rivett conceded his position. 'Judging by what both these people say, it looks as though the canning situation is getting pretty desperate and that, unless your laboratory takes hold of it immediately, a great deal of loss may result. It seems therefore that the reasonable course is just to realize that anything at all which we can do to help in the next three months or more will have to be done irrespective of our theoretical *raison d'être*' (Rivett to Vickery, 9 June 1942, 113/A13/1). The desperate nature of the situation was soon given tragic proof when two outbreaks of botulism occurred in army camps in northern Australia and eight soldiers died (November 1942); in both cases the cause of the illness was locally canned beetroot.

As Rivett predicted, the flood-gates did indeed open. Throughout 1942 and 1943 the Division examined all canned and dried foods and all Emergency (02) Rations from New South Wales and Queensland, intended for the Australian defence forces. The work took up most of the time of the Canning, Dehydration and Microbiology Sections. It was carried out willingly as long as it was seen to be essential, but no one was in a hurry to relieve the Division of the job and, again as Rivett had warned, it began to have a crippling effect on research effort. At the close of 1943, Vickery wrote a strongly worded memo to Gerald Lightfoot pointing out that the Division was 'still burdened with this routine examination work. It occupies a considerable amount of the time of the Canning staff and has seriously interfered with the research work being conducted by the Bacteriology Section', and suggesting that Lightfoot should simply inform Commonwealth Food Control 'that we cannot continue to examine routine samples of defence foodstuffs after 1 January next.'

The strong line was fairly effective and the Division was relieved of most of this work. Throughout the war, however, it carried on a number of supervisory functions and of course it was always, and legitimately, called upon where any unusual problem arose.

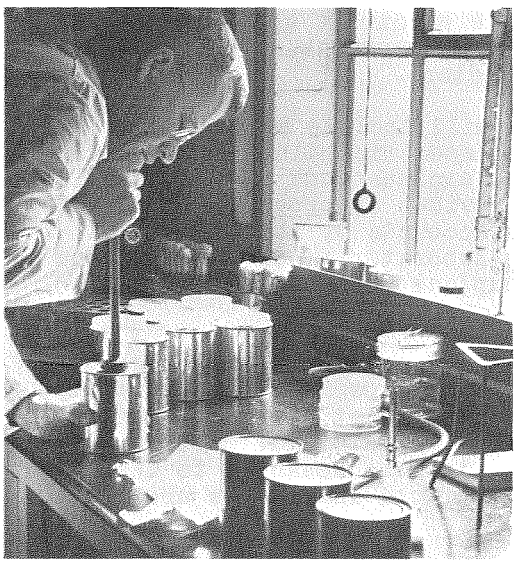
Teaching others—and being taught

As a corollary of its two years as a service laboratory, the DFP was drawn into giving courses of instruction to make others competent in the work. The first of these short intensive courses was given in early 1942, at the request of the Food Council, for selected inspectors from the Department of Commerce. During 1942 and again in 1943, several more schools were arranged for groups from different Government Departments and Army Supply, and for operators of vegetable dehydrators. The courses included

instruction in the technology of canning and dehydration, in canning bacteriology and in the inspection of canned and dried foods.

As the war progressed, it became apparent that a much greater knowledge of food technology was needed in the army among those responsible for the care of rations in storage and during distribution. In the difficult conditions of northern Australia and New Guinea particularly, army authorities had repeatedly suffered loss from the deterioration and wastage of incorrectly stored foods; they could not ignore the risk that unwholesome or dangerous food might on some occasion be issued to the troops.

Brigadier R. T. A. McDonald, Director of Supplies and Transport for the Army, proposed to start an Army School of Food Technology to provide the trained personnel necessary for a much more rigid technical control of army foodstuffs. While the plan itself was excellent, it depended for its success on the cooperation of the DFP, which would be needed to run the first course of the School and so provide instructors for further courses. Vickery concurred in the scheme and he and his staff threw themselves into the work with enthusiasm. The first course extended over four weeks of April and May 1944, and practically everyone at Homebush was engaged in lecturing or demonstrating, as well, of course, as having to carry on with his own current work in the laboratory.



P. R. Maguire opening a can for bacteriological examination of the contents.

When it was over, Vickery wrote to Rivett expressing the staff's enjoyment of the course but also entering a plea for mercy: 'the period has been particularly strenuous for the whole staff: we would not care to repeat the job for quite a long time. I hope, therefore, that it will be possible for us to reject requests for conducting schools of instruction for at least eight or nine months' (Vickery to Rivett, 12 May 1944, 113/A13/1).

The officers of the DFP knew that they also had a lot to learn; they were well aware that Australian processed foods, certified as being of acceptable standard when manufactured, were attracting many complaints from servicemen-consumers. The DFP could work more efficiently at improving quality if it had a closer knowledge of actual storage conditions in the tropics and of the factors important in deterioration. On two occasions men from Homebush had the salutary experience of going and seeing for themselves just how well the foods they tested had stood up to the rigours of climate and exposure.

Hicks accompanied two army officers on a tour of northern Australian food stores in 1943 and Hicks, Kefford and McKee made a more extensive survey of food stores in New Guinea in early 1945. They came back with a very real appreciation of the difficulties in the field and a healthy respect for the standards generally achieved in cooking and catering. The party was able to make a number of recommendations to improve the quality and variety of rations as issued to the troops. But the main culprit responsible for the issuing of poor rations appeared to be a commonsense army regulation, the rule that foods were to be issued from stores in strict rotation—'First in, first out'. The principle was excellent, but it broke down where large stockpiles of foods had accumulated on the mainland and in forward areas. Here it meant that soldiers never received canned and dried foods until these had gone beyond their warranty expiry date; nor were they able to enjoy the benefits of improved products developed by the DFP and the Section of Dairy Research. When war ended, for instance, most soldiers in forward areas had not seen the new packs of canned meat, dried vegetables or concentrated hardened butter, in all of which substantial improvements had recently been made.

EDITORIAL

In presenting the first issue of this publication which, as its title implies, is concerned with the preservation of food, we consider that the time is opportune for commencing this project. The decision to begin publication this year was reached after obtaining favourable expressions of opinion from men intimately concerned in the various food industries throughout Australia.

In the past, the translation of the results of the Division's investigational work into commercial practice has been attempted by means of publications such as trade circulars, articles in trade journals and newspapers, and by personal contacts, either directly or through the medium of the personnel of the State Departments of Agriculture and the Commonwealth Department of Commerce. It has been felt that the efficiency of such extension services could be increased by the diffusion of knowledge through a special regular publication containing semi-technical articles which would be circulated directly to those persons responsible for the control of processes in the field of food preservation. There has been, as the result, a growing appreciation amongst food processors of the advantages to be gained from the application of scientific methods in the many phases of processing and storage of foodstuffs.

In order to maintain contact with advances in technique and with the latest developments in the food industries it is important that the personnel be acquainted with the results of investigational work being carried out in various parts of the World. Such information is available in a wide range of overseas and Australian publications. The present periodical, although an additional publication, should prove to be of special value to those who are unable to secure overseas literature, and since it will deal largely with results which are capable of direct application, should be of special interest to those who are responsible for the control of technical processes in food manufacture.

The scope of the publication will include articles in semi-technical language dealing with specific points in handling, processing and storage of foodstuffs, explanations of advances in technique from outside sources, and reviews of progress in specific fields. In addition, there will be accounts of the nature and scope of the work in progress in the laboratories of the Division of Food Preservation together with explanations of results of investigations already published.

Because of the present emergency conditions and the necessity for holding foodstuffs for longer periods than normally, it becomes increasingly important that the most efficient methods are adopted in all stages of processing and storage. It is hoped that this publication may contribute, in some measure, to the solution of the problems with which the food industries are confronted.

Part of the editorial from the first issue of *Food Preservation Quarterly*, March 1941.

The *Quarterly* appears

Very few scientific papers were written during the war; it was a luxury for which there never seemed to be time. The most generous estimate of publications stemming from those years would not go past 23. In consequence, when the newly formed American Institute of Food Technologists suggested closer cooperation with the Division and an exchange of published papers, it was somewhat embarrassing to know what to send them. Vickery got over the difficulty only by opting for masterly inactivity: 'I would suggest that . . . we agree that closer cooperation would be most desirable and that we await suggestions regarding methods for closer liaison' (Vickery to Rivett, 22 July 1942, 113/A13/1). Most of the results of the work the Division was undertaking were being put out in the form of confidential memoranda for people concerned with the supply of foods to Britain or the defence forces.

The majority of the papers that did get written were digested accounts of masses of data, summarizing the main results and making recommendations, so that industry would not lose the benefit of the investigations. The necessity of compressing a vast amount of material into a narrow compass sometimes yielded excellent work. When F. E. Huelin was recalled to Homebush from Melbourne in 1941, he was given paper, pen, a chair and a desk and was told to write up the results of all the work done under the direction of the Citrus Preservation Technical Committee. In three months Huelin compiled a report of work that had occupied a team of investigators for six years. His 60-page Bulletin, 'The handling and storage of Australian oranges, mandarins and grapefruit' (1942), is a model of thoroughly digested and well presented information. Nevertheless, in his Foreword, Huelin warned that he had been forced to omit a large amount of valuable detail, and expressed the hope that it would be published later by investigators in specific fields. Unfortunately, as a rule, investigators do not go back to old work and in this and several other instances, useful work almost ready for writing up was never published. It meant that in later years the experience of older members of staff was sometimes the only repository of information that would have been of considerable value to food science.

The times seemed appropriate for bringing out one new publication as a further means of offsetting the dearth of technical information in the food industry. After consulting with men in industry, the DFP decided to start an extension journal. The first issue of the *Food Preservation Quarterly*, of 15 roneoed pages, appeared in March 1941; the first editor was W. A. Empey, who had proved his ability to present technical material to a non-specialist audience through articles he contributed to *Queensland Country Life* in 1938, giving an account of the Section's work on chilled beef. The intention of the new journal, as avowed in its first editorial, was to provide a regular medium for passing on technical and scientific information of interest to food processors, in the hope that the results of scientific investigations would be more rapidly applied in industry: the scope of the *Quarterly*—it was renamed *CSIRO Food Research Quarterly* in 1971—has broadened somewhat over the intervening years but Empey's first editorial would hardly be out of place in more recent issues.

As the Division did not begin producing its own annual *Report of Research* until 20 years later, the *Food Preservation Quarterly* became closely identified with the Division both in Australia and overseas. As well as informing local industries of technical developments, it served a useful function in letting industry know the kinds of work being

J. R. Vickery at the end of World War II.

A13/1

ACDR/AS

Ref. No.

COMMONWEALTH COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH,
314 ALBERT STREET, EAST MELBOURNE, C.2.
Telephone: J4171.
Teleg. Address: Coresearch, Melbourne.

From the
Chief Executive Officer.

Personal

24th September, 1943.

Dr. J.R. Vickery,
Chief, Division of Food Preservation and Transport,
Food Preservation Research Laboratory,
Private Bag, Homebush P.O.,
SYDNEY. N.S.W.

My dear Vickery,

You will, of course, long ago have appreciated the fact that I have ceased to be as much use to your Division as I ought to be, or as I once imagined myself to be. We have today something like 20 major laboratories in C.S.I.R., while, if minor field stations be included, the total must be well on towards 30. It is impossible to pretend that I can keep in sufficiently close touch with them all to satisfy either myself or anyone else. You have been exceedingly patient with me for a long time, but your patience has only added to your own increasing load and it is high time a change was made.

To meet the position the Executive Committee, after much discussion, internally and externally, has decided that there has to be a rearrangement of responsibility and an increase in the Head Office staff if it is to do its share of the general job properly. This is forced on us, not only by the growth of the whole organisation, but also by the inescapable fact of advancing age in the executive and administrative group.

As a first step it has been decided to ask Dr. Richardson to take over general executive collaboration with the six primary industrial divisions, viz., Plant Industry, Animal Health, Economic Entomology, Soils, Food Preservation and Fisheries. He will at once seek an assistant and, if you can help him to find a thoroughly competent man, your aid will be much appreciated.

Of course matters of general policy will still be fully discussed by the Executive Committee; and needless to say, the other members and Mr. Lightfoot will strive to keep themselves as fully aware as possible of all current activities. Dr. Richardson

will, however, take responsibility for most of the correspondence and interviews on passing events and programmes, apart of course from the normal routine correspondence which is addressed directly to the Secretary.

This plan will, I am sure, lead to closer touch between the laboratories concerned and the head office and so reduce the weight which you are carrying. While I myself am not exactly saying farewell (you cannot get rid of me as easily as that), I would like to thank you very much indeed for the way you have put up with my shortcomings of late in connection with all the primary side of our work, due not only to the march of time, but also to the growth of our secondary industrial interests. Dr. Richardson will seek opportunity before long for discussions with you about matters of divisional concern.

Yours very sincerely,
David Rivett.

Rivett ends his close association with the Division of Food Preservation.

carried on in the laboratories and the type of scientific and technical service the Division was attempting to provide.

Significance of war to DFP

The second world war gave to food research in Australia the first important outside stimulus after the initial call to bring scientific help to Australia's ailing food export industry. The DFP achieved a fine record in assisting the food industries to meet a difficult challenge in a field where failure could have had chaotic consequences. Even the decision to sacrifice, for a time, some of its research role and take on the work of a service laboratory was wise, as such a course alone ensured the safety and reasonable quality of the foods going to the armed services. A modern canning industry in Australia dates from this time, called into being almost inadvertently like so much else during the war, but built on a foundation of sound technology provided by the DFP and the American experts; in a similar manner, most of the technology was successfully developed for that other war baby, the dehydration industry, although this one failed to thrive in peacetime.

The Division added little to its stature as a research establishment during the war years: a paltry number of papers were published and only a small amount of basic research was undertaken; yet again the development of a multi-disciplinary laboratory had been postponed, as it had to be during the Depression. On the other hand, the Division developed firm ties with a wider range of industries than it ever had before and became better known on the national scene. Evidence of a growing confidence in its role as technical adviser to government and industry is seen in its assumption of new tasks such as drawing up specifications for foods and arranging specialist courses to keep those who had control over food supplies better informed of new requirements in processing and storage.

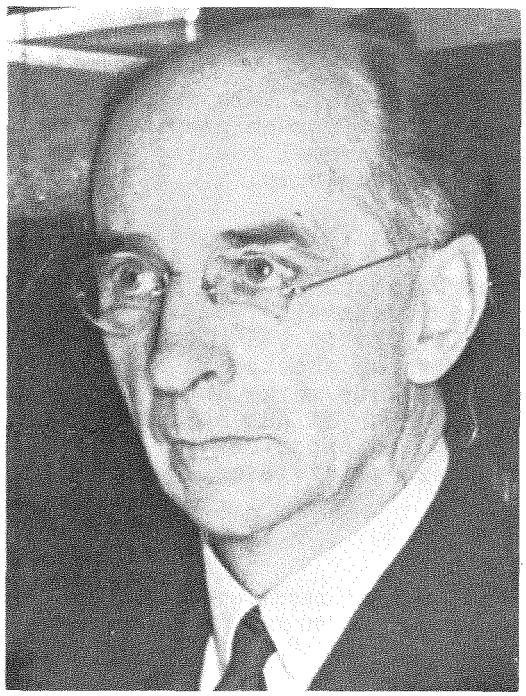
At Homebush, there was a new, more relaxed atmosphere. Before the war, as in most working environments at the time, the atmosphere had been somewhat formal: colleagues addressed each other by surname if they were on close terms, otherwise more distantly as 'Mister' or 'Doctor' (nearly every senior officer at Homebush, of course, *was* a Doctor, with a Cambridge Ph.D.). Now, in general, people were on first-name terms and the stiffness had disappeared. The

transformation had come about through the recruitment of many more young officers, the mingling with American scientists who could not pick up the habit of addressing workmates as 'Mister' or 'Doctor', and perhaps most of all through the presence of Laurie Lynch with his predilection for informality, his propensity for bestowing nicknames on others and his own mocking assumption of the honorific, 'Lord'.

Although the Low Temperature Research Station at Cambridge had probably been the premier establishment in food science during the 1930s, by the time of the war the most important developments were taking place in America. Through its close working relationship with the Army scientists in Australia and the generosity of American trade and research institutions in making their technical knowledge available, the DFP was able to bring local industry the benefit of some of these advances. The American influence was strong in giving some Australian workers in food research a better sense of identification as belonging to a separate branch of practical science, rather than thinking of themselves as biochemists and physiologists who had strayed into an unorthodox calling. American attitudes were influential in starting up, shortly after the war, an Australian Section of the Institute of Food Technologists (the first outside America) and in confronting Australian workers with the realization that if food research was indeed a separate branch of science then it should be *taught* and the machinery must be set up for doing so.

Rivett says good-bye

Amid the explosive growth, the strains and pressures and hustling activity of CSIR at war, one good thing came to an end. This was the close and vital partnership that J. R. Vickery and Sir David Rivett had shared in their joint responsibility for the development of food research. In September 1943 Rivett wrote to Vickery telling him, with regret, that he could no longer look after Vickery's Division nor oversee its development as he had been accustomed to do. The expansion of CSIR, particularly in research for secondary industry, had forced on the Executive the realization that one man could no longer guide all the organization's activities. Henceforward, Dr A. E. V. Richardson would look after the Divisions concerned with primary industry whilst



Sir David Rivett in 1949 at the time of his retirement from CSIR.

Rivett confined himself to those serving secondary industry.

The relationship that had existed between these two men was a difficult one to replace. Something similar would develop between Vickery and Sir Ian Clunies Ross, but there was nothing of the sort between Vickery and A. E. V. Richardson. The Division of Food Preservation, as far as Richardson was concerned, was no true primary industrial Division: it partook both of primary and secondary. He felt he knew little about it, and he was rarely willing to expose possible ignorance by stating his clear views in any matter presented to him for decision.

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