Richardson

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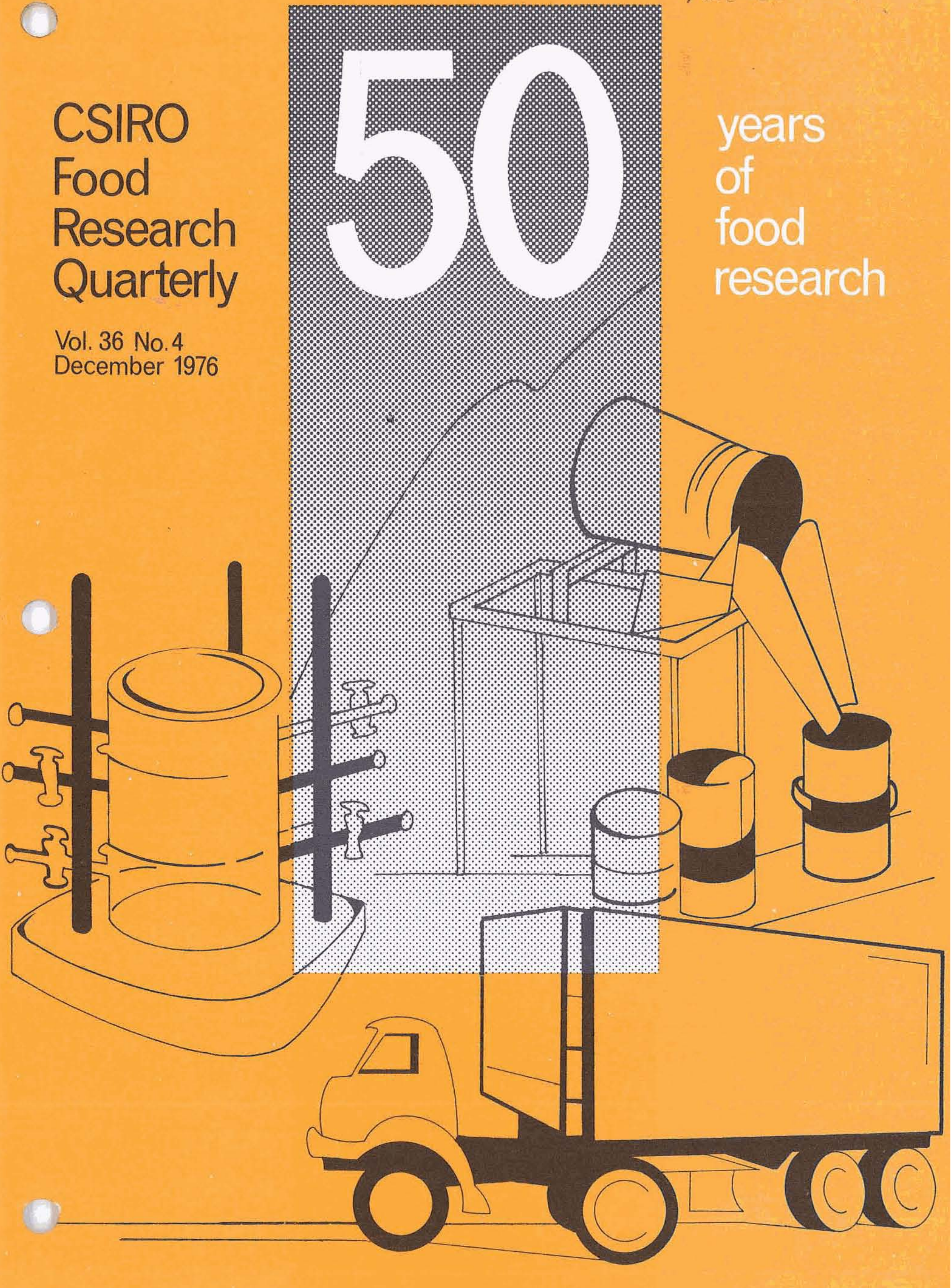


years of food research

Fifty years of food research. Part 2

By Josephine M. Bastian

CSIRO Food Research Quarterly **36**, 4

Division of Food Research
Commonwealth Scientific and Industrial Research Organization, Australia

Fifty years of food research. Part 2

By Josephine M. Bastian

CSIRO Division of Food Research, Food Research Laboratory, North Ryde, N.S.W.

This edition of the *Quarterly* forms Part 2 of the story of the Division of Food Research, Part 1 appeared in Vol. 36, No. 3, September 1976, the Jubilee edition. The history will be completed in Vol 37, No. 4.

Chapter 6. Controversy delays CSIR entry into dairy research

In World War II the new Section of Dairy Research of the Council for Scientific and Industrial Research (CSIR) made a valuable contribution to the war effort by developing special dairy products for tropical conditions. The Section was created in 1939 under the leadership of Dr Waldo J. Wiley and by 1945 it consisted of five scientific officers and four laboratory assistants working in Melbourne in laboratories shared with the Division of Industrial Chemistry.

Although the Section had been formed at an opportune time, just before the outbreak of war, this was the result of good luck rather than good management, for the Executive of CSIR had attempted to establish a dairy research group as early as 1928. The main reasons for its failure were the conservatism of the dairying industry and the opposition of the Australian States. In the face of these difficulties, which emerged gradually and only after much effort had been expended on inquiries and draft proposals for research, the Executive's attitude swung from vigorous commitment to the project to cool disengagement from it. It was only by taking advantage of novel circumstances in 1939 that CSIR successfully entered this new field.

Part of the interest in following the early vicissitudes of dairy research lies in the contrast between its history and that of food preservation studies. In place of a slow but fairly purposeful attainment of objectives there was a confused search for appropriate problems. In place of cooperation with the individual Australian States there were repeated abrasive contacts, requiring constant wary diplomacy to avoid a conflict. Sir David Rivett was in his element here and it was he who, sensing earlier than his colleagues the impossibility of useful collaboration, steered the Executive to the sidelines to await a more favourable time, when States and industry would have clarified their attitude towards Commonwealth participation in dairy research. Dr A. E. V. Richardson, who had been an onlooker in most of the Executive's deliberations on food preservation studies, came forward as its principal spokesman on dairy matters. Throughout 1927 and 1928 he led CSIR's efforts to find a suitable Chief for a Division, or Institute, of Dairy Research; he submitted to the Standing Committee on Agriculture* a sensible report on the possible role of CSIR in dairy research, thus framing the only set of proposals over a period of

*For an account of the role of the Standing Committee n the development of CSIR, see Currie and Graham (1968).

years that obtained the support of the Committee; and he supplied sound comment on the proposals of others.

Heath advocates Institute of Dairy Research

In 1926 when Sir Frank Heath outlined the most urgent tasks facing CSIR, he advocated giving first priority to the formation of 'an Agricultural Section, attached to which there shall in the first instance be formed a Dairy Research Institute' (Heath 1926, 4). The Executive tended to adhere to the divisions of research suggested by Heath and for the most part the selection of topics was eminently sensible. However, when it tested the reaction of those associated with the industry to the concept of a national institution for dairy research, it encountered fierce controversy. Somewhat baffled at the response, the Executive instructed Secretary Lightfoot 'to ascertain (privately) from Sir Frank Heath exactly what was the reason prompting him to make his recommendations re Dairy Research' (*CSIR Mins Exec. Comm.* 1926).

Heath's reply was not specific enough to be particularly helpful but he reiterated that in his opinion research was urgently needed. Dairy produce was one of Australia's principal exports, with an average value of $18 million annually; butter alone accounted for $15 million and after wool and wheat was the largest export item. Yet dairy produce had been the subject of less scientific work than any other product of Australian agriculture and the quality was generally poor. Factories experienced recurring technical problems with failure of cheese starters and outbreaks of serious chemical and bacterial taints in butters. Exported butter and cheese drew heavy criticism and could not fetch prices comparable with the New Zealand products, let alone those of such premier exporters as Denmark and Ireland.

Thus the dairy industry appeared to be a natural target for research. CSIR was aware of its importance to the national welfare, and realized that the application of scientific knowledge must lead to increased production and better quality.

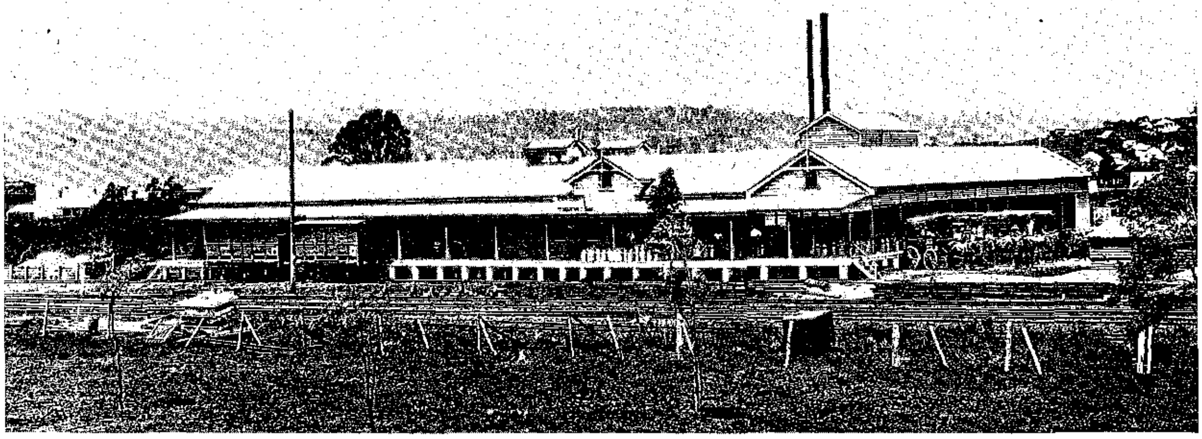
Political complications

There were unforeseen hazards in following Heath's recommendations, which were based on a Commonwealth interpretation of the situation, not a State one. The Commonwealth Government of the day was particularly sensitive to the voices of the dairying industry, from which it drew many supporters, and was prepared to provide it with a comprehensive technical service covering pasture improvement and market development as well as research on manufactured products. By setting up, through CSIR, a National Institute of Dairy Research it hoped to attain all three objectives.

The dairy industry, however, was organized on a State basis, with a minimum of cooperation between the States and a minimum of Commonwealth supervision. Indeed, the States were business competitors and were reluctant to bring about overall improvement in the industry. All the State Departments of Agriculture had strong and well-organized Dairying Divisions engaged in extension work and some research; they resisted Commonwealth intervention, contending that the urgent need in the industry was for better application of known principles, work that lay within their own competence. Historically, dairying had developed at a different rate in individual States and this unevenness had been aggravated by a tendency to remain isolationist: neither knowledge nor practice was uniform. The stronger States, New South Wales in particular, felt self-sufficient and considered that any money they contributed to national research would simply go to bolster the weakness of their neighbours.

At the industry level, too, conflicting voices made progress difficult. Several spokesmen insisted that there was an urgent need to form a research institute but none seemed able to define the specific problems it should work on. There was little economic incentive to bring about improvement because of the way in which payment for butter-sales was structured: a manufacturer was better off marketing 'first grade' butter than laying out the extra capital expenditure needed to assure the production of 'choicest'.

These factors all combined to create an exasperating state of affairs for CSIR. Rivett protested at 'the extraordinary clashes of opinion which [CSIR] has met in the course of its enquiries' and urged 'the leaders of the industry (including dairy experts in Government Departments) . . . to speak with one voice' (letter to Secretary of Australian Dairy Council, 23 Sept. 1927). Such a background, however, hardly made concerted action easy.



Butter factory, Lismore, N.S.W.

Attempt to form a Division

Throughout 1927 the Executive made resolute preparations for undertaking dairy research along the lines suggested by Sir Frank Heath. Its initiative met two obstacles. Despite a search in Australia and overseas it could not find a suitable Chief, the man of 'high scientific attainments and high personal qualifications' to whom it could entrust development of the new field: systematic dairy research was a comparatively recent enterprise, even in England, and trained specialists were exceedingly hard to secure. Further, it witnessed the breakdown of several special conferences it had arranged in the hope of mapping out a specific program for research; in particular, a meeting of the Standing Committee on Agriculture, the body that had been formed specifically to ease collaboration between CSIR and the States, discussed a possible program but failed to reach agreement.

Finally, in an attempt to free itself from the morass of conflicting opinion, and as the industry refused any enquiry from an overseas expert, the Executive assigned to Dr A. E. V. Richardson, the 'delicate and difficult task' of reviewing the dairy industry and reporting on the scope for Commonwealth research. Richardson's brief was simple but comprehensive: 'The question which the Executive has to answer is whether there is a real place in dairy research for CSIR; if there is, it has to determine precisely what lines of work it should undertake. The position is complicated by the fact that all the State Departments are deeply involved in dairy matters and some are doing excellent scientific work. It would be most undesirable for us to overlap with them or do anything at all likely to be regarded by these Departments as wholly unnecessary.' Richardson's recommendations were embodied in a report entitled 'Tentative proposals for investigation of dairying problems', and on 7 March 1928 they were discussed by the Standing Committee on Agriculture.

Dr A. E. V. Richardson.

Richardson's report

Richardson suggested that there were many topics 'of regional rather than local interest' (as shown in the accompanying table) that lay within the sphere of a CSIR Division of Dairy Research, and that 'the most urgent investigations appear to be those relating to bacteriology and biochemistry of milk and manufactured products.' He proposed that 'until trained men are available and the relative spheres of the Commonwealth and the States are more clearly defined by experience, it would appear advisable on all grounds to begin with a relatively small establishment and staff.'

Dairy investigations appropriate to CSIR, as listed in the Richardson Report, 1928

Dairy bacteriology
Butter and cheese starters
Effects of pasteurization on bacteria
Flora of export butter
Flavour defects in butter
Optimum acidity (pH) of cream for buttermaking
Dairy chemistry
Impurities in factory water supply
Physical and chemical changes induced by pasteurization
Influence of pasture on flavour, quality and vitamin content
Interaction of salt and acidity in stored butter
Chemistry of casein and methods of using casein and whey

This modest proposal, which fortuitously coincided with a serious outbreak in Victoria's leading butter factories of the intractable 'rabbito'* tainting of butter, received sufficient support to be accepted. The meeting resolved, 'That this Committee is in accordance with the suggestion that the CSIR should undertake research on problems affecting the dairying industry. It is considered that not more than one bacteriologist and one chemist would be required in the immediate future.'

Action aborted

Richardson's Report adumbrated, with considerable foresight, the future course of Australian dairy research but it failed to achieve its immediate objective of bringing CSIR into this new field. In April 1928, Lightfoot advertised for two experienced scientists to fill the positions approved by the Standing Committee; generous salaries of $14–1800 per annum were allotted in order to attract men of high calibre. But no suitable applicants were found and the Executive's hope of obtaining a dairy scientist, Dr H. H. Green, from the Veterinary Research Institute of South Africa, likewise came to nothing. Finally, the Executive decided to award a research studentship instead, so that a young Australian graduate could undertake advanced training at the National Institute for Research in Dairying (NIRD), Reading, England.

Despite the fact that it still had the support of the States (at least until the next meeting of the Standing Committee, which might well disclose a fickle change of heart), CSIR now retreated from its resolution to commence research in dairying. Rivett, for one, felt growing doubts about the wisdom of entering a field dominated by the States and in which there might not be any need for major research.

Other reports

Less than five months after the vote of the Standing Committee appeared to have settled the matter, we find the CSIR Executive commissioning another review of the dairy industry, this time from S. M. Wadham, Professor of Agriculture at the University of Melbourne. His brief was identical with Richardson's.

Like Richardson, Wadham recommended the entry of CSIR into dairy research, where he envisaged an extensive role for the Commonwealth in both extension services and fundamental investigations. But his report seemed unrealistic and his undisguised partiality for N.S.W. practices was unfortunate. CSIR was prevented by its charter from taking up the regulatory role he advocated and it had no hope of finding trained officers to staff a network of small research stations as he suggested. Wadham's cutting remarks about Victorian practices aroused so much antagonism that his report was suppressed and the considerable amount of interesting material it contained never reached a wide public.

*So-called because the smell of the butter resembled the stale-meat smell of the rabbitos' carts that wandered through Australian suburban streets, in the period up to World War II.

A third report on the dairy industry followed in 1930, also carried out at the request of CSIR. The Federal Dairy Investigation Committee produced the first volume of what was to have been a comprehensive review of the industry and its needs; however, whilst this volume covered the need for pastoral and economic research, a further report detailing needs in manufacturing research was blocked by the advent of the financial Depression.

Initiative abandoned

The Executive made no further attempts to form a Division and possibly welcomed the breathing space provided by the financial stringency of the Depression. In letters to men like Professor J. K. Murray (Gatton Agricultural College) who continued to advocate a national institute, Rivett was generally encouraging but non-commital. However when, in 1936, Sir Herbert Gepp approached him on the same matter, Rivett spoke his mind; Gepp was an astute businessman and a good friend of CSIR. 'We have discussed this matter several times and in great detail in the Standing Committee on Agriculture. Its State members have been asked on more occasions than one whether in their opinion there is a place for the Commonwealth in dairy research, and each time they have given the same answer, namely that their own organizations are fully competent to attend to the existing situation.' In the eight years that had supervened since Rivett briefed Richardson for his review of the industry, the States had not moved from their original position: in 1936 as in 1927, they were adamant that they would not welcome Commonwealth participation in this area.

Rivett summed up CSIR's point of view with devastating finality: 'No one would be foolish enough to suggest that further and intense work is unnecessary; but it is no use pretending that the problems of the industry are going to be solved by the establishment of a dairy research institute when we know perfectly well that in most of the States the industry has not yet proved itself willing to make use of the thoroughly established knowledge at its disposal. At any rate the State Departments of Agriculture are not prepared to support a move by the CSIR to establish a Commonwealth Division of Dairy Research.'

Collaboration with New Zealand

When CSIR at length obtained money to appoint the first permanent worker in dairy research, it was not because the basic situation had changed; it came about through the Australian Government's desire for closer scientific contact with New Zealand.

In December 1935 while on holiday in New Zealand, Julius was asked by the Australian Prime Minister to investigate the possibility of reciprocal arrangements for scientific collaboration. He conferred with the Council of the Department of Scientific and Industrial Research (DSIR). In most areas of research Julius was able to speak as the senior partner, inviting New Zealand workers to join Australian teams investigating problems of animal diseases and food preservation. Not to be completely outdone, New Zealand then suggested 'that something might be done on the other side': surely there was some work that was being actively pursued in New Zealand which was not yet being tackled in Australia? Julius cast around and soon came up with the perfect answer: 'I thought of dairy research. They have in being a Dairy Research Institute. . . . We have for years past been pressed to establish a Dairy Research Institute, but for various reasons we have refrained from doing so. I think it might be a useful gesture if we were to . . . attach an Australian to their team, thereby helping them in a measure and ourselves perhaps, whilst at the same time it would enable us at least to say that we were actively participating in a study of dairy problems' (Julius to Rivett, 17 Dec. 1935, Julius Letters).

So it was agreed that an Australian scientist should be posted at the New Zealand Dairy Research Institute at Palmerston North. This was the position that came to be filled by a man whose fortunes had already been linked with CSIR's, not altogether happily, for nearly 10 years.

Progress of 'a rather good chemist'

Whilst it may have been sensible, even desirable, for the Executive to mark time while awaiting a more favourable climate to start dairy research, it was quite another matter for Waldo Jackson Wiley, the man who had hoped and indeed expected to make his career in dairy research with CSIR. Wiley had won the dairy research studentship offered in 1928 and had gone overseas for advanced training. He thus entered upon a long association with CSIR which, at least for the first 10 years, was intermittent and unsatisfactory. Throughout the period when the Executive had no permanent position for him, Wiley held fast to his ambition of working in and possibly eventually directing a CSIR dairy research group. But for many years he could make little headway against the double odds of the Depression and the ambivalent attitude of the Executive to the prospect of undertaking dairy research—odds that, naturally, he was not fully aware of. Eventually, however, a stroke of luck presented him with the chance to act as catalyst in bringing CSIR into dairy research. When the occasion came, Wiley proved equal to it.

Problem of woodtaint

When Wiley first returned to Australia in 1930, after studying at NIRD and visiting dairy research centres overseas, CSIR was approaching the nadir of its financial fortunes: any prospect of a job in pure dairy science was out of the question. As the result of an unexpected request from the Export Board, however, CSIR was able to offer Wiley a temporary position in the Division of Forest Products under I. H. Boas, investigating the problem of woodtaint in butter packed in boxes made from Australian timbers.

Although the problem concerned the treatment of wood, not butter, and Secretary Lightfoot, for one, was apt to scoff at any notion that it constituted a start by CSIR in dairy research, the work was obviously important to the butter industry. Manufacturers were sustaining losses through the downgrading of affected butter and the necessity to give preference to the safer but more expensive New Zealand timbers. Richardson and Julius both urged Wiley to take on the work, so that if and when CSIR entered dairy research proper he would not have sacrificed his training: 'assuming I could make a success of my work', Wiley told himself in his Journal, 'being the first worker I would have good opportunities' (25 Oct. 1930, 45, Wiley Papers). Instead of going straight back to his job with the Queensland Government Analyst, he decided to accept a two-year extension of his studentship.

Wiley's work on his first problem was completely successful. He devised a method, using casein combined with formaldehyde, that completely eliminated woodtaint, thereby saving the industry many thousands of dollars a year. The method was made compulsory with butterboxes for export and continued in almost universal use in Australia until butterboxes were replaced by cartons in the late 1940s.

The young W. J. Wiley.

Memoranda on research

Hoping to chart a course for CSIR (and himself) in dairying work, Wiley next submitted a Memorandum (1931) outlining key problems in the butter industry; he commented, 'there is enough research indicated in the following pages to keep a staff of research workers busy for years'. The report was circulated to members of the Standing Committee on Agriculture; whilst it did not elicit any call for a staff of research workers, Wiley was asked to spend the remainder of his studentship preparing a review paper on one of the topics he had singled out for attention.

As the date approached for his return to the Queensland Public Service, Wiley again raised the question of his future prospects. This time he was more direct. He told CSIR

45

Visits made in Connection with C.S.I.R. work – Commencement of work on wood Taint in Butter.

Oct 25, 1930 S.S. Barrabool arrived Adelaide & in morning called on Dr Richardson at Waite Institute. He explained the Councils proposals re my future employment. Council had been asked to undertake investigation of wood taint by the Export Board & had consented, the proposal being Ex. Board pay £200 travelling allowance (not yet agreed to 30th Oct 30) – The council find my salary at rate of £400 & £450 for 1st two years out of their endowment fund. Dr Richardson strongly advised me to undertake the work. He in common with other officers seen later said that once dairy work was started it would not be allowed to drop, and assuming I could make a success of my work, being the first worker I would have good opportunities.

Entry in Wiley's journal 25.10.30 concerning work on woodtaint in butter.

of huts available

Later called on Sir George Julius Culwullaha Chambers, Cnr Castlereagh St & King St. He explained predicament of Council over my appointment owing to lack of funds & that they wanted to hang on ~~to~~ me & this wood tannin came along opportunely. The last report on need for dairy research very strong & if there is any money at all it should carry much weight — Advised me to take a chance ~~of the Q. Govt~~ let the Q. Gov. job go (after trying for extended leave of absence of course). Dr Brisbane advised me to listen a lot & not argue — Prof Richards very influential & tactful and would be very helpful in "opening doors" & smoothing things. Graham may be sore over a beef research scheme which has been accepted by the Q. Government against his advice.

Next tried to ring ~~up~~ up Mr G. Wright of University Lecturer in Ag. Chem & Bact. to present Tommerups letter of introd.

Entry in Wiley's journal 31.10.30 concerning discussion with Sir George Julius about job possibilities.

frankly that he would like to stay on—but only if dairy research could be established on a proper footing. He had had enough of the frustrations of working alone. 'I feel sure that proper results for the industry could only be obtained by a properly equipped dairy research institute. One laboratory worker could only attack theoretical aspects

WJW/MRP

To ACSR

TEL. CENT. NO. J. 4171

D4/3

COMMONWEALTH OF AUSTRALIA.

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

DIVISION OF FOREST PRODUCTS.

Cable and Telegraphic Address:— CORESEARCH, MELBOURNE.

Official correspondence should be addressed to "The Secretary."

314 ALBERT STREET,
EAST MELBOURNE, C.2. 18th July, 1932

In reply refer to ....

MEMORANDUM TO:

The Secretary,
C.S.I.R.

I desire to draw the Council's attention to the fact that the two years' studentship to which I was appointed on my return from studies abroad will expire early next November.

I am proceeding with the preparation of a review of the subject of acidity and keeping quality in butter as opportunity presents itself in the course of the wood-taint investigation and will soon complete the work. At conferences of factory managers in both South Australia and Queensland last month, at which I happened to be present this subject was discussed by speakers and the need of further work in Australia emphasised. At both conferences papers on the need of dairy research were read.

I feel sure that satisfactory results for the industry could only be obtained by a properly equipped dairy research station. One laboratory worker could only attack theoretical aspects of any problem, and these, although essential, would not have the immediate practical bearing which would be necessary if the research were to have the support and approval of the industry.

£15,000 to £20,000

A dairy research station would be fairly expensive to equip, but not excessively so to maintain. I consider it should consist of a farm from which the raw material, milk, could be obtained of known purity, chemical and bacteriological laboratories and a small but completely equipped factory for the manufacture of butter and cheese. Supplies for the factory would have to be drawn from surrounding farms in addition to the research station's own farm. I have in mind a factory such as that at Hawkesbury College. If the farm here were of grade cattle there would be a source of revenue from the sale of stock and this and the factory should be practically self-supporting, leaving the laboratories to be maintained from outside.

Once such a station were working, I am sure it would soon have the full support of the manufacturing side of the industry. If the Council sees any likelihood of developments on these lines I would be pleased to discuss them in more detail.

W. J. Wiley

W. J. WILEY.

W.J.W. is free to return to the Q. Dept. in November, but would prefer to stay with us if the way were open for a proper establishment of Dairy Research work. 18/7/32 ACSR

Wiley's memo raising the question of his prospects.

of any problem and these, though essential, would not have the immediate practical bearing which would be necessary if the research were to have the support and approval of the industry. A dairy research station would be fairly expensive to equip, but not excessively so to maintain' (Memorandum, 18 July 1932). In the margin of this

AC/WL

COUNCIL FOR SCIENTIFIC & INDUSTRIAL RESEARCH
D 4/3

5th August 32

D.4/3

AUG 6 - 1932

Copy ...

MEMORANDUM TO :-

W.J. Wiley, Esq.,
314 Albert Street,
EAST MELBOURNE. C.2.

Re DAIRY RESEARCH.

Your memorandum of the 18th ult. on the above matter was considered at a meeting of the Executive Committee held in Brisbane last week.

The Executive is quite in accord with the statements you make and realises the importance of dairy research. For that reason it would very much like to carry out some work in that field, provided the necessary finances are available. However, the Committee sees no chance of the Council being able to obtain the necessary funds, at any rate for a considerable time to come.

With much regret, therefore, it has agreed that the best course for you to take is to return to the Department of Agriculture and Stock in October next.

The Executive desires me to say how greatly it appreciates the ability and zeal which you have displayed during the tenure of your Research Studentship.

G. Lightfoot,

SECRETARY.

Letter to W. J. Wiley terminating his research studentship.

letter, opposite Wiley's description of a properly equipped dairy research station, Rivett has scribbled his estimate of the capital cost of such an establishment: $30–40 000. In the prevailing financial and political climate, Wiley might just as well have been crying for the moon: he gave CSIR no alternative but to let him go.

Return to Queensland

Wiley returned to work with the Queensland State Government but his interest in dairying matters persisted; he gained his D.Sc. in dairy chemistry from the University of Queensland, and was awarded the Rennie Memorial Medal of the Australian Chemical Institute for his work on milk. When the position in New Zealand, which Julius had arranged, was advertised in 1936, Wiley was by far the best qualified applicant and it was reclassified at a higher salary to enable him to accept. Wiley commenced work at Palmerston North, N.Z., in March 1937.

Gerald Lightfoot, who had not regarded Wiley's investigation of woodtaint in butter as a genuine topic of dairy research, would now have agreed that CSIR had at last been able to initiate such studies for Australia—even though its man had to leave the country to do the work, and his nominal leader was Dr L. B. Bull, the Chief of the Division of Animal Health and Nutrition.

Visiting worker at Palmerston North

At the New Zealand Dairy Research Institute, Wiley was placed in charge of experimental work on butter manufacture. This was his chance of working with excellent laboratory and factory facilities and he made the most of it. During his 18 months there (1937–39), he worked on the deterioration of butter in cold storage, the flavour of butter, fat losses in buttermilk and variations in the properties of butter caused by variations in feed and season of the year. He was able to test the necessity of the Australian practice of neutralizing the cream before churning it into butter and to confirm that this was essential in order to obtain a product of good keeping quality.

CSIR forms Dairy Research Section — official

In January 1939 Dr W. J. Wiley was the most experienced dairy scientist Australia had yet produced and he had made a sound contribution to the welfare of the butter industry. While he could be satisfied with his research and his present working conditions, he was well aware that he could not progress much further professionally as long as he was a visiting worker in an overseas laboratory. The prospect of CSIR starting dairy research in Australia, with laboratory and factory facilities, seemed as remote as ever.

Yet within a month that prospect was imminent and CSIR was writing urgently to Wiley, offering him the position of Officer-in-Charge of a CSIR Section of Dairy Research. The *volte-face* was brought about through the competition of State and Commonwealth interests, working for once to CSIR's advantage.

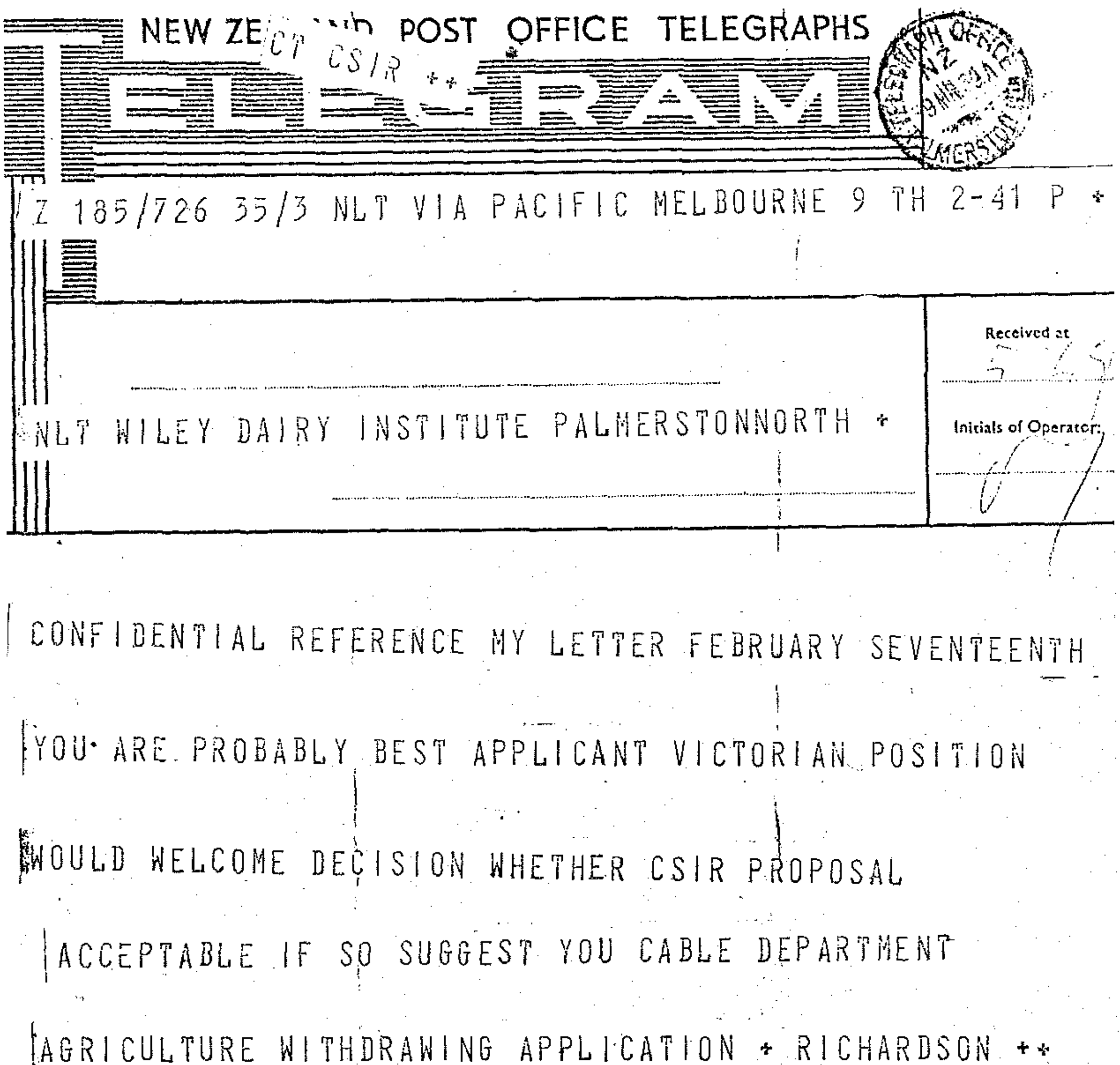
The series of events leading to the formation of the new Section began with the decision of the Victorian Government to establish a School of Dairy Technology on its State Research Farm at Werribee. This station would be the first one in Australia having dairy research as its major activity; if other States followed Victoria's lead, the prospect of ever obtaining a dairy research institute controlled by CSIR would recede almost out of sight. In January 1939 the Victorian Department of Agriculture advertised for a Principal for its new School. Specialists for conducting research in dairying were still rare birds; it was hardly surprising that Mr H. A. Mullett, Director of Agriculture in Victoria, did all he could to attract Wiley to apply for the position. The implication was that, if he applied, he would almost certainly be offered the job.

Wiley not only applied for the job with the Victorian Government but wrote Richardson of the CSIR a masterly letter, *telling* him of his actions, and asking Richardson if he had done the right thing.

The news dealt CSIR a tremendous blow. It came in the same week as the Executive heard from NIRD of the excellent progress of its second Dairy Research Scholar, a young graduate from Western Australia named C. C. Thiel, who was training as a dairy bacteriologist. If Wiley and Thiel were both retained by CSIR, it would have the nucleus of an excellent team to start dairy research; without them, it would be back behind the starting line of 1927. 'We . . . felt it would be the end of CSIR work on dairy research if you left us', L. B. Bull admitted in a letter to Wiley (20 Feb. 1939, Wiley Papers).

Since nothing material in CSIR's prospects had changed, its only hope of obtaining a first-class dairy research establishment was somehow to negotiate its way into the State's nest at Werribee. It says much for the three who took on this task, Richardson, Rivett and Bull, with some able assistance from Bull's Technical Secretary, A. J. Vasey, that they carried it off to perfection. At the conclusion of the negotiations, Mullett officially invited CSIR to undertake a cooperative program of dairy research in the Victorian Government's Werribee laboratory. CSIR was only too happy to oblige. Richardson, with some complaisance, outlined the new situation in a letter to Wiley (17 Feb. 1939, Wiley Papers): 'Important developments have taken place in the past week which promise to put an entirely different outlook on the prospects for national work in Dairy Research. The Department of Agriculture of Victoria and the CSIR have agreed to the principle of cooperative effort in the field of Dairy Research. The Department, moreover, is agreeable to make laboratories available for CSIR and for CSIR to utilize the experimental butter and cheese factory facilities; and we on our part are agreeable to establish CSIR Dairy Research headquarters at the School of Dairy Technology at Werribee.'

It was a considerable triumph for CSIR, and one which placed Wiley in a droll situation. On 9 March 1939 he had an


NEW ZE... POST OFFICE TELEGRAPHS

TELEGRAM

Z 185/726 35/3 NLT VIA PACIFIC MELBOURNE 9 TH 2-41 P +

Received at

Initials of Operator:

NLT WILEY DAIRY INSTITUTE PALMERSTONNORTH +

CONFIDENTIAL REFERENCE MY LETTER FEBRUARY SEVENTEENTH
YOU ARE PROBABLY BEST APPLICANT VICTORIAN POSITION
WOULD WELCOME DECISION WHETHER CSIR PROPOSAL
ACCEPTABLE IF SO SUGGEST YOU CABLE DEPARTMENT
AGRICULTURE WITHDRAWING APPLICATION + RICHARDSON ++

Cable to W. J. Wiley offering him position as Officer-in-Charge, CSIR Dairy Product Investigation.

experience that should happen to more of us: on that day he received two cables containing offers of almost equally attractive jobs. Richardson invited him to become Officer-in-Charge of CSIR Dairy Research; Mullett informed him that the Principalship of Victoria's School of Dairy Technology was his if, in view of CSIR's offer, he still wanted it. Self-interest and loyalty both led Wiley to accept the CSIR appointment which would, he felt, give him all the opportunity he wanted for broad research without involvement in academic lecturing or in routine service to industry.

Thus did 'a rather good chemist', as Rivett, with quiet satisfaction, had described the young graduate he sent off to Reading in 1928, become the first Officer-in-Charge of Dairy Product Investigations. 'I would like to offer you my hearty congratulations on your appointment', Richardson wrote to Wiley (1 June 1939), 'and on the prospect which apparently now lies ahead of developing dairy research in Australia. . . . It seems a long while since you left here, with high hopes, for Reading. The late entry of Australia, however, into the field of dairy research may not be without some advantages, if we fully profit from the pioneering efforts of Reading and Palmerston North.'

There were to be some disappointments in store for both Richardson and Wiley, starting with the months of unexpected difficulties with the Victorian Government that delayed Wiley's instalment at Werribee until near the close of 1939 and betrayed the extent to which the 'agreement in principle' between State and Commonwealth Governments had been a shotgun wedding mediated by the enthusiasm of Mullett and Richardson.

Nevertheless, with the onset of World War II the time could hardly have been more propitious for the new Section to prove it had a useful function and one that could not easily be filled by the States, as an advisory and research group for the Commonwealth Government in filling the special needs of the armed services for dairy products and also the problems of export to the United Kingdom.

The Section was in being for little more than a year when it took on the audacious

W J WILEY PO BOX 367 PALMERSTONNORTH

Received at

Initials of Operator:

+ HAVE INFORMED C S I R I PROPOSE RECOMMEND YOU POSITION DAIRY RESEARCH INSTITUTE STOP RIVETT HAS ADVISED ME HE IS MAKING YOU COUNTER OFFER STOP BEFORE PROCEEDING FURTHER YOUR APPOINTMENT GLAD TO KNOW WHERE YOU STAND

+ MULLETT DIRECTOR AGRICULTURE +

Cable to W. J. Wiley offering him position as Principal of Victoria's School of Dairy Technology.

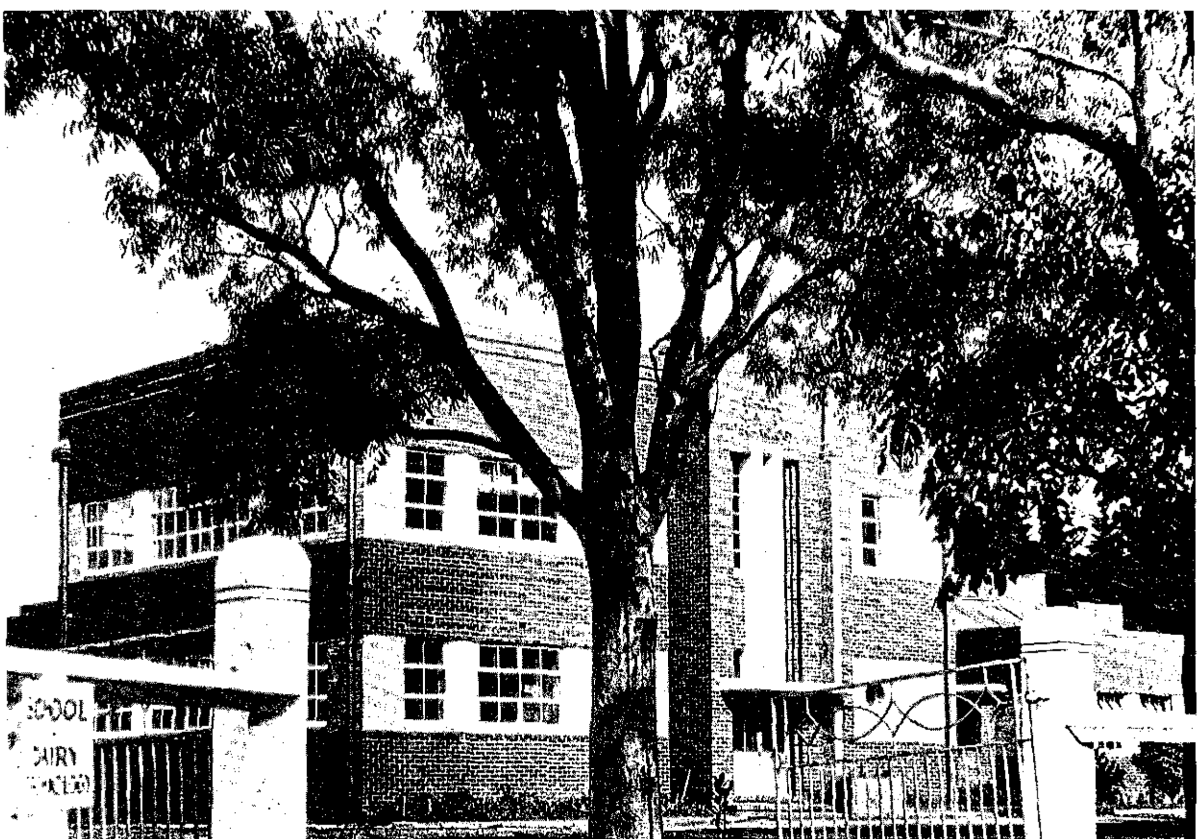
task of preparing some of the most perishable of fresh produce in forms that would withstand the difficult conditions of tropical theatres of war.

Chapter 7. War fosters new approach to dairy problems

Dr W. J. Wiley started dairy investigations for CSIR early in 1940, at the Victorian State Government's School of Dairy Technology, Werribee, some 30 km south-west of Melbourne. He had one laboratory assistant, A. Padgett, and in August 1940 he was joined by a dairy bacteriologist, E. G. Pont, who had been working in the N.S.W. Department of Agriculture. Their accommodation was not grand: Wiley had an office and small laboratory for his own use, similar to those assigned to the lecturers at the School; Pont had simply a desk in a corner of one of the class laboratories, with minimal equipment. However, CSIR had been given the right to make use of all the School's factory facilities, and the men were later to take enthusiastic advantage of this.

During the first year or so of the war, the Section of Dairy Research (SDR) had the same experience as the Division of Food Preservation: far from being asked to take up wartime problems, it was ignored completely, by Government and by the Executive. During this time, while it was still impossible to identify specific ways of contributing to the war effort, the small group carried out some interesting work to help advance quality in the butter industry.

However, it is questionable if the original concept of a Commonwealth research group in a State school of dairy technology would have been viable, had it not been for the appearance on the scene in 1941 of a vigorous new group with a different approach to the problems of dairy manufacturing and a whole range of new techniques at its command. The situation at Werribee did



School of Dairy Technology, Werribee.

not turn out as Richardson or Wiley had expected.

Richardson did not obtain from Wiley the quality of leadership he had hoped for, and this was one factor in allowing the formation in CSIR of a second group addressed to dairy research problems, very shortly after the first. But Wiley also encountered difficulties. The facilities at Werribee and the scope for research were nothing like those at Massey College, N.Z., with which he had been comparing them before his appointment; moreover, relations with Mr T. M. Jensen, newly appointed Principal of the School, soon became strained. Perhaps most disappointing to Wiley, the research program did not work out as he had envisaged. Since the early 1930s, Wiley had hoped to see established an *institute* of dairy research, a place where long-term basic research could be conducted without the need to worry over the industry's housekeeping problems, and at Werribee he thought he had obtained it. To a large extent he was to be disappointed in this, for his orderly effort was soon overtaken by the *ad hoc* arrangements and the crash programs of wartime when, for several years, almost all the work was practical, devoted to solving the urgent problems of the industry. Wiley's research interests were not broad or flexible enough to enjoy such a challenge. One element in his early retirement from CSIR, soon after the war, was the fact that the Section's unorthodox wartime activities had propelled dairy research into unfamiliar new fields where he had little to contribute.

Early work at Werribee

The Section did not become immersed in the war effort until 1941, and so Wiley and Pont were able, for a time, to go on investigating some of the classical problems of butter manufacture.

As CSIR's first dairy bacteriologist, Pont found urgent industry work awaiting him, for the most serious defects in Australian butters were still mainly bacterial in origin. An outbreak of the most notorious of the bacterial defects, 'rabbito' taint, had occurred in South Australian factories, under puzzling new circumstances, and Pont was able to identify and find the source of the organism and suggest the steps needed to eliminate it. He was also consulted several times on the subject of spoilage in 'tinned' butter, generally by insurance agents seeking expert advice on where to assign the blame for a shipment that had spoiled during the voyage: Melbourne at the time was the centre of a small but flourishing trade to Africa and the Orient. Recognizing the unsoundness of attempting to trade in such a product, which was simply conventional butter sealed into cans, the Section was cautious about involvement in the problem. Later, however, when the Australian Army experienced similar trouble and requested help, it set the Section onto one of its most sustained and useful projects of the war.

In continuation of his work in New Zealand, Wiley explored further some scientific and technological aspects of the neutralization of acid creams, as required to give good storage qualities in butter. He also started the Australian Butter Survey, a long-term project aimed at collecting information on methods and conditions of butter production throughout Australia's dairying regions, in order to link them with variations in the properties of Australian butters. This useful survey continued throughout World War II, much of the detailed work being carried out by the State Departments of Agriculture. The results were collated by workers in the SDR and the completed Survey appeared in 1949.

The CSIR and State research groups at Werribee began testing an innovation in butter manufacture: technologists overseas proposed eliminating the traditional practice of washing the butter granules after churning, a simplification that would give greater yields and cut out the need for a supply of pure chilled wash-water. Trials at Werribee were soon interrupted for work of higher priority but the simplified method appeared successful and became common practice in factories in Victoria, N.S.W. and South Australia. After the war, however, it came under attack as the possible cause of much poor quality butter, and the Section was obliged to carry out a thorough investigation of the method it had unwittingly propagated. In the end the method was cleared for use and proved commercially valuable to the industry.

First wartime task

At the start of 1941 Wiley acquired a second bacteriologist in Dr C. C. Thiel, who was just back from NIRD—and he came within an ace of losing his first, when Pont was called up by the Army. As yet there was no national policy of exemptions for reserved occupations, but Pont attended his medicals furnished with a persuasive letter from Wiley, and the Army agreed to manage without him.

By this time, one problem was looming over Australian dairy exports: shortage of refrigerated cargo space had begun to curtail the export of second-grade butters, leaving States like Queensland, the chief producer, with large accumulated stocks. On its own initiative, the SDR began to work out a satisfactory process for removing the water from butter, thus converting it to butteroil. Such a product could be packed in airtight containers and shipped as ordinary cargo without loss of quality.

Work on production of butteroil marked a turning point for the SDR, bringing them into contact with new colleagues and, at the same time, dealing an unfortunate blow at good relations with the State School of Dairy Technology. Trouble at Werribee stemmed from the enthusiasm with which the men attacked the project. When the time came to undertake pilot-scale trials, it seemed the most natural thing in the world to take over the processing area of the School and use the School's excellent equipment; one step was omitted however, that of liaising at the outset with the Principal, T. M. Jensen. Every day and night for a week the processing bay was monopolized by the men from CSIR, presiding over a mound of melting butter. Jensen was anxious for his expensive new equipment, now being put to uses for which it had not been intended, and for his boiler, which was tended by operators who certainly lacked proper qualifications. Whether in a good cause or not, would they survive such treatment? Jensen was so disturbed by the whole affair that he broke off all social relations with the SDR. The butteroil trials, while successful technically, caused a rift in relations with the School that was remembered even 10 years later, when another CSIR dairy research officer was temporarily stationed there.

As soon as work on war projects started, the CSIR group of four was augmented by a recruit from a powerful new CSIR Division that seemed, on the face of it, to have very little to do with dairy research. It was destined to provide an unusually successful approach to several current problems.

Second approach to dairy problems

Among special measures taken by CSIR to help meet the needs of the war, a Division of Industrial Chemistry was formed early in 1940 to act as a research service—not, this time, for primary, but for secondary industry. The first Chief, Dr I. W. Wark, found himself master of such a huge and cloudy domain that in the years following the war no fewer than nine CSIR Divisions were to spring from the original Division of Industrial Chemistry.

Wark's objective was to bring the resources of chemistry to the development of better industrial processes, making Australian industry more efficient and self-sufficient, and less wasteful of industrial byproducts. Not wishing at first to spread his activities so widely as to be ineffective, Wark intended to concentrate on certain craft-industries connected with minerals, wool and hides, where production tended to follow rule of thumb methods passed down over the centuries. At the suggestion of his close colleague, E. J. Drake, who was forming a Section of Chemical Engineering in the new Division, Wark added dairy manufacture to his list. Drake criticized the condition of dairy foods as supplied to the troops—the runny butter and mouldy discoloured cheese—and advocated the development of improved forms as a matter of wartime necessity. Looking further ahead, he pointed out that the standard processes of dairy manufacture, which involved pumping, centrifuging, heating and cooling large quantities of liquid, had never been examined from the point of view of chemical engineering; innovatory technology and new methods based on better scientific understanding would bring about savings in labour in many traditional processes and would assure consistent quality in the product.

Wark was known for the immense pains he took with the appointment of his first, key scientists. He and Drake together chose an agricultural chemist, Geoffrey Loftus Hills, to initiate Dairy Research.

Loftus Hills was then about 30 years old; although younger than Wiley, his early career had run on roughly parallel lines; he had worked as a State Government officer and had gone to NIRD on a joint Government–industry grant. But unlike Wiley, Loftus Hills had worked for several years in the butter and cheese industries, both as manager and technologist. He knew their problems intimately. Moreover, his broad background made him more at home with the techniques required to transform a successful laboratory

Geoffrey Loftus Hills.

experiment into a workable commercial process. With such qualities he was well prepared to usher the Australian dairying industry into the modern world.

Premises for the Division of Industrial Chemistry (DIC) were to be built at Fishermen's Bend, a piece of industrial wasteland on the banks of the Yarra River, where laboratories for the CSIR Division of Aeronautics were already going up. In the meantime, the officers of the research sections were scattered in temporary quarters all over Melbourne. Loftus Hills had the caretaker's room in the Division of Animal Health at Parkville. His first studies were to be on aspects of processed cheese and on a novel method of cooling milk during pasteurization. Almost immediately, however, he was asked to join forces with Wiley for work on the butteroil project, where his interest in chemical engineering would be particularly useful.

From the start, the two groups worked as a single team, although integration was not formally accomplished until some time after the war. No further officers were recruited for Wiley's Section but an Agricultural Science graduate named John Conochie, and a Technical Officer, W. G. T. Laffan, were added to Loftus Hills's group. Although it was Loftus Hills and his colleagues in DIC who were officially seconded, it was the SDR that was absorbed, in outlook and ideas, into the DIC. When the new laboratories at Fishermen's Bend were completed, the SDR moved into excellent quarters alongside the Sections of that Division. Conochie happened to be the first scientist permanently stationed on the new site. Reporting for duty immediately after the bombing of Pearl Harbour, news of which had reached him whilst travelling in the train from Western Australia to take up his appointment, Conochie was pressed into service for the task of stocking up on chemicals and consumables for the new Division: Wark's storeman was still in the army, not due for release for several weeks, and Wark rightly feared that some stores would become unobtainable if he delayed.

Dairy products for wartime conditions

Butteroil for Britain

The Section of Dairy Research displayed considerable skill in anticipating the special needs of the armed services and the problems of export which arose as a result of the war. When shortage of refrigerated cargo space halted the shipment of lower grade butters to Britain, work on butteroil was already underway and rapid progress was possible in the practical use of the method. The Queensland Butter Board (QBB) began commercial production in April 1942 and over the next 12 months processed 1950 t butteroil for shipment to Britain as ordinary cargo; later in 1942, a further 115 t were prepared for the United States Army. In the development of a successful method the SDR worked very closely with the dairy manufacturing industry and with dairy machinery manufacturers, adopting a principle of close cooperation from the beginning with those who would put the method to use, a principle which was subsequently followed by the Section in all its practical projects. The development of butteroil was a valuable contribution in Australia's role as provider of concentrated foods to Britain, and in itself was a highly satisfactory product. As Britain followed the practice of placing her fats in reserve, much of the butteroil was not used until over 12 months old; its quality even then was found to be excellent.

Butter for the tropics

At the outbreak of war, the Australian Army had bought up thousands of cases of tinned (canned) butter, presumably believing it to be a stable product like canned meat or jam. The butter was sent to northern Australia and stored in unrefrigerated food stores and outdoor dumps. Not surprisingly, when the product was opened it was generally found to be inedible. Army authorities in Melbourne consulted with the SDR, asking them to provide an improved canned butter that would not develop bacterial defects.

Instead, the SDR set about developing something new. Having successfully completed work on butteroil, it was able to proceed at once with the development of anhydrous spreads which would have a better chance of meeting the army's stringent requirements. The aim was to supply a product that would not melt at high temperatures and that was not susceptible to bacterial deterioration; it was expected to have good flavour and texture into the bargain.

The Section first produced Tropical Spread, a blend of butterfats, skim-milk powder and salt (1943). Consumption of this product brought to light its defects, particularly in flavour, and the Section was able to develop a greatly improved spread, that was given the unhandy name of 'Butter, Concentrated, Hardened'. Care was taken to eliminate traces of oxygen and copper and a small amount of diacetyl was added to improve flavour; by working closely with the QBB, which was manufacturing both spreads, the SDR was able to ensure careful quality control. Butter Concentrate, as it came to be known, met the army's exacting specifications extremely well; moreover, its keeping qualities were such that a can made at the close of World War II and subsequently opened by Cliff Thiel in England in 1952 was still in sound condition.

The anhydrous spreads developed by the SDR proved to be the most successful of several that were devised for the same purpose in the Allied countries during the war, and extensive use was made of them. A total of 4000 t Tropical Spread and 1300 t Butter Concentrate had been manufactured for supply to the Allied forces in the South-west Pacific area before war's end. Butter Concentrate is still being manufactured for supply to the Australian Army and to shops serving campers and hikers.

Other wartime products

The SDR experimented with milk and cheese products not needing refrigeration, and had considerable success with a compressed milk-powder and sugar tablet that could be easily crushed and dissolved in liquid. Although this compressed milk and sugar mix would not withstand the most extreme tropical conditions, its storage properties at average temperatures were very good and it was widely used by the Australian navy. Investigations into the compression of milk powder to save shipping space and reduce oxidation were started, which led to the development of an extensive study of gas-packing of milk powder and a comparison of the relative quality of milks reconstituted from dried whole milk and from dried skim-milk plus butterfat.

In the later years of the war the Section was able to cooperate closely with army and government authorities. It maintained close quality control over all dairy products supplied to the Australian Army, and it helped to resolve a constant stream of technical problems.

Development achieved by SDR during the war

Most of the work which has just been described was sound technology that was applied to immediate practical problems. Sometimes in the course of a study, gaps in existing scientific knowledge were revealed that could not be made good at the time, but which were taken up after the war. One subject which received constant attention in the laboratory during the development of anhydrous spreads was the oxidation of butterfats, which caused pronounced flavour deterioration in the spreads. The Section recognized and began to elucidate the role of traces of copper and iron, picked up from materials then widely used in Australian dairy processing equipment. These elements promoted oxidative deterioration. As early as 1938, W. J. Wiley had been studying the oxidant effect of acid and salt in cold-stored butter, and the Section now recognized a closely related effect in the deterioration caused by adding dry dairy salt, made from sea-water, to butterfat. With the end of the war, it was possible to proceed to more fundamental work on the nature of these oxidant effects.

The experience gained by the Section in modifying the separation techniques for milk stood it in good stead for subsequent work on recombined milk products. Similarly, the creation of butter concentrates was the first of its 'new food' projects, a line of work it continued to pursue with considerable success after the war.

Several analytical techniques were developed, often as a byproduct of other investigations. These included an apparatus for the rapid determination of oxygen in the head-space gas in cans of gas-packed milk-powder, and also a highly sensitive test capable of showing the first uptake of oxygen by milk-fat.

SDR at Fishermen's Bend

Fishermen's Bend was not in itself a pleasant place. Sir Ian Wark has recently written about the early days of the DIC and described the isolation of the laboratories, 'served only by open-sided buses travelling fast over unsealed roads strewn with coal dust and horse manure' (Wark 1976). There were no shops and few houses; indeed, staff members could not put in every Saturday morning at work, as many CSIR Divisions were doing, because of the need to have some hours off to get their shopping done: with the long journey to and from the laboratory and the necessity—voluntarily undertaken—of working back on two evenings a week, there was little time left outside working hours.

The DIC was cheek by jowl with the Division of Aeronautics and two aircraft factories: with such neighbours, staff members had no difficulty in taking seriously the regular fire-squad drill and the air raid practices. Air raid shelters were on the site: half cylinders of corrugated steel covered with sand. It was impossible to excavate shelters as the whole site was only a foot or so above the water-table of the Yarra River.

Such handicaps were unimportant, however, to a young and talented staff working on projects of wartime importance. Loftus Hills has commented on the stimulation of working in such an environment. Members of the Section were constantly in contact with the problems of other manufacturing and extractive industries, which consequently broadened their perspective on their own problems. Advice and help on matters of engineering or metallurgy were as close as the next laboratory.

Loftus Hills leads Section

Shortly after the end of the war, in January 1946, W. J. Wiley applied for, and obtained, the job of Commonwealth Dairy Expert in the Department of Commerce (now Primary Industry). Wiley had not been well and his health contributed to his decision to leave CSIR. However, he remained a good friend to the Section. In his new position he had at his fingertips information useful for its efforts to improve dairy exports and, by the same token, he helped propagate in industry the more advanced practices developed in the Section. Even bearing in mind Wiley's valuable work with Loftus Hills on the creation of butteroil and anhydrous spreads, we may conclude that his most original work was done while he was 'a loner', and before a CSIR Section of Dairy Research existed. His solving of the problem of woodtainting and his elucidation of some of the factors important for good keeping quality in butter were notable accomplishments and were important to the successful operation of the Australian butter industry.

After Wiley's resignation, in September 1946, CSIR took the opportunity to unite officially the two groups that had, in practice, been working as a joint team for several years. The scientists in Industrial Chemistry were formally transferred to the Section of

W. J. Wiley on his retirement.

Dairy Research and Geoffrey Loftus Hills was made Acting Officer-in-Charge.

Two facets of his wartime experience had helped prepare Loftus Hills for leadership. One was his confidence that a radical scientific approach could transform the industry, an attitude that gave him a purposefulness reflected in the enthusiasm of the entire group. His other relevant experience was in the actual day-to-day administration and guidance of a research group. The man who had created dairy research in the DIC and had intended to oversee its development, E. J. Drake, had been seconded, immediately after its formation, to head Munitions Control and he returned only briefly to the DIC. Thus Loftus Hills was left to exercise his own judgment in running the Section.

Nevertheless, transition to the position of full Officer-in-Charge was by no means automatic. The Executive advertised for, and would have liked to obtain, a leader of greater proven scientific stature; failing in this, it considered the possibility of placing the Section under the overall jurisdiction of Dr J. R. Vickery of the Division of Food Preservation. Nothing came of either plan and finally, in May 1947, Loftus Hills was confirmed in the position of leader of the CSIR Section of Dairy Research. The selection proved to be a sound one.

Chapter 8. Technological innovations 1945–59

As soon as the pressure of wartime commissions eased, the Section of Dairy Research (SDR), under the leadership of G. Loftus Hills, turned its attention to some of the longstanding technical problems of the Australian dairy industry. Loftus Hills saw the need for innovation in many facets of the industry—the need, for instance, to build up fundamental knowledge in areas of dairy chemistry and bacteriology where lack of understanding deprived the manufacturer of adequate control over his process; and the need to devise completely new processes for some products, in order to alleviate the high requirements in labour and costs that were holding back the expansion of some traditional dairy manufactures.

Loftus Hills was unusual among CSIR/CSIRO leaders, not in having a keen sense of the needs of an industry in a particular period (for others also had this), but in being willing to take them over holus-bolus. In the words of L. L. Muller, his partner in several schemes to advance the industry, 'Loftus always operated on a broad front; he knew that people and facilities must be favourable before work could be carried out'. The disorganization in the industry, which had so much pained the CSIR Executive in the 1920s, still hindered its general advance: Loftus Hills, with W. J. Wiley and a few others, urged the formation of an Australian Society of Dairy Technology. Once this was a reality, Loftus Hills throughout his career did everything to see that it worked successfully as a unifying and educative force. He edited the Society's *Journal* for 17 years; he and some of his colleagues at the SDR acted as office bearers over long periods. Later on, the Section played an equally important role in the formation of the Australian Dairy Products Standards Organization. Over many years, Loftus Hills argued the case with industry leaders for generous support of research by means of an industry levy; when such arguments bore fruit, he took a place on the supervisory committee responsible for the detailed application of the funds. In all these ways Loftus Hills hoped to lead the still rather primitive Australian industry into more modern concepts. His approach to scientific work was equally broad. The small cooperatives which constituted the greatest number of dairy processors in the 1940s and 1950s were still backward in applying established technical principles, just as they had been two decades before: the SDR was prepared to give continuing advice and help in their practical problems, even where this entailed extension work rather than research. A key step that had to precede any fuller utilization of the constituents of milk as human food was to change the dairyman's traditional practice of sending only his cream to the factory whilst holding the skim-milk for use on the farm; once again, Loftus Hills was aware of this and used the SDR's energy and influence to help bring about the change.

Loftus Hills came under criticism for some of these activities which it was felt, turned the Section into an industry service centre rather than a centre of research. But his philosophy and approach made the SDR effective at a time when the industry laboured under severe practical difficulties.

The kitchen scientists

Without in the least letting the knowledge affect its spirits, the small group of dairy research men at Fishermen's Bend were aware that they lacked a certain glamour when set beside the scientists of Wark's Division of Industrial Chemistry (DIC), many of whom had doctorates and were engaged on particularly recondite fundamental research. This was the period of the 'Surgeons' Club' at the DIC, formed in humorous self-defence to parry the thrust of so many doctors; for some years after Wiley and Thiel departed in 1946, the entire staff of the Section of Dairy Research would have been eligible to join the Surgeons' Club. As one of their number asserted, the dairy men were 'the kitchen scientists, messing around with milk and butter'. They were solidly valued by their colleagues in the DIC for their practical accomplishments, as evidenced in the wartime development of foods suited to difficult conditions (no doubt also for the wartime provision of homebrew for Divisional parties).

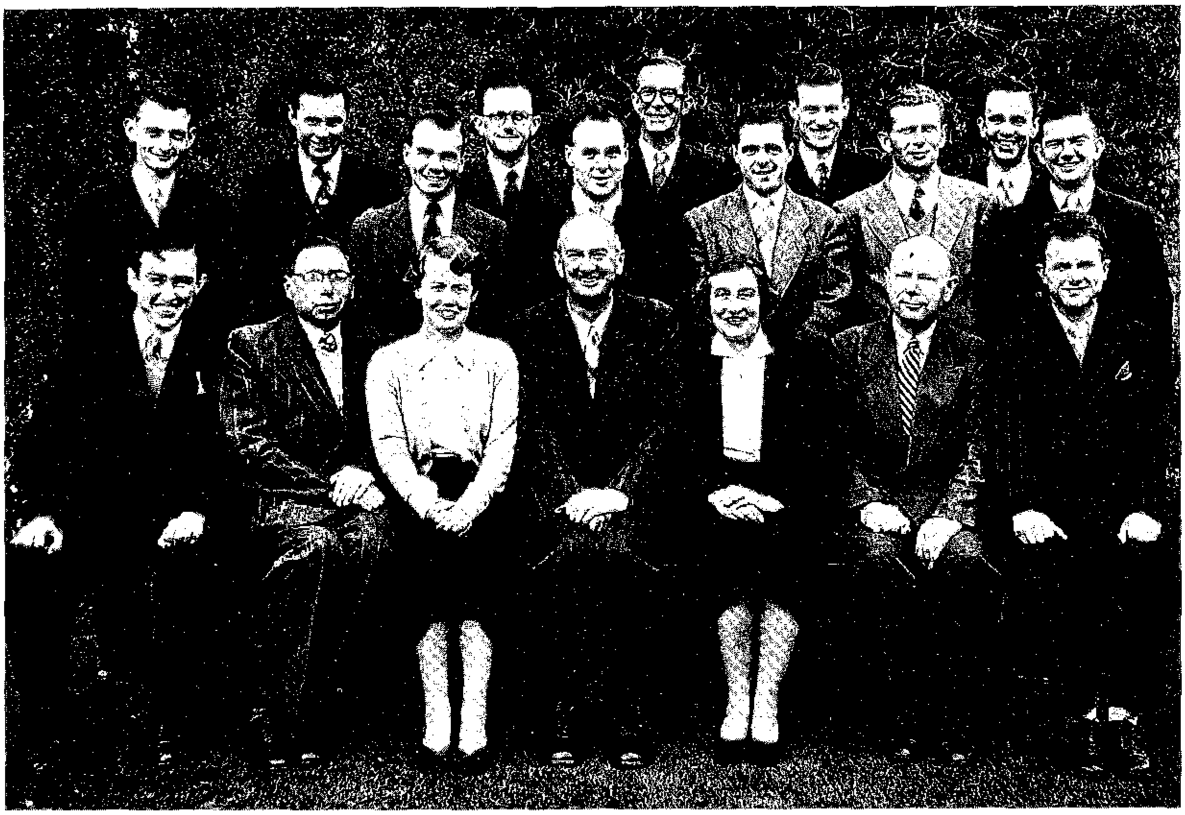
Like most of the early CSIR leaders, Loftus Hills had imbibed Sir David Rivett's philosophy that the ideal research group would comprise about 30 professional scientists, with a somewhat larger number of ancillary staff. The opportunity to test this did not, however, arise for many years. For its first two decades Dairy Research remained a small and close-knit Section, operating on modest resources; in 1949 there were five professional scientists and in 1959 there were 10. Over these years the annual budget had climbed slowly from \$17 000 to \$149 000. Its rate of growth was partly stifled by the increasingly cramped quarters at Fishermen's Bend, but more important was the Executive's belief that, at least for the time being, the group serving the dairy processing industry should not be a large one. Loftus Hills battled strongly with the Executive, but to little effect, for a greater share of money and positions.

The Section was organized for work along flexible lines, in keeping with its size, so that it was easy to shift men from one group to another to concentrate on work of high priority. Like Vickery at Homebush, Loftus Hills offset the shortage of room at Fishermen's Bend by taking up offers of space at sister institutions: the earliest work on using skim-milk in bread manufacture, for instance, was done at the Division of Food Preservation (DFP) at Homebush and at the William Angliss Food Trades School in Melbourne; it was later carried to success by an officer stationed at the Bread Research Institute in Sydney. Similarly, when work on starter-cultures for cheese commenced in 1951, the first studies were done at the Victorian School of Dairy Technology at Werribee.

The normal difficulties of obtaining first-rate staff to extend the program were compounded at Dairy Research by the small size of the group and the fact that as yet it was little known outside Australia. At one point Loftus Hills had to defer projects on oxidation defects and on specialized milk-powders for want of suitable officers. Even when he received comparatively ample funds from industry, he found it much easier to get the equipment he wanted than to obtain suitable men.

In the early years, Loftus Hills partly overcame the scarcity of dairy specialists and the lack of advanced overseas training among his own officers, by seeking out staff when he made visits overseas. Thus in about 1950 he brought to the SDR three European food scientists whose careers had been interrupted by the Second World War, Dr Karl Kumetat, Dr Nikolai King and Mr Josef Czulak. They had a *brio* that was valuable to the Section, with vivid personalities and a broad research background. Even King, whose most notable work was done before he reached the SDR, was able to illuminate an important and hitherto neglected aspect of the products the SDR was studying. Czulak was to make the greatest scientific contribution, using his great vitality and technical brilliance to force to a successful conclusion the project of mechanizing cheesemaking.

Of the three, Dr K. H. J. Kumetat earned a special place in the life of the SDR. Kumetat was 'a kitchen scientist', a clever inventor who had been pressed into service by the German government to create substitute foods during wartime scarcity, work he performed with great success. He possessed a ruthless candour and an air of deadpan innocence that masked a gleeful sense of humour. Like Huelin or McKee at the Division of Food Preservation,



Staff of the Dairy Research Section in the early 1950s. *Left to right standing:* R. A. Wilkinson, D. A. Forss, D. Harris, J. Conochie, R. Beeby, E. G. Pont, L. R. Hammond, W. Stark, J. Czulak, J. W. Lee, A. J. Lawrence. *Seated:* P. Smith, K. Kumetat, H. Billing, G. Loftus Hills, T. A. L. Thomson, N. King, E. A. Dunstone.

he generated a fund of anecdote, much of it to do with the slow naturalization of this very European character.

Karl Kumetat had been overjoyed at getting away from Germany and when he reached the New World he hastened to embrace the local ways. In his new job, he decided, he would not insist on the formality he had been used to at home: there was no need at all for his colleagues to address him as Herr Doktor Kumetat. 'Call me', he invited generously as he was being introduced around the laboratory, 'Call me Charles'. Somewhat to his perplexity, no one called him Charles—he was Charlie from then on to all and sundry, from the handyman to the Officer-in-Charge: it took the Herr Doktor a while to get used to the salutation. Although every line of his face betrayed his Teutonic origin, Kumetat took immense pride in the fact that he now 'belonged' to Australia; his language and dress became as Ocker as he could contrive. One morning he arrived at work livid with rage, too angry

The young Joe Czulak.

to speak. When his colleagues had managed to soothe him, he spluttered out the explanation. While he was waiting at the bus stop to come to work a couple of migrants had approached him and struck up a conversation, in German. 'The buggers!' Kumetat howled, '*In German*! I was wearing my bloody Australian shirt, my bloody Australian trousers and my bloody Australian sportscoat: couldn't they *see* I was a bloody Australian?'

Kumetat died, much too soon, in 1957, well before he had worked out his scientific vein.

Roots of post-war scientific program

Stimulus for the SDR's post-war program came from three sources. During the war the Section had become adept at the practice of taking milk apart and putting it together in new ways, and this was the first step into an important new field of research, that of new and recombined dairy foods. Overseas techniques in analytical chemistry, devised during the war or in the years following, proved of enormous value when the SDR appointed a scientist to study flavour compounds in dairy foods (1948). The third and strongest influence of all in shaping the SDR's work was the noble ideal of applying chemical engineering principles to the dairy manufacturing process, and this derived, of course, from its roots in the Division of Industrial Chemistry (DIC).

In 1946, two Sections that had grown up among the DIC's many wartime activities, the Sections of Dairy Research and of Physical Metallurgy, were severed from the parent Division as being outside its true scope. However, the Section of Dairy Research remained physically a part of the DIC until the end of 1954, and hence could avail itself of more varied expertise and more elaborate equipment than such a small group would normally dream of possessing. To take a single instance of practical support, early studies on oxidation of butterfat, requiring steam distillation of 9000-litre quantities of milk, were accomplished with the help of the Chemical and Mechanical Engineering Sections of the DIC. Space at Fishermen's Bend was too restricted, however, to continue the close association of the two groups indefinitely. The Executive expected the DIC to extend its work on minerals problems, whilst the SDR wished to cover the full range of dairy products. Hence, soon after the war, Loftus Hills began to plan for a move to independent quarters; this was eventually accomplished in 1955. In its new laboratories at Highett, the SDR maintained useful contact with several of the Divisions that had evolved from the DIC as well as opening closer relations with the Divisions of Food Preservation and Animal Physiology.

Unfinished business: improving butter

Soon after the war, E. G. Pont and J. Conochie made two thoroughgoing investigations on aspects of buttermaking, in an attempt to answer questions left unresolved at an earlier time.

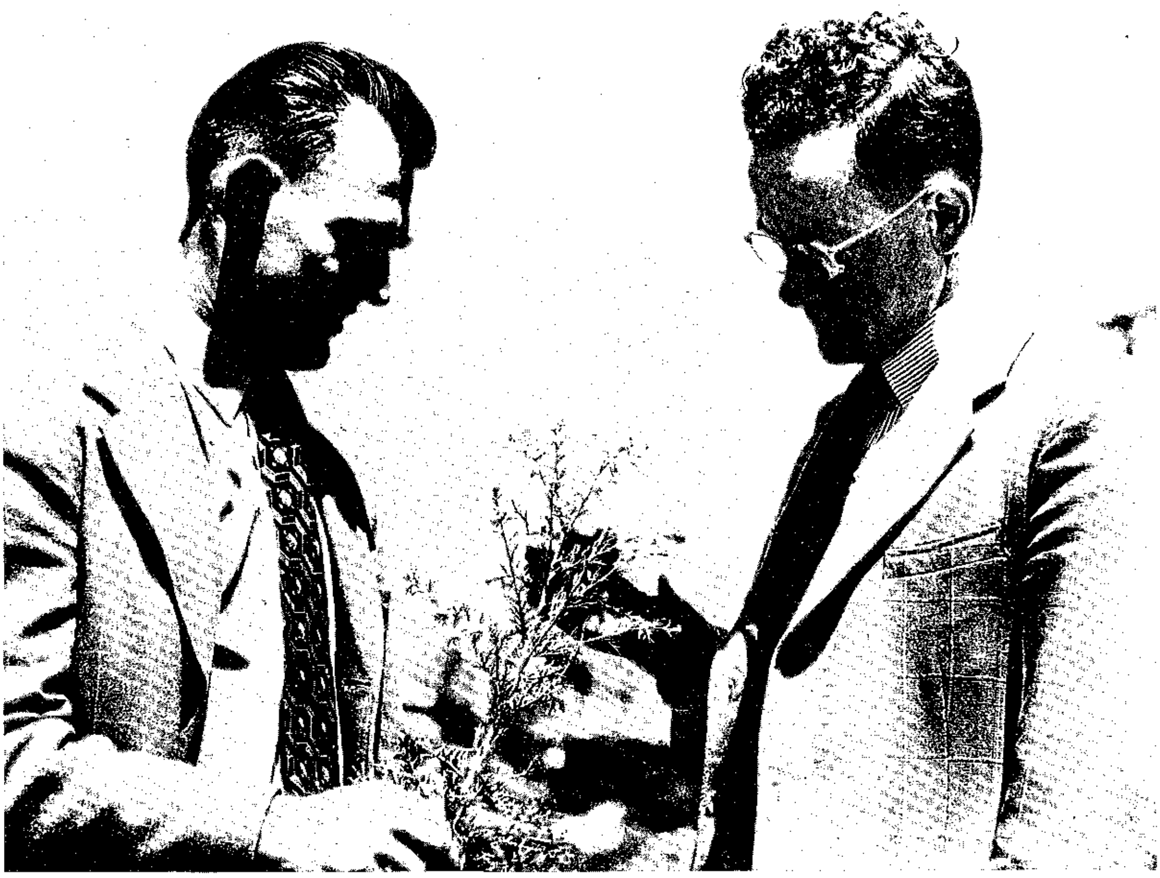
Making butter more efficiently

As official butter graders considered that the omission of the washing procedure caused poor quality and rapid deterioration in butter, Pont was asked to make a critical appraisal of the effects. His thoroughgoing investigations in many butter factories throughout Victoria (1946–47) cleared the method for general use and the change in manufacture was gradually adopted throughout the industry.

Later on in his career (1962–63), Pont reviewed another accepted practice, that of churning butter from slightly alkaline cream. His findings, like other SDR studies, showed the possibility of more efficient manufacture, provided that copper was eliminated from dairy utensils and processing equipment. Pont's investigations alone were recently estimated as being worth some $650 000 annually to the Australian butter industry.

Removing weedtaints

In its work with the Queensland Butter Board on anhydrous spreads, the SDR had become all too familiar with the problem of seasonal weedtaints—pungent off-flavours which were not removed by any available treatment of the cream. The problem was an old one, encountered for instance by Professor Wadham in his 1929 investigations; now John Conochie attempted to trace the mechanism of tainting and find a remedy. For several years, Conochie spent the winter months at Gatton Agricultural College, working with milk samples collected from near and far in Queensland. Subsequently he took his field work indoors, as it were, by stationing a goat at Fishermen's Bend and feeding it on a supply of Queensland weeds. At the time, Conochie was forced to conclude



John Conochie studying *Coronopus* weeds.

that the taints could not be removed until more was known of the flavour compounds responsible; this problem became the incentive for the formation of a flavour chemistry group at SDR, as soon as a suitable officer could be found.

It may be added that the goat, once safely returned to its owners, proved as hard as weedtaint to erase from the official records in any way acceptable to CSIRO's auditors, since it had not been used up or worn out and Conochie refused to sign a death certificate for such a lively lady. Eventually he worked the trick with some nice sleight of hand and a $2 bill borrowed from and subsequently restored to petty cash.

New work

Two areas of work particularly attracted Loftus Hills as being profitable for the SDR to undertake. One was that of food engineering, to distinguish those processes of dairy manufacture (and, as in any craft industry, there were several) that would respond to attempts at mechanization or at least at improving their efficiency. In addition, he was enthusiastic about the possibility of making more and better use of all the constituents of milk, particularly of the proteins, by adapting them for use in other foods and by creating new dairy products.

Innovation for the cheese industry

After the expansion achieved in wartime the Australian cheese industry had actually contracted in post-war years in the face of baffling technical problems and a crucial shortage of skilled labour. In 1950, with the assistance of funds allotted by the Australian Dairy Produce Board, the SDR created a position for a scientist to work on cheese manufacture. This was the position filled by Jozef Czulak, a one-time Polish cavalry officer who had settled in England after World War II and embarked on a career in dairy science. Czulak's influence on the Australian cheese industry was to be remarkably useful and far-reaching.

Improved starter cultures

Czulak's first task after arrival in Australia was to investigate the problem of

Joe Czulak working on starter cultures.

bacteriophage attack on starter cultures, the organisms used to start the fermentation of the milk sugar in the cheesemaking process. The industry of the period had no effective remedy for the slowness or failure of starters under bacteriophage attack, which could be so serious and persistent as to force factories to close.

Fresh from similar work in England, Czulak offered a new approach which depended on the use in rotation of a range of pure starters distributed from a central point. The SDR established a service of preparing freeze-dried starter cultures for distribution through the State Departments of Agriculture (1950–54); at a later time (1967–75), it developed a method of storing deep-frozen starter concentrate over long periods. The service pioneered by Czulak reduced starter failure substantially and, with some modifications, is widely used by the Australian dairy industry today.

Mechanizing cheese manufacture

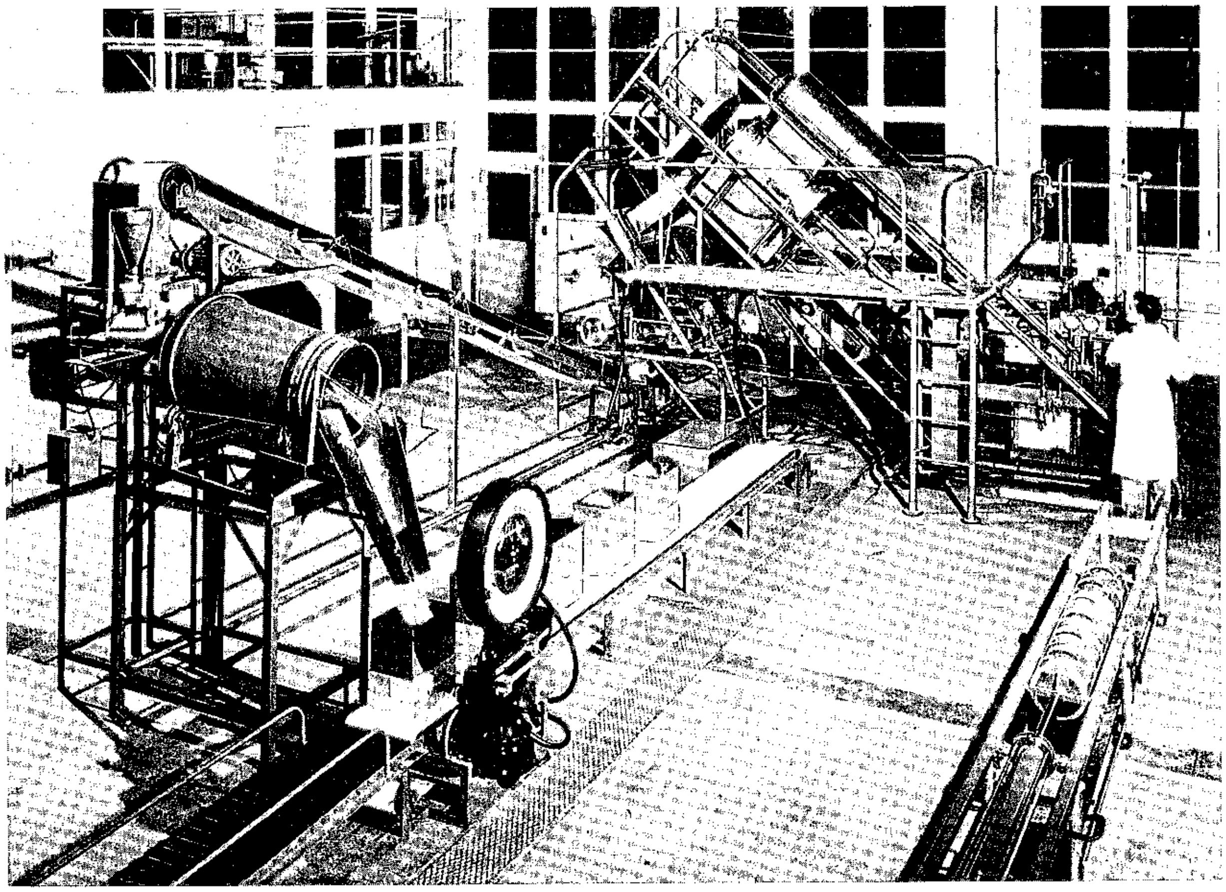
When Loftus Hills first suggested that Czulak should take on the task of mechanizing cheesemaking, Czulak replied that he was a bacteriologist, not an engineer. He did not assert, as most cheesemakers of the day would have done, that the task was impossible: cheesemaking was an art and no machine could substitute for a cunning craftsman. Cheddar cheese was the only economically important variety manufactured in Australia, and the process for Cheddar was especially laborious, complicated, and poorly understood. Machines had already been introduced to replace labour in some of the early stages of the process but the later and more difficult stages, those of cheddaring, milling, salting and hooping, and then pressing the finished cheese into blocks, appeared to defy scientific control and mechanization.

However, once Czulak agreed to take up the problem, difficulties were brushed aside: he was determined to bring it off. He had an able young assistant in Mr Les Hammond who remained Czulak's technician over his 25 years of service, and is now regarded as a leading cheese technologist in Australia. Characteristically, Czulak confronted the hardest part of the problem first: the invention of a machine able to take over the cheddaring process. In 1957, after more than two years of working long days and nights, Czulak was able to announce that the team now had pilot plant that could encompass all stages of cheesemaking through the phases of cheddaring, milling, salting and hooping. This pilot plant was constructed by the Mechanical Engineering Section of CSIRO. In the same year, Czulak's team was joined by a first rate engineer, Mr N. H. Freeman.

So far, so good. The work was applauded when a progress report was presented in London in 1958, before an audience of cheesemaking experts. There remained the even more difficult and very protracted task of translating the pilot-scale machinery into a commercial system, work that will be described in the next chapter. But by 1957 it was clear that cheese of good quality could be made by a machine, without invoking any art higher than technical skill and scientific knowledge.

Introduction of rindless cheese

The traditional Australian export Cheddar, consisting of large, round, bandage-wrapped cheeses, was often blemished by surface cracks and moulds, and was downgraded accordingly. Even where care was taken to improve quality, the reputation remained obdurately low. In 1958 Loftus Hills surveyed the out-turn of Australian rinded cheeses on the London market and confirmed the generally poor quality. To overcome poor quality and poor reputation at one blow, Joe Czulak prevailed upon



Les Hammond operating the prototype of machinery for mechanizing all of the stages of cheesemaking.

cheese manufacturers to change to rindless cheese wrapped in polyethylene film, following the practice that had recently been introduced in Britain and the U.S.A. Conochie was made Executive Officer of a Committee to guide Australian industry, and all technological and extension work was done by the SDR. The transition to rindless cheese was managed quickly, and it proved very effective in raising export quality and also export prices.

Using all the milk

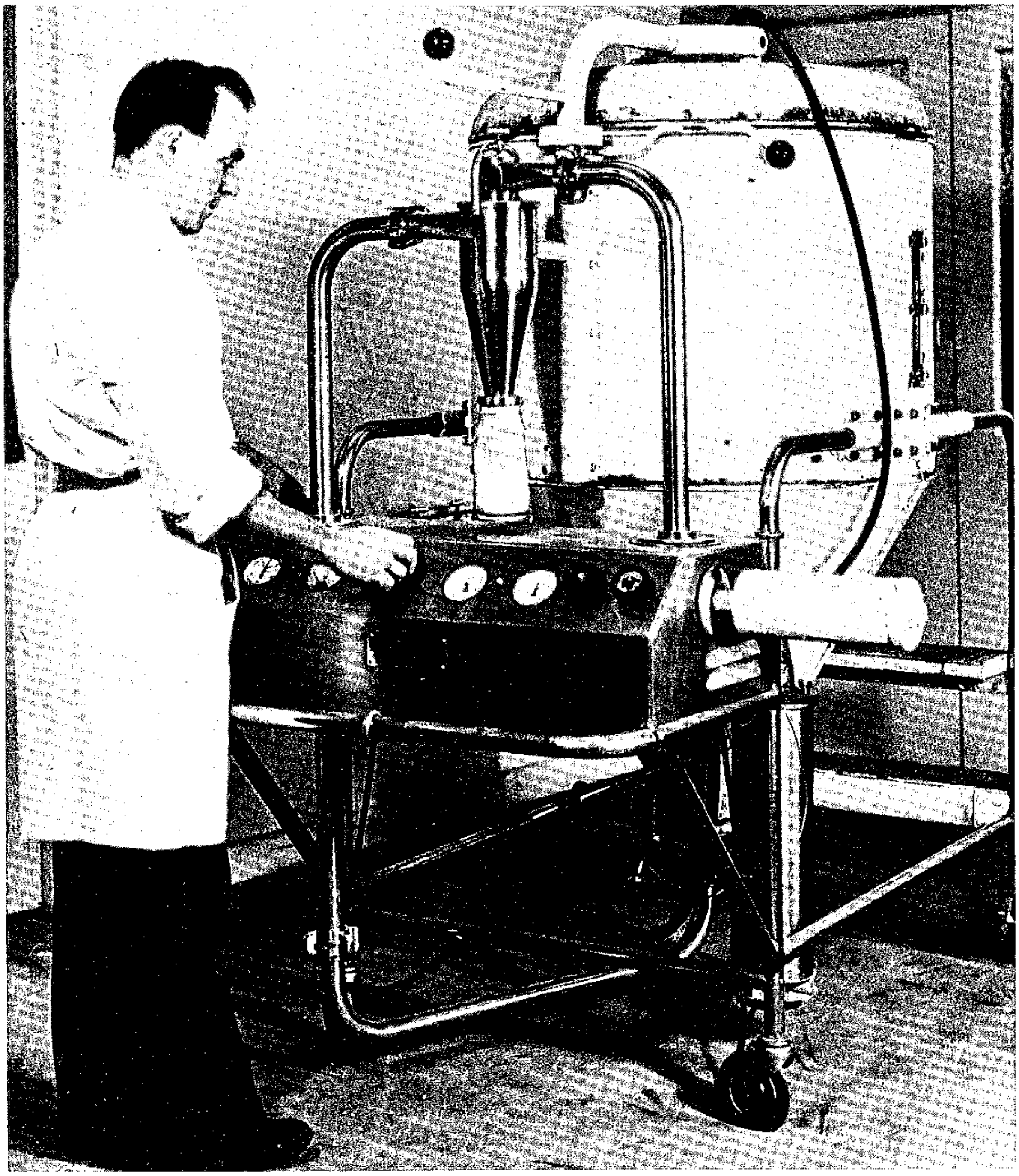
One result of the growing practice in the dairy industry of sending whole milk rather than cream to the butter factory was to give the dairy technologist the opportunity to use all the milk constituents for human food. Such usage would give the farmer a better financial return and would help to avoid the wasteful use of high-grade protein in animal feeds, glue and fertilizer. A first consequence of the new practice, however, was an unwelcome surplus of skim-milk powder, and the SDR was asked to help develop new outlets. Loftus Hills took up the request and

John Conochie examining cheeses.

directed J. Wilson Lee and later, K. H. J. Kumetat and R. Beeby to work on the project.

Specialized milk powders

The SDR's first efforts at utilizing skim-milk were drawn from technology developed overseas. As often happens in such a situation, further development was needed to suit local conditions and ingredients. After several years of experiment, Wilson Lee was successful in providing the bread industry with a form of skim-milk that could be added to a standard recipe without any reduction in loaf volume (1952). Kumetat, while in Germany, had developed the 'milkegg' as a replacement for eggs in baked goods, and he created two similar products here, for use as egg-white in meringues and whole-egg in cakes (1954 and 1956).



Ralph Beeby operating a Niro spray dryer.

Addition of skim-milk powder to bread proved a valuable technique and one that still accounts for sales of quantities of skim-milk. Kumetat's ingeniously devised egg-substitutes failed on the commercial market as a consequence of an unexpected rise in the price of skim-milk and a fall in the price of eggs—a fate that always threatens the inventor of new products. In the late 1950s, J. Conochie and R. A. Wilkinson worked out a method of maintaining the stability of vitamin A after incorporation in skim-milk, thus increasing its dietary value; UNICEF agencies have made extensive use of this procedure over recent years.

In all these projects, the SDR built up valuable expertise in modifying milk powder to suit specific purposes and in trying out laboratory successes on a factory scale. This was excellent preparation for work on recombined milk products in the 1960s.

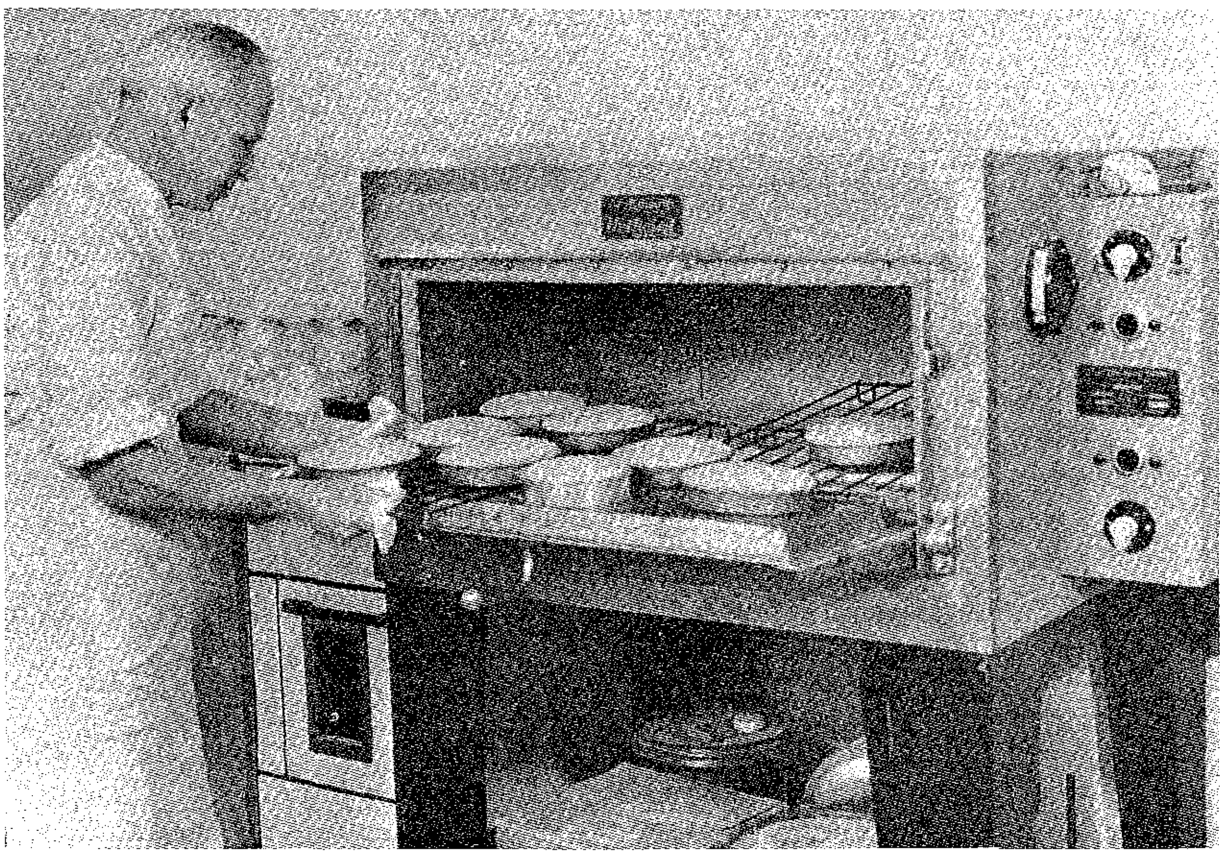
Basic studies

The Section's strongest suit, at least during its first two decades, was in applied work. It is generally only after an industry has used most of the technical knowledge already available that new fundamental work is necessary before further practical advances can be made. Fairly early on, however, and prompted by difficulties arising in some of the SDR's applied investigations, Loftus Hills appointed specialists to work on the flavour chemistry and microstructure of dairy products.

Flavour chemistry

Both in Conochie's work on weedtaints and the studies by Loftus Hills and Wilkinson on flavour defects arising from fat oxidation, it became clear that intense off-flavours often arose from minute concentrations of compounds. Separation and identification of the compounds were essential steps in understanding and possibly controlling the production of flavours and off-flavours. The SDR was already familiar with micro-chemical techniques, but the isolation and identification of unknown trace organic compounds was a different matter, calling for sophisticated techniques outside the expertise of anyone then on the staff.

David Forss was appointed in 1948 to undertake this work, making the Section the



Baking sponge cakes in the test kitchen using modified milk protein products (egg substitutes).

first dairy research group in the world to begin studies in flavour chemistry. In the course of 20 years with the SDR, Forss built up a research team that won international recognition, particularly for its work in identifying the profiles of compounds responsible for the typical off-flavours caused by oxidation in milk, cream and butter.

Forss began with crude techniques—the only ones then available—and his earliest identifications, obtained by spinning band distillation, cost him days of work to achieve results that could nowadays be obtained in half an hour with the help of automated instruments. Within a few years, however, he was blessed with a spate of new and valuable techniques emanating from developments in physical chemistry: gas–liquid chromatography, ultraviolet and infrared spectroscopy and, ultimately, mass spectrometry. Forss was quick to grasp the usefulness of the new techniques for work on dairy products. With the new methods, his team identified certain products of fat oxidation for the first time and was able to demonstrate, also for the first time, the powerful role of specific vinyl ketones in causing off-flavours (1962).

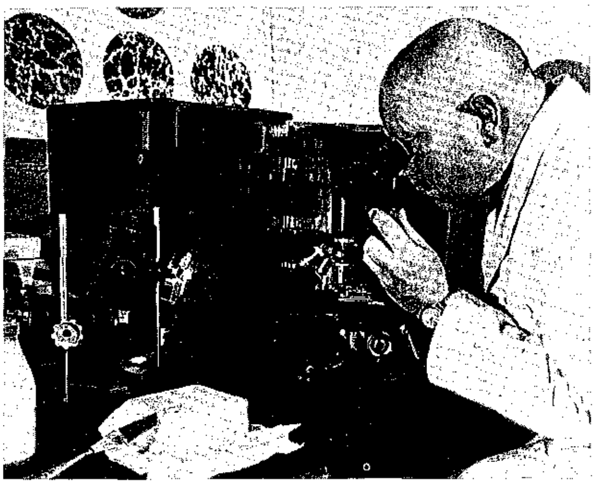
Microstructure

Loftus Hills was able to introduce the study of the microstructure of dairy products in 1951 when he obtained the services of Dr N. King, already a well-known figure in European dairy science for his mastery of the techniques of light microscopy. In the 1930s, it was King's theory of churning, based on his studies of the microstructure of butter, that permitted German technologists to develop a new, continuous method of buttermaking. King did no work of equal significance after coming to the SDR, and he was never altogether won over by that later development, the electron microscope. Yet his skill with the light microscope was so great that, by means of new techniques such as anoptral phase contrast, he was able to produce for his colleagues pictures of the microstructure of milk powder, casein and cheese, that were immensely useful to them in their studies of these products. King's monograph on one of the most important constituents of milk, *The Milk-Fat Globule Membrane* (1955), written by invitation after he was established at the SDR, remained for some 10 years the authoritative account of the subject.

Bricks and mortar

By comparison with Dr Vickery in his attempts to rehouse his Central Laboratory and to expand meat research in Queensland,

Bill Stark using a gas chromatograph for detecting off-flavours in butter.



Dr Nikolai King studying microstructure of dairy products.

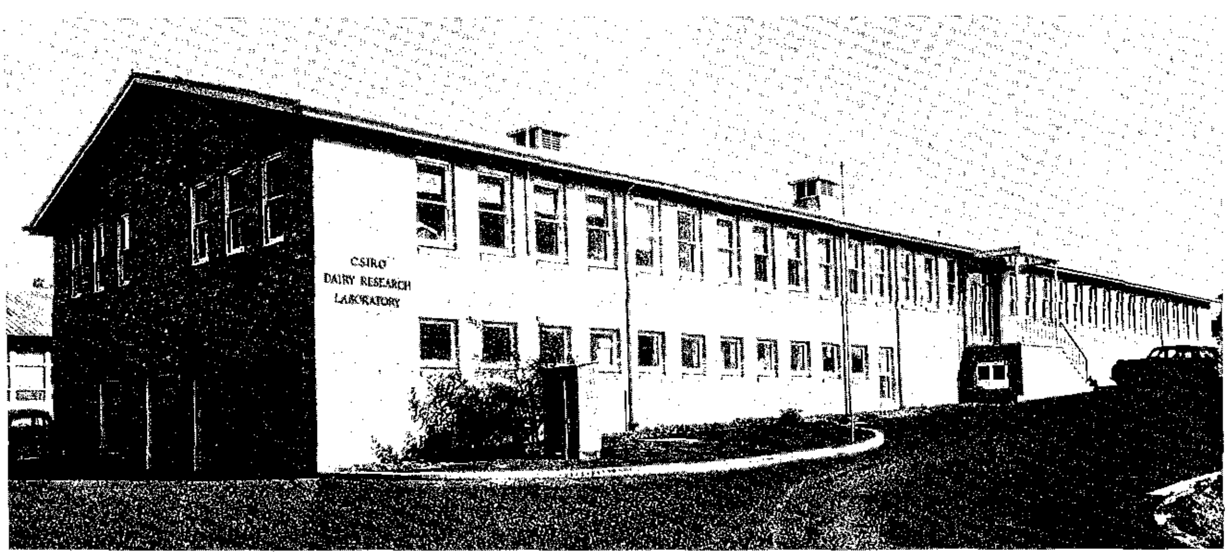
Loftus Hills faced few difficulties in obtaining independent laboratories for the Section of Dairy Research. His advantage lay, not so much in his own needs, as in being in the right place at the right time. He was caught up in the impetus of an expanding Division of Industrial Chemistry, a concept that had a high priority with the Executive, and hence perforce the Executive had to provide Dairy with new quarters.

The process of finding a site and formulating plans began immediately after World War II. CSIR already owned 15 acres of land at Highett, a suburb of Melbourne, and it was here that the new premises would be built, partly with money contributed by the dairy industry. Plans were submitted in 1948 and approved by the Parliamentary Standing Committee in 1951.

By 1953 the temporary accommodation that the SDR had been enjoying at Werribee and at the Bread Research Institute, Sydney, was no longer available and space at Fishermen's Bend had become severely strained. To alleviate matters, a prefabricated hut was constructed on the SDR site at Highett, and was occupied for several years by that cheerful pair, Kumetat and Beeby, along with a Swiss pastrycook, W. Siebenmann, who tested their wares in his experimental kitchen.

At length, in July 1955, the SDR moved into its own laboratories. E. G. Pont records the awe felt by the small staff on first walking into the large process bay: they wondered how on earth they were going to fill it with equipment or make good use of it. Before long, however, largely with the help of money from the dairy industry, it was jammed with experimental equipment and pilot plant.

The SDR now had its own 'Institute'; nevertheless, it made no attempt to establish an experimental dairy factory of its own, a prospect that had attracted W. J. Wiley in the 1930s. The drawbacks of such an arrangement, and in particular its inflexibility, were now more widely recognized. Lacking its own facilities, the SDR always carried out any large-scale experiments in commercial factories, with the cooperation of the factory managers. This procedure had certain advantages in that it tended to lead to ready acceptance by industry of the SDR research work and more rapid exploitation of ideas coming from the laboratory.



Dairy Research Laboratory, about 1955.

Relationship with DFP

From about 1954 and onward through the 1960s, there was active cooperation between the Section (Division, after 1961) of Dairy Research and the Division of Food Preservation. Although this might have evolved naturally through the common interests of Loftus Hills and Vickery, it was also nurtured by direction of the CSIRO Executive.

Under the Chairmanship of Sir Ian Clunies Ross (1949–59) and Sir Frederick White (1959–70), the Executive was intermittently troubled by the anomaly of an independent establishment for dairy research, cut off from the mainstream of general food investigations. On several occasions after 1950, it proposed to Dr Vickery that the DFP should take over dairy research. Vickery always declined the invitation—mainly on the grounds that he had enough to do looking after the DFP's scattered groups without taking on another large unit in a distant city.

The Executive accepted this situation, at least for the short term, but insisted that there should be a very close liaison between Dairy Research and Food Preservation. In response to this direction, the leaders cooperated where they usefully could, and took care to avoid duplication of effort. For instance, all detailed study of the autoxidation of fats was carried out at Dairy Research while, for a number of years, Dairy Research left to the DFP (through Hugh McKenzie's Physical Chemistry group) the study of the biophysical properties of casein and other milk proteins. In addition, the two Divisions collaborated in symposia and schools of instruction for the food industry.

Chapter 9. Rewards of the 1960s

The 1960s began and ended dramatically for the Section of Dairy Research. In 1959–60 it received the first annual instalment of the Dairying Industry Research Levy, funds that were to lead to a major expansion in staff and in the research program, and to influence the metamorphosis of the Section into a full Division in 1962. The decade that had opened so expansively closed with the announcement, to an angry and rebellious staff, that the Division was to be amalgamated with the Division of Food Preservation, thus losing its independent status to make up just one Laboratory in a new Division of Food Research with headquarters at North Ryde, N.S.W. This was almost the first time that such an amalgamation had occurred; it certainly was not to be the last, for the Executive was determined to reduce the unwieldy number of Divisions in CSIRO. Although most of the officers of Dairy Research now endorse the change, it came at the time as a bitter blow, and was particularly affecting to Loftus Hills on the eve of his retirement.

Change in the industry

Two new developments in the Australian dairy processing industry were evident by 1960, and were to be important to the SDR. One was the trend to a smaller number of much larger factories; these generally manufactured a range of diversified milk products, with larger throughput and resultant reduction in costs. By 1970 there were only half as many dairy processing factories as there had been in 1946. The changeover brought in more modern and efficient equipment and made it economical for management to employ more highly trained technologists. Such a development gave Loftus Hills the opportunity, if he wished to avail himself of it, of reducing the educational and extension services the SDR had been providing, in order to encourage more self-reliance in technical matters. However, he failed to take full advantage of the new circumstances to increase the Section's potential for research.

The other development of importance to the SDR and other dairy research groups in Australia was the industry's decision, ratified by Act of Parliament in 1958, to raise a levy on milk products in order to support research and promotion; the portion of the levy devoted to research was to be matched by an equal sum from the Commonwealth Treasury. The dairying industry had always been generous in this respect; for instance, some years earlier it had contributed a tenth of the sum of $200 000 needed for the SDR's premises at Highett, and it had given large amounts to the SDR investigations on mechanization of cheesemaking. Now it was the third among Australian industries, and in advance of the meat industry, to achieve the resolution and organization needed to raise a regular levy.

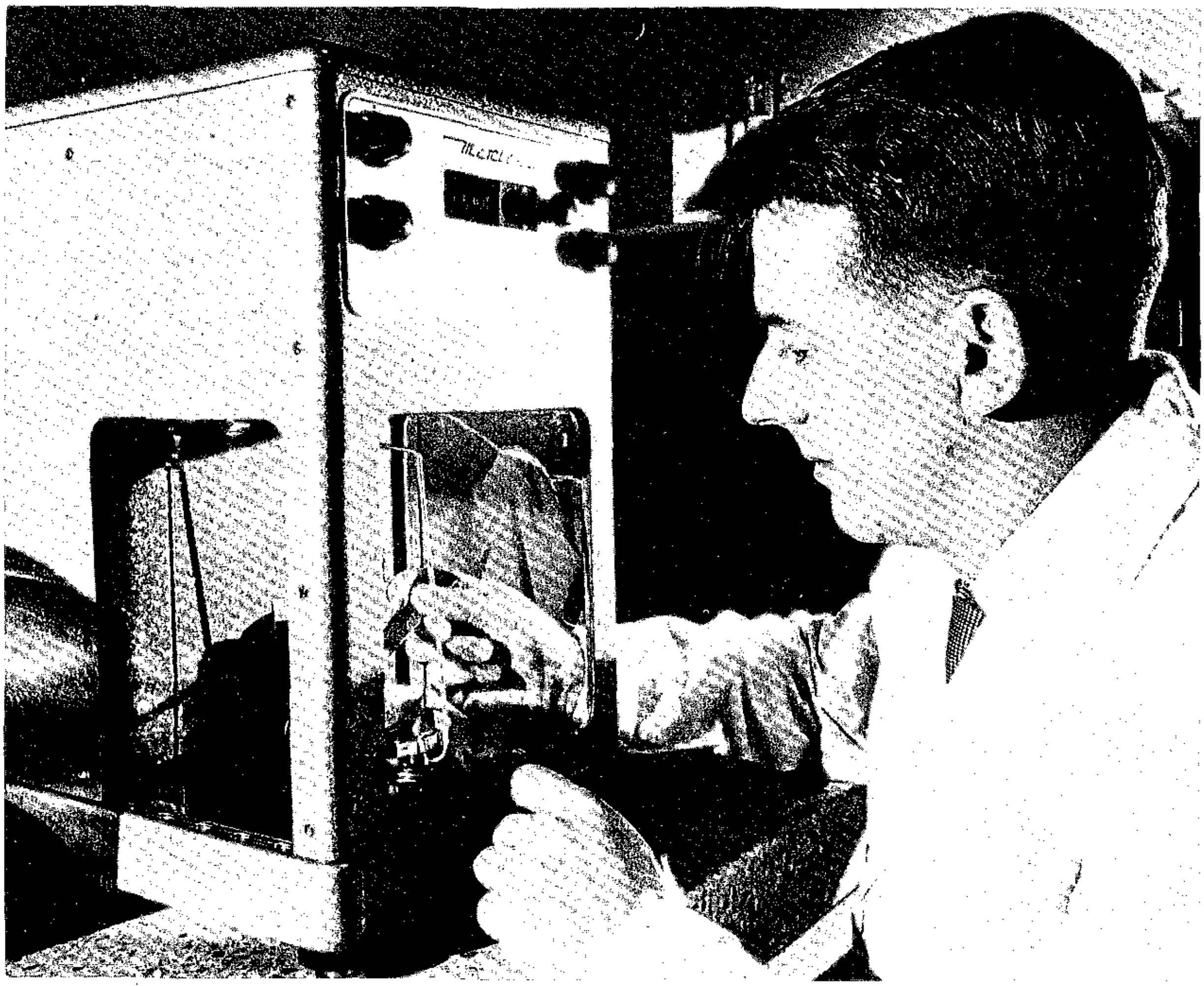
From 1960 on, a fund amounting from the start to \$280 000 was available for research on dairy manufacturing, to be disbursed amongst some nine Australian research groups working in this area. The criteria for allocation were the past performance of the group in research, the physical possibilities for rapid expansion and the capacity of the group to gain rapid economic benefits for the industry. The task of allotting the money was, in practice if not in principle, carried out at the annual meeting of the Dairy Manufacturing Subcommittee of the Dairy Produce Research Committee. Loftus Hills annually took his seat on this Committee and fought long and hard—and successfully—to maintain CSIRO's share of the funds allotted. As a consequence, the SDR was awarded responsibility for the major part of research on dairy manufacturing that was being carried out in Australia, and its brief was very wide.

Change at SDR

In the first year of the new funds, the SDR was allocated \$93 000 for additional staff, equipment and maintenance; this was an increase of 60% over its normal budget.

Within two years, 17 new staff positions had been created and filled, six by professional scientists and the rest by technical, workshop and administrative personnel. Loftus Hills also made heavy allocations, over the first year or two, for new equipment: there was a backlog of instrument requirements if the Section wished to use the advanced techniques already available to many corresponding research groups in other countries. Among major new instruments obtained were an electron microscope (soon put to excellent use in the study of the casein micelle), and highly sophisticated instruments for work in flavour chemistry.

Almost immediately, the SDR began to suffer from some overcrowding, which



Peter Shimmin using the first of the Mettler balances.

became apparent first in the workshop and process bay. A new workshop was built in 1964 and additional floorspace was provided in the process bay in 1967. Laboratory and administrative staff needed to wait until 1970 when a fine new building funded equally by industry and Treasury, provided them with a new library, meeting room and canteen, as well as additional laboratories and offices.

Section becomes Division

The increase in size and the growing reputation of the Section now raised the question, should it be promoted to the status of a Division? The Executive had misgivings on the score. It was dubious about the magnitude of the research field in dairy manufacturing; moreover, the existence of monolithic Divisions such as those devoted to wool and forest products was raising certain problems of policy. Nevertheless, doubts on the matter were overcome and at the end of 1961 the Section became the Division of Dairy Research (DDR), with Geoffrey Loftus Hills as its first Chief. The action was justified in view of the important role the DDR was already playing in research for industry, and would facilitate its work of technical leadership and liaison.

The advent of industry funds ushered in a period of intense activity at Highett. The more ample budget and the lift to morale given by the advancement in status, as well as the momentum already achieved in several projects, all ensured that the 1960s were years of satisfying work and achievement. It is noteworthy how much of the development during the decade was in strenuous practical activity and in close involvement with the immediate and long-term problems of industry. One sign of the volume of innovative technical work was the range of patents taken out by CSIRO in the name of DDR officers; they covered products such as co-precipitate and processes such as manufacture of casein, mechanization of cheese-making and recombining of milk products.

New practical investigations

Three major new projects of the period under review, those on casein and co-precipitate, on recombined dairy foods, and on the utilization of whey, revolved around one man, the energetic figure of L. L. Muller. Muller joined the Section in 1957, ostensibly to serve as Technical Secretary. It was soon clear that he would not confine himself to administration and equally clear that Loftus Hills had not expected him to; however, the same qualities that helped him as Technical Secretary and as Secretary from 1951–68 of the Australian Society of Dairy Technology served him in guiding technological development. He was well suited to the work of converting laboratory successes to commercial-scale operations and he worked easily with other research groups and with industry. The study of whey was not fully developed until recent years and so rightly belongs in our final chapter; however, the projects on casein and co-precipitate and on recombined products were some of the most vigorous and successful at Highett in the 1960s.

Casein and co-precipitate

Casein was being produced in Australia by slow, laborious methods that seemed to invite review, but it was not until the late 1950s that casein manufacture became important enough for industry to request assistance in improving efficiency and quality. L. L. Muller along with R. A. Buchanan and J. F. Hayes undertook the work. By 1963 they had perfected a method of continuous manufacture, with low labour requirements and improved yields, that quickly became standard in Australia and served as a model for similar developments in other casein-producing countries. Within a few years, Buchanan also introduced simple methods of producing co-precipitates, i.e., casein plus whey proteins, with a range of functional properties. Co-precipitate formed the basis for some products created by the New Foods group at DDR, and it has increased the possible uses of milk proteins in other foods.

Recombined milk products

Virtually all the chemical and biochemical processes associated with recombined dairy products were developed within Australia, and almost all the published literature, other than that on recombined liquid milk itself, is associated with members of CSIRO Dairy Research.

Yet the first investigation, a feasibility study on recombined sweetened condensed milk, was regarded almost as a joke when J. Wilson Lee was asked to undertake it in 1958. At the time, it was hard to imagine a country preferring to mix its own condensed milk from skim-milk powder, butter, sugar and water, with all the complications involved, rather than importing it readymade *in cans*. Wilson Lee and E. G. Pont proved that the stuff could be made, at least on a bucket scale, and did no more.

They had unwittingly done the pioneering work on one of the DDR's most successful ventures into the production of specialized milk powders. By 1962, world market conditions made it clear that the most economical way for many developing countries to obtain dairy products was to fabricate them locally, from imported raw materials. In order to bring Australia into this promising new market, the Australian Dairy Produce Board (ADPB) decided to take a share in setting up recombining plants in Asian countries. The first plants would be installed at Singapore and Bangkok, for the production of recombined sweetened condensed and evaporated milks. Almost as its first action, the Board consulted the DDR, the only research group in Australia with technical knowledge of the process.

Thus began a hectic time in the Division, particularly for Muller and for F. G. Kieseker, who joined Muller's team to promote the project. The DDR undertook to provide the technical backing for the new plants; this meant that it would take full technical responsibility for the processes and the raw materials and that it would train the operatives. At the same time as the first recombining plant was being installed at Singapore, a pilot-scale replica was set up at Highett so that the DDR could work out process variables and, having done so, could train the operatives who were to open the plants at Singapore and Bangkok. At a later stage in the project, Muller spent months in Asia helping to solve processing difficulties. His responsibility was to ensure that the process worked successfully on the factory scale, whilst Kieseker's was to help

Anhydrous milk fat from Australia is combined with skim milk powder in this plant in Djakarta to make a range of canned milks and pasteurized fresh milk.

Australian manufacturers produce the 'tailor-made' milk powders needed for recombining.

At the height of the operation, the ADPB had interests in recombining plants in five Asian countries which produced sweetened condensed milk, evaporated milk and butter on a very large scale. The DDR provided whatever technical assistance was necessary—even to the extent, on one occasion, of sending Muller to Singapore and Bangkok at 36 hours notice to help solve a microbiological problem. Today, Australia is exporting 30–40 000 t skim-milk per annum to the recombining plants, as well as large amounts of anhydrous milk fat. The expertise gained by the Australian industry, in adapting the raw materials to their end uses, has made it still the principal supplier of raw materials, even though the ADPB no longer holds a commercial interest in some of the plants.

The present CSIRO Dairy Research Laboratory is still active in this area. It recently arranged a training course for new factory operatives, and it is at present carrying out fundamental research on the heat stability of skim-milks, a factor important to the success of recombining processes.

New foods

One of the largest allocations of the first industry levy in 1960 was used to build up a New Foods group in the Division. This new Section undertook the development of new food forms and new methods of presenting and using foods derived from milk and its constituents. The group's own efforts would, it was felt, be supplemented by expansion of existing work in the fields of flavour chemistry, milk proteins, casein and cheese. Loftus Hills demonstrated his own interest by taking charge of the Section himself until another leader of high calibre could be found.

The group applied a fresh and imaginative attitude towards the possible uses of the butterfat and protein fractions of milk, and in the course of 10 years it produced a series of technically excellent inventions, including butter powder and butterfat shortening tailored for specific uses in the bakery trade. Of particular interest were several foods with high nutritional value, which were based on co-precipitate: two dietary milks for infants with special feeding requirements, and a high protein biscuit which combined the nutritive properties of milk without its difficult storage requirements. Widespread use has been made of this Australian Milk Biscuit in feeding programs in some developing countries, particularly in Zambia.

The Australian milk biscuit–a high protein biscuit possessing the nutritive properties of milk without its inherent storage problems.

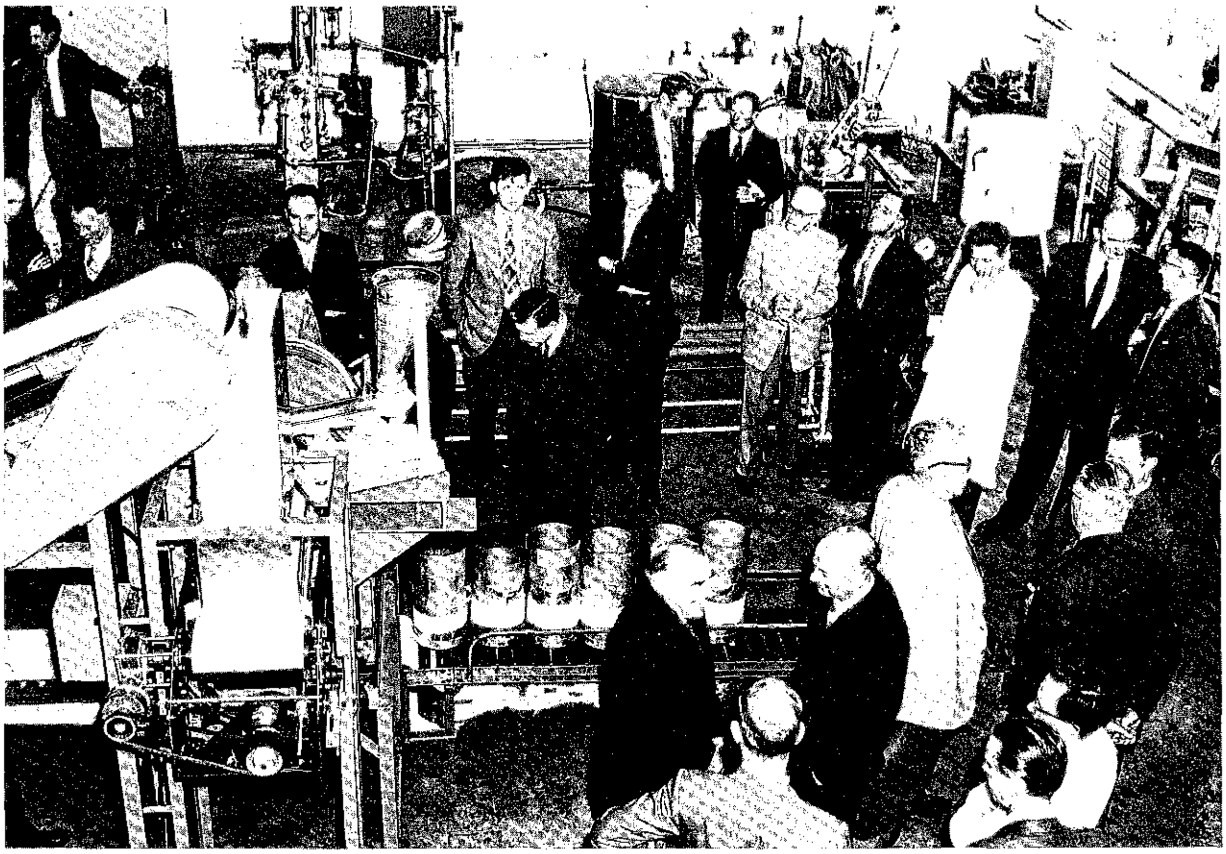
New Foods failed to fulfil the euphoric hopes of the time when it was set up. Although several of its creations are in commercial production, none has yet become popular or captured a worthwhile new market for the dairy industry. This was scarcely due to any lack of technical flair among the group of scientists, but probably because it was pitted against a conservative industry—the food industry—which in turn reflects the extreme conservatism of the general public on this point. The average eater has admitted only some two or three new foods to his menu in the course of the last 100 years*.

Successful 'work in progress'

Mechanizing cheesemaking

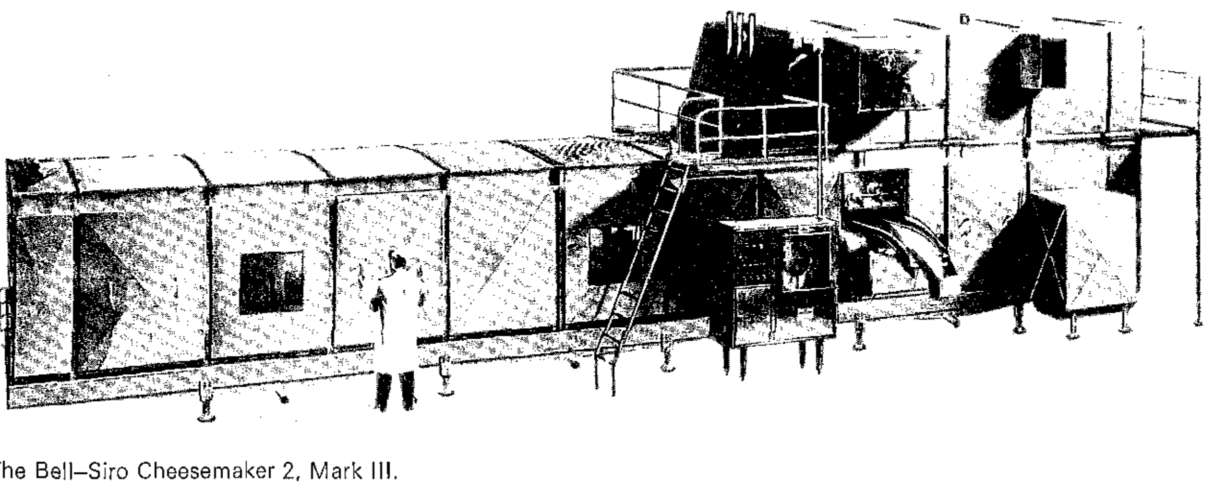
Still the major project at DDR was the work started by Czulak and Freeman six years before, to mechanize and ultimately

*The foods generally allowed to be new are hydrolysed yeast extracts, peanut butter and 'instant' breakfast cereals.



Trial of first CSIRO-built prototype of Cheesemaker 3.

automate the manufacture of Cheddar cheesemaking. After pilot plant had been devised to cover many of the labour-intensive stages of cheesemaking, the machines were commercially developed in collaboration with an Australian engineering firm, James Bell Machinery Co. The first result of this working partnership came in 1961 when Bell–Siro Cheesemaker 3, the curd-milling, salting and hooping machine, went into operation in a Victorian factory; within 10 years of the first installation, Czulak could report that about 70% of cheese made in Australia now passed through machines of this type. In addition, some 40 Cheesemaker 3 machines had been sold to other large cheese-producing countries, such as Britain, the U.S.A., New Zealand and Holland. After this success, it took several more years to develop the cheddaring machine for satis-

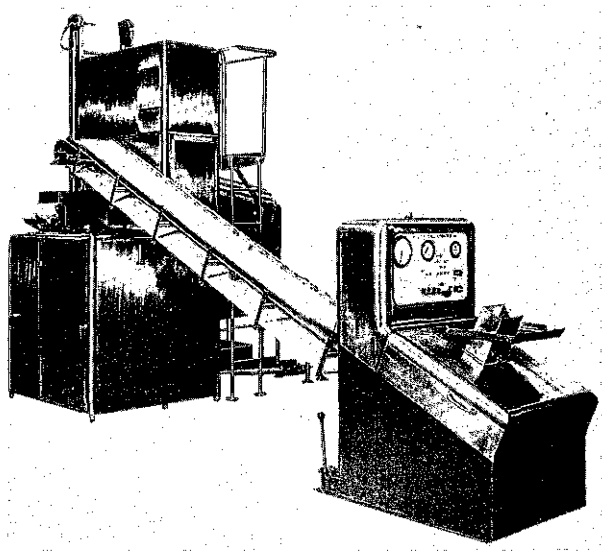


The Bell–Siro Cheesemaker 2, Mark III.

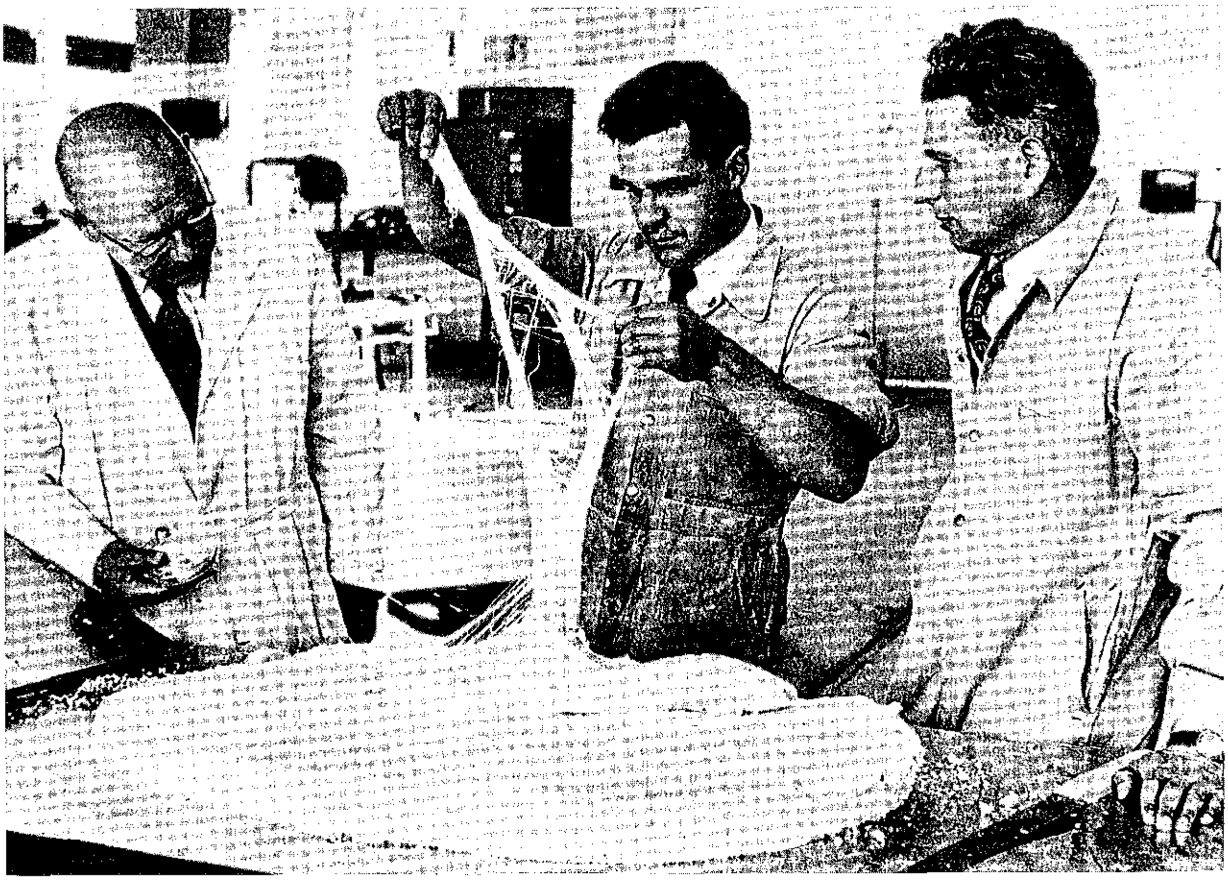
factory commercial production. The first Bell–Siro Cheesemaker 2, as it was named, was eventually installed in a New Zealand factory in 1967.

When used in conjunction with an electronic control-device for the first stage of cheesemaking, the DDR machines now covered all the stages in cheesemaking except the final pressing of the cheese. Later in his career Czulak turned his attention to this final stage and he and Freeman devised a mechanical press, thus completing the whole process of automation. The first commercial-scale model of the hoop-press, Bell–Siro Cheesemaker 4, was constructed and tested in 1975.

Progress towards mechanization of cheesemaking was being made in a number of countries, particularly in the U.S.A., over this period; however, the work of Czulak, with Freeman as designing engineer, had special distinction. The Australian machines were the first on the market and have maintained a prominent position, because of the attention paid to quality of the product during their development. They have revolutionized Australian cheese manufacture: in 1973, a comparison of costs in conventionally equipped and in the partly mechanized factories, showed that savings in labour and higher yields could be estimated to amount to $1 million annually.



The Bell–Siro Cheesemaker 3.



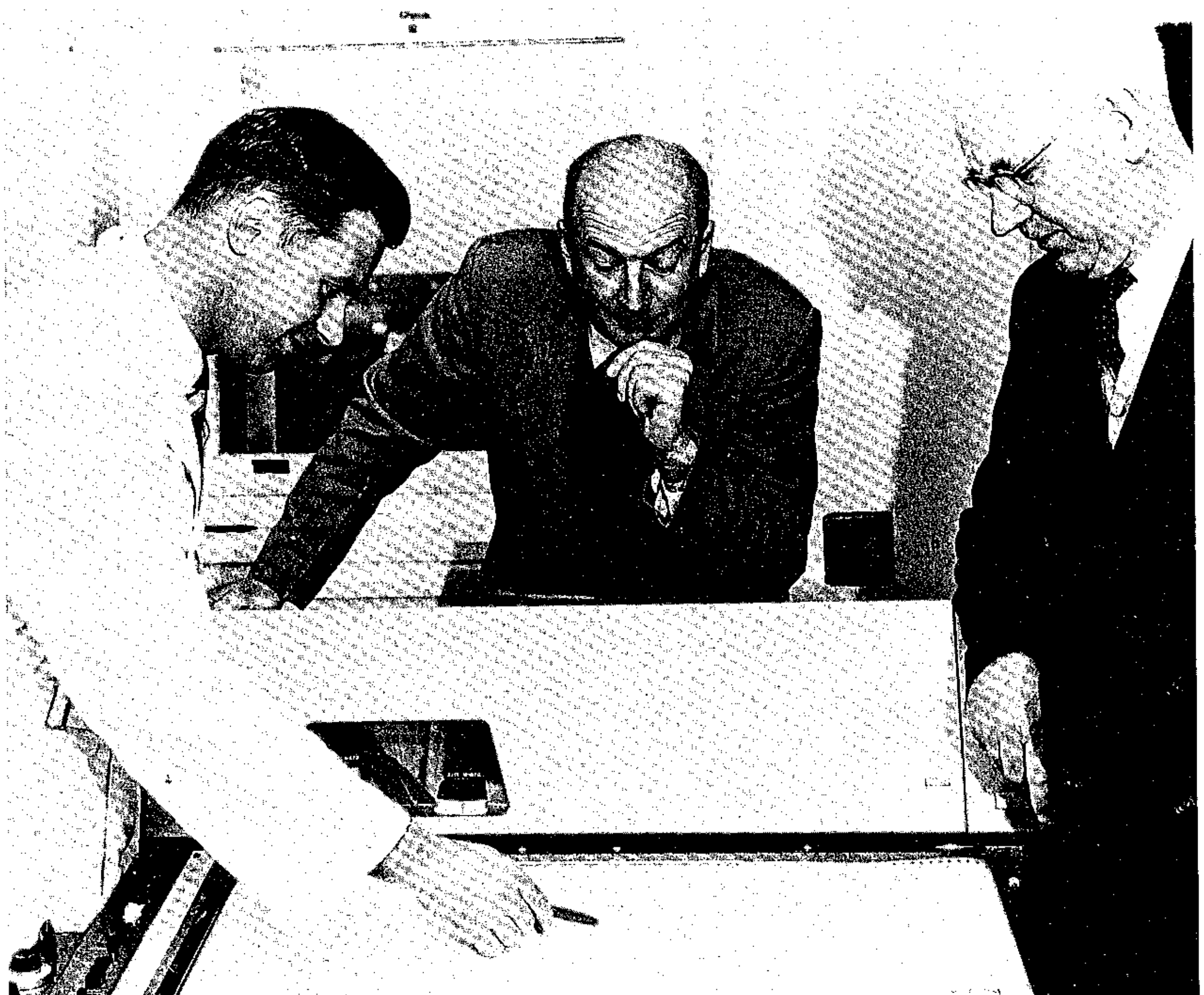
Nikolai King, Les Hammond and Joe Czulak examining the texture of cheese.

In many of the DDR's contributions to food engineering, it was singularly fortunate in attracting the interest and collaboration of a far-sighted engineering firm. The firm of James Bell Machinery Co., which later became Bell Bryant Pty Ltd, participated equally with the DDR in the development of the improved machinery for cheese and casein manufacture and the plant for recombining milk products.

Success of the Bell–Siro Cheesemakers led to further innovatory work in cheese investigations. Two new varieties, Cheedam and Novo Romano, were developed for manufacture by machine, and Czulak also ensured that the Cheesemakers could be used for producing modified forms of traditional varieties. Satisfactory processes were also worked out for drying cheese and for making recombined cheese. The problem of 'seaminess' in the machine-made product prompted John Conochie to undertake extensive studies on the chemical composition of milk and the changes brought about during the cheesemaking process; these had wide application, giving the cheesemaker better control over the quality of his product.

Flavour chemistry

The advent of industry funds brought David Forss a king's ransom—modestly scaled, perhaps, but not less welcome—in urgently needed instruments. Flavour chemistry is a discipline that does not prosper on a shoestring budget, nor even on the hospitality of friends. With its existing manual equipment, the DDR group found progress so slow that it could not keep pace with problems arising from the Division's investigations. Some of the best work up till



David Forss, Geoffrey Loftus Hills and Dr J. D. Morrison (CSIRO Division of Chemical Physics) discussing flavour chemistry.

1960 had been achieved with the use of equipment in the Division of Chemical Physics; for instance, Forss' friends in the Spectroscopy Section there, Drs J. D. Morrison and A. J. C. Nicholson, had constructed perhaps the best mass spectrometer in the world at the time and Forss and Morrison were both seized with the potential of this technique for work on dairy products. But there was a limit, albeit often conveniently stretched, to the amount of time the instrument could be used for Dairy work. It was clear that the group at DDR needed a range of new items urgently, in order to expand its potential.

Flavour chemistry studies had a role in the creation of new foods as well as underpinning work on quality of butter, cheese and casein; hence industry willingly provided funds to build up the Section in staff and equipment. Between 1960 and 1962 the Section obtained instruments for ultraviolet and infrared spectroscopy and, to cap these acquisitions, a medium range mass spectrometer, purpose-built and housed at the Division of Chemical Physics. The publications record tells an appreciative tale: between 1948, when Forss was appointed, and 1960, his small group published 15 papers; in the course of the next 10 years he and his team published 51.

By accurately delineating the compounds responsible for a range of off-flavours, these papers laid the groundwork for progress in understanding the mechanism of oxidation—work that had long interested the Division and which it returned to later, for new insights on deterioration in polyunsaturated dairy products. Similarly, valuable work was done in attributing the choicest bouquet of butter and the gluey tang of casein to the complex of chemicals making up these flavours.

Milk proteins: chemistry and microstructure

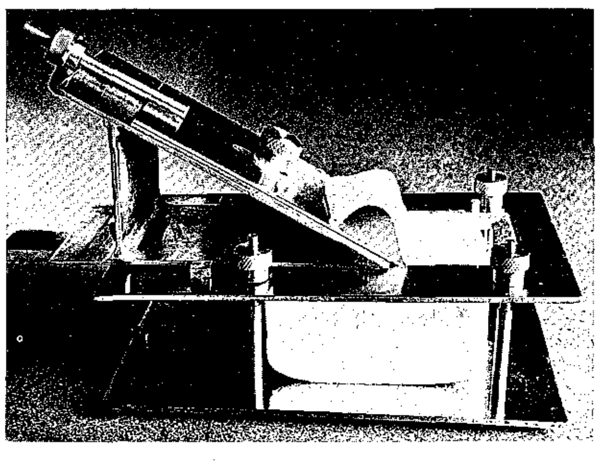
The milk proteins and in particular casein, play an important and little understood part in many dairy processes. A knowledge of their physical chemistry and microstructure is basic to progress in many fields, from cheesemaking and milk-drying to many vacuum processes. The DDR had taken an active interest in the work being done by Hugh McKenzie's group and by Dr N. S. Snow, both at the University of Sydney. Now it was able to appoint R. D. Hill to lead work in this field.

Hill and his group concerned themselves particularly with the chemistry of casein, a research topic arousing wide interest at the time. They obtained the first electron micrographs showing the structure of the casein micelle and proceeded to do pioneering work concerning the reaction of milk proteins to heating and to the addition of rennin.

After some years' study in this rather recondite field, the group moved into areas which combined fundamental and applied values, with studies on the use of immobilized enzymes in the manufacture of dairy products, and on the heat stability of sterilized milk.

Milk enzymes

For some years, Dr G. R. Jago had led a small University group, financed by the dairy industry, in studies of the enzymology of cheese maturation. In 1966 this group was transferred to CSIRO, though continuing to work at the University of Melbourne, and the energetic Jago (who was credited with being able to produce a theory a week and a dozen papers in a year) became a member of the Division of Dairy Research. Whilst Jago was concerned mainly with very basic studies on the formation of flavour, his work paid off handsomely when he was able to identify and control the cause of excessive bitterness in cheese, a flavour-defect that was proving a serious problem in Australia's efforts to sell her wares on the new Japanese market. Jago's team was also able to explain why cheese made from milk containing a high content of polyunsaturated fatty acids did not develop flavour and how the addition of another species of bacteria to the cheese



Sampling butter for studies of surface deterioration.

curd produced the desired flavour in this cheese.

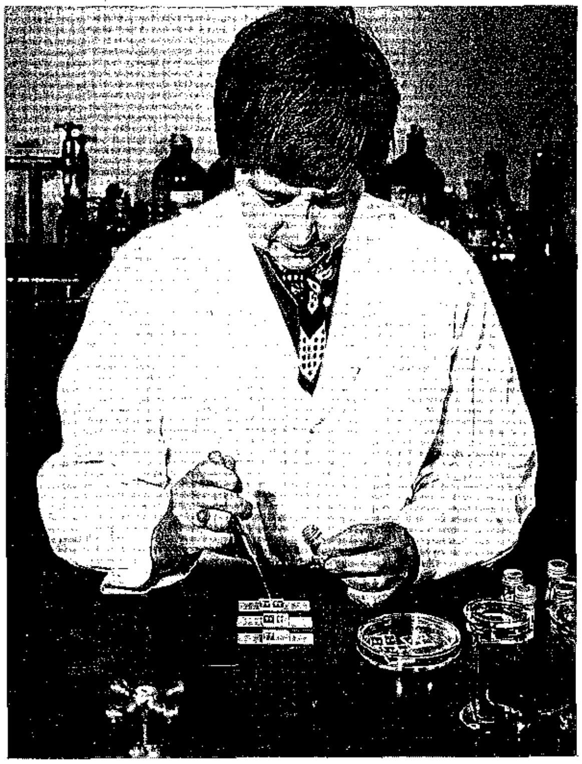
The larger scene

As a background to the investigations I have particularly described, the reader must imagine much other work going on, both in and out of the Highett laboratories: work to improve the efficiency of buttermaking and raise the quality of stored butter; to determine the amount of dirt and extraneous matter in condensed milks and keep a check on the number and types of enterotoxins in cheeses. Such work as this became urgent when Australia entered the Japanese and U.S. markets with their demanding standards of quality. Research continued on improving methods of culturing and distributing cheese starters. Technical help was given to local manufacturers contemplating production of soft cheeses and fermented milk products.

The services of the group at Highett were in demand for a variety of tasks: to oversee the first experimental shipments of cheese to Japan; to go to India to help the Indian dairy industry develop methods for the manufacture of buffalo-milk cheeses; to visit Scotland and the U.S.A. to assist in setting up equipment based on designs developed in the DDR.

Towards the close of the 1960s, two outside events claimed some of the energies of the staff. The XVIIIth International Dairy

Jack Lawrence using electro-conductivity to study changes in composition and behaviour of dairy products.

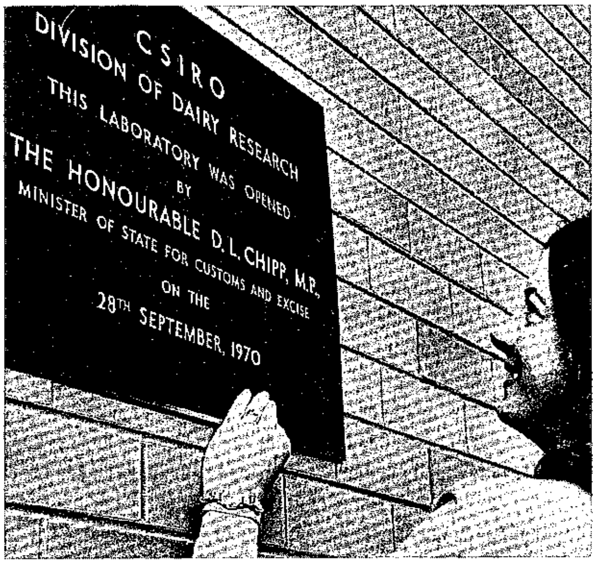


Barbara Keogh setting up a micro-gel diffusion test–the final step in the detection of staphylococcal enterotoxin.

Congress was to be held in Sydney in 1970, the first time the honour had gone to a country outside Europe. Loftus Hills, who was a member of the Australian National Dairy Committee, became Chairman of the Technical and Editorial Committee of the Congress. Most of the editorial work for the printed Proceedings of the Congress was carried out at Highett; this was a formidable task which required the senior members of staff to correct and edit the many hundreds of 'brief communications'.

While the preparations for the Congress were at their height, a large new laboratory building at Highett was nearing completion. Construction of the building, which doubled the space originally occupied by the DDR, would not have been possible if CSIRO had needed to rely only on Treasury funds. Half the cost had been guaranteed by a fund to which numerous Australian dairy companies had contributed. The new laboratory would be officially opened in September 1970.

Geoffrey Loftus Hills was to retire at the end of the year, after the two events had taken place. He could look back on 30 years with CSIRO during which he had forged the once puny Section of Dairy Research into a strong technical and research force for the



The new Laboratory was opened in September 1970.

dairy manufacturing and engineering industries. He had established a group of broadly trained, mature scientists who had won the respect of the industry and were skilled in coordinating their investigations effectively with the efforts of other State and Commonwealth departments.

DDR amalgamated with DFP

It was against such a background that the Executive of CSIRO, now under the leadership of Dr J. R. Price,* had to decide what to do with the Division after Loftus Hills's retirement, the break at which any necessary changes of direction are normally made. The Executive was not helped by the limelight imparted by Congress and new Laboratory, for it had already decided to restore dairy research to a larger context, this time that of general food research. Such a course would indicate an apparent diminution in importance: the DDR would lose its title and become one in a trio of Laboratories of Dairy, Food and Meat Research that were to make up a new Division of Food Research with M. V. Tracey as Chief. The next leader of Dairy Research would be Officer-in-Charge and Assistant Chief, but not a full Chief of Division.

There was nothing particularly secretive about the Executive's motives. It foresaw the possibility of a reduction in funds from the troubled dairy industry, and it had explored enough to know that there would be difficulties in finding a successor to Loftus Hills. Moreover, it had increasing misgivings about the wisdom of any CSIRO Division being too closely committed to one narrow industry and in keeping with this, it had recently rejected a strong plea from Dr W. J. Scott to transform the Meat Research Laboratory into an independent Division. The Executive was acutely aware that some industry funds might not be able to cope with the existing situation of rapidly rising costs and still maintain the same level of research effort. This general lack of guarantee for the future could have serious effects on the efficiency of research in some Divisions and on staff morale.

After much anxious discussion of alternatives, not only among its members but with other concerned organizations, the Executive decided that incorporation of the DDR within a Division of Food Research would be the most viable arrangement. At the same time the ADPB, which had been one of the parties consulted, was given an assurance that Treasury's contribution to funds for dairy research would not be reduced.

On the positive side, the Executive saw more than mere administrative wisdom in joining the DDR to the larger group. Amalgamation of dairy research with general food research was in keeping with a world-wide trend at the time: a number of

Geoffrey Loftus Hills.

*Sir Frederick White, who had been Chairman of the Executive since 1959, retired in May 1970.

Brian S. Harrap, Officer-in-Charge, Dairy Research Laboratory.

agricultural colleges and universities had recently created diplomas and degrees in food technology and incorporated study of dairy products in the general courses. Examples near to home were Gatton and Hawkesbury Agricultural Colleges and Massey University, N.Z. The DDR had always had eclectic tendencies, drawing strength from its broad background in the Division of Industrial Chemistry and its links with a number of industries; it seemed reasonable to expect it would gather strength from this new partnership.

Reasonable expectation, however, was upset by the fact that the change was dramatized out of proportion to its significance. If there is a good way to manage such transitions the Executive did not find it, nor did Loftus Hills do anything to help. To have had someone with the conciliatory powers of a David Rivett at such a time would have been pure gold; instead, two members of the Executive were lumbered with the role of *deus ex machina*. Coming to Highett one Friday afternoon in late October 1970, they assembled the staff of the DDR and announced the Executive's 'final decision'. Loftus Hills immediately moved dissent, and all his officers rose to support him.

There followed several troubled months during which Loftus Hills, backed by industry leaders, made strenuous attempts to get the decision reversed. But the Executive had sufficient grounds for its action and now stood by it; fruitless protest did the staff a disservice in this period of readjustment. Matters were not improved by the fact that no Officer-in-Charge had yet been appointed. Joe Czulak became Acting Officer-in-Charge and handled a difficult position well.

However badly presented, amalgamation was the staple that needs must be digested. The officers of the newly arisen Dairy Research Laboratory (DRL) chewed on it over the next few months, while awaiting a successor to Geoffrey Loftus Hills. They had plenty of opportunity to see that at least there was little substance in the dire predictions of loss of independence and close liaison with industry; moreover, the three Laboratories of CSIRO Food Research were soon required to cooperate on a major new project, the development of dairy products with high polyunsaturated fatty acid content, and this was made easier by the new relationship.

The next leader of Dairy Research, Dr Brian S. Harrap, came to DRL from a distinguished research career in CSIRO's Division of Protein Chemistry. Although invited to the position in mid-1971, prior commitments to research for the leather industry prevented him from taking up his appointment before March 1972. In the intervening year, the officers of DRL had regained most of their old enthusiasm and sense of commitment. They were ready to approach the positive benefits that amalgamation might confer.

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