TECHNOLOGY AT MASSEY UNIVERSITY

A UNIQUE EXPERIENCE 1965-1995

Personal memories and mementos of thirty years of active involvement

By

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BACKGROUND

WHAT IS TECHNOLOGY? Is it the most advanced Science or is it the lowest form of Science? People in the community would say advanced, as they associate it with new developments - the iphone, electric cars, gluten-free bread. Industry leaders would say advanced as it leads to new products, processes, and indeed industries. Scientists would say the lowest, as it is not specialised in an area of science and therefore lacks depth of knowledge. And what about engineers and technologists? Some engineers working in specialised areas would agree with the scientists. But mostly we would agree that it is advanced applied science working often at the limits of scientific knowledge in developing new products, processes and industries. The Oxford English Dictionary defines technology as "the application of science to the practical or industrial arts", which seemed to fit a national need in New Zealand and be appropriate for a new university.

DEVELOPMENT OF TECHNOLOGY EDUCATION IN GLASGOW: At the time of the Enlightenment at the end of the 18th century, there was a strong drive for the teaching of applied science. This was so strong that in 1796 John Anderson, Professor of Natural Philosophy at Glasgow University, left his estate for the founding of an institution devoted to "useful learning" called Anderson's Institution, later Anderson's University. This initially included medicine and mechanical and civil engineering, extending later in the 19th century to electrical engineering and chemical technology. In time, the medicine joined up with the large Royal Infirmary, and the engineering grew into the Glasgow Royal Technical College. There was early emphasis on mechanical engineering which arose from the development and needs of industries such as boilers, sugar extraction, shipbuilding, smelting and then railway engines and marine engines, all pushing for staff with an advanced education.

At the end of the 19th century, the chemical industries started to grow – dyes, sulphuric acid, bread making, milling, and most important the shale industry. James "Paraffin" Young, the shale pioneer, persuaded the Glasgow Technical College to start a degree in applied chemistry. During the next few years the Technical Chemistry degree added petroleum products, explosives and later high polymers. The Scottish School of Bakery was also added. Contemporaneously, the two Glasgow university institutions had allied, to give Glasgow University degrees from both. Somewhat similar developments were occurring at the technische hochschulen in Germany and at MIT in the United States. The Applied Sciences were born primarily due to community needs. In the early 1950s, The Scottish School of Bakery developed into a Department of Food Science in the Royal Technical College. This strong philosophy of higher education for useful knowledge inspired us when we were students at the Royal Technical College in Glasgow.

EARLY BEGINNINGS OF FOOD TECHNOLOGY AT MASSEY

In the years prior to the 1960s, Massey Agricultural College had had a degree in Dairy Science, and a Diploma in Dairy Technology, as well as housing the NZ Dairy Research Institute. The early 60's heralded a new era: the national environment was changing! The old meat and dairy commodity industries were being forced to change as the British market became restricted. Also there was a growing local vegetable and fruit freezing and drying industry.

Another change was that Massey was becoming a university and needed to face a new future and expand its horizons. The person sparking the introduction of technology, through food technology, was Jack Andrews. During WW2 he had been seconded into the food drying and freezing industry, set up to provide stable food for American troops. He was appalled by the lack of food technology knowledge in New Zealand and went abroad to better educate himself and hence, New Zealand. He went to California where there was an active Department of Food Science and Technology at UC Davis, to learn. He had been advocating a degree in food technology in New Zealand since 1945. By 1961 he was the first Chancellor of the new Massey University and General Manager of Ivon Watkins Dow and was in a position to put these new ideas into practice.

FACULTY: Encouraged by Dr. Andrews, Massey founded a Faculty of Food Technology in 1962. This was strongly supported by the Vice-chancellor, Dr. Alan Stewart. It had already, in 1961, appointed a Professor of Food Technology in Kelvin Scott. He had previously been the first process engineer in the NZ Dairy Research Institute. He had innovative ideas on providing technical education and saw a niche not only for the food industry, but also for the whole of manufacturing which was developing with the national drive to establish new industries.

It commenced as a Faculty of Food Technology with one solitary department, Food Technology; later to become a Faculty of Food Science and Biotechnology in 1963, with the first additional Department, Biotechnology, in 1967, and ultimately a Faculty of Technology in 1984.

Space was found for laboratories in food processing, chemistry and microbiology. Staff drawn from Massey and industry were appointed. Money was short, but courses were set up and research started. Industry had to be actively involved so a conference on food technology was organised in 1964. People from industry came flocking, vividly showing a clear need for coming together to stimulate new and advanced knowledge. At the next conference in 1965, the NZ Institute of Food Science and Technology was formed.

The first students moved in 1961 from the Dairy Science degree into the new B. Food Tech. degree and thereafter students enrolled only into the new degree. Intake of students extended beyond NZ in these early days. There were Australian students as comparable courses were not started in Australia for several years. Also four Thai students under the Colombo Plan arrived, from the two major universities in Bangkok that were starting courses in Food Technology and wished to train future staff.

With minimal new resources the degree had to make the maximum use of existing courses designed primarily for other degrees. As soon as possible these had to be replaced. Another problem was students who did not have the required level of mathematics for process engineering; this required alternative supplementary courses until mathematics could be strengthened.

The outline of the degree course in food technology offered in 1965, and in 1995, is shown in Figure 1.

	1965	1995
Year 1	• Chemistry 1 • Botany 1 • Zoology 1 • Physics 1	• Org. & Bio Chem. • Inorg. & Phys. Chem . Physics 1a & 1b • Intro to Technology • Food Tech 1 • Intro to Computing Tech • Intro Calculus • Principles of Statistics
Year 2	• Food chemistry • Power Engineering or Food Production • Food Geography • Tech Maths or Quality Control • Statistics • Agricultural Microbiology	• Physical Chem. • Engineering Principles • Properties of Biological. Materials • Food Technology 2 • Packaging Materials • Industrial Marketing • Applied Microbiology • Process Engineering 2 • Production Management • Tech Maths 1
Year 3	• Food Chem 1 • Food Microbiology • Process Engineering or Nutrition • Food Processing 1	• Food Chem. 3 • Applied Chem. 3 • Food Microbiology & Preservation • Food Product Formulation • Food Process Engineering II • Plant Utilities • Project Management • Tech. Maths 2
Year 4	• Food Hygiene & Quality Control • Food Plant & Process Design or Food Evaluation • Food Processing 2 or Economics • Food Preservation • Marketing	• Food Processing Technology • Food Safety & Nutrition • Food Storage Tech. • Food Quality Assessment • Quality Management • Management in Industry • Food product Development or Food Technology Project • Option (two or three from the following: • Consumer Marketing of Food products • Industrial Marketing and Exporting of Food Products • Food Engineering Plant Design • Food Engineering III • Product and Process Development • Special Topic in Food Technology)

FIGURE 1: THE FOOD TECHNOLOGY COURSES IN 1965 AND 1995
Food Technology degree course synopses showing 30-year change

BIOTECHNOLOGY: A chair in Biotechnology was advertised and in 1965 Dick Earle was appointed Professor of Biotechnology and Mary Earle Senior Lecturer in Food Product Development. Biotechnology, internationally, was a word seeking meaning in 1965 and was open to be definition. At Massey it became the industrial processing of biological materials, obviously appropriate in New Zealand as these were the preponderant source of export income. It covered wide areas across natural products including non-food, to fermentation, to pharmaceuticals, to waste handling and treatment.

BUILDING THE FACULTY OF FOOD SCIENCE AND BIOTECHNOLOGY 1965-72

RESOURCING: Knowledge had to be accumulated for courses in new areas much wider than for the foundation dairy technology. Knowledge was borrowed from other countries, from books and papers, from overseas and local industry, and rounded out with novel ideas.

What emerged was based on process engineering with chemistry/biochemistry microbiology and mathematics and also nutrition, management, marketing, quality assurance, statistics, and safety. Importantly the emphasis was quantitative wherever possible. Also the courses had to be fitted into four packed study years. Students vitally needed exposure to industry which was accomplished by three, three-month periods of approved industrial practice in the vacations. Quickly three specialised areas grew: food processing, food product development, and biotechnology.

Then there was the need for equipment. Some was bought from precious capital, some discarded from the dairy industry and from DSIR, and some from invention such as washing machines when centrifuges could not be afforded. It had to have laboratory space, first begged or shared. Then triumph, the Riddet Building (Figure 2) opened in 1966, financed from the Colombo Plan and politically enabled through the involvement of the Thai, Malaysian and Indian students.

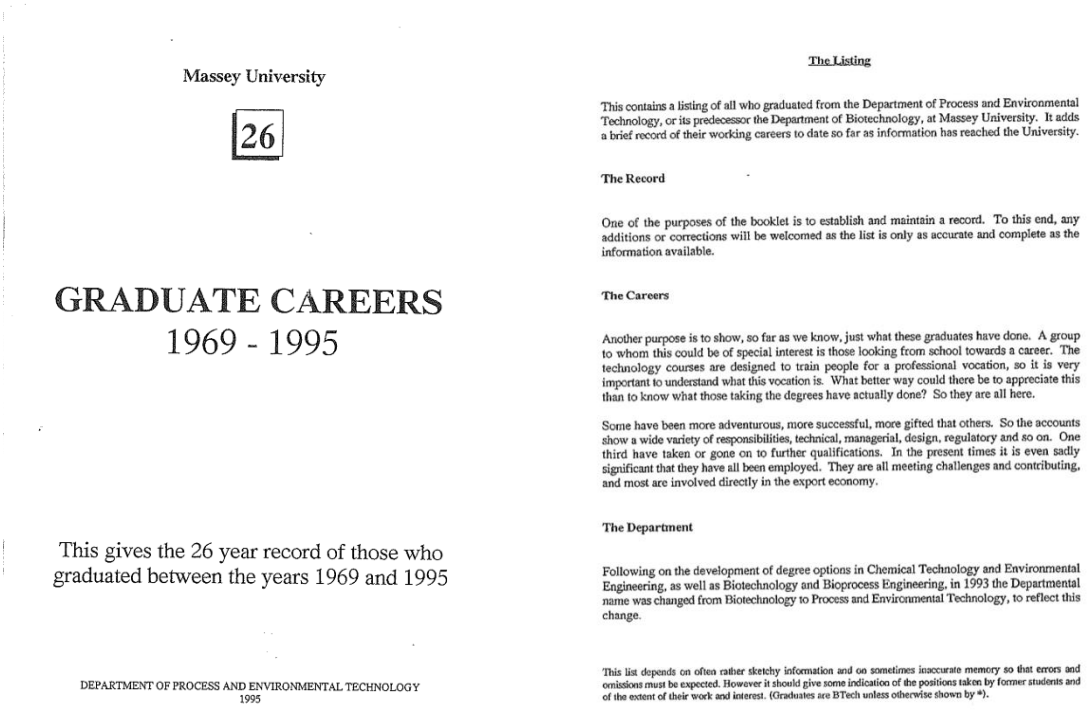
FIGURE 2: THE RIDDET BUILDING 1966
The original Riddet 1 – still extant but almost buried in the subsequent Riddet complex

With the increase in courses and in student numbers, there was a desperate need for more staff and resourcing. It became obvious that for the Faculty to have its necessary specialised staff, buildings and equipment it had to have resources. To justify these resources it had to demonstrate planning and need, and need in the university system was fundamentally based on student numbers. Needs had then to be canvassed, first to a very sympathetic but resource-limited Massey, and then to a much less sympathetic University Grants Committee with its access to the government coffers.

Importantly there existed a thoroughly positive growth environment at Massey – one in which the Vice-Chancellor implied “we could have and do anything we wanted as long as it did not cost any money”. He meant it and his advice was followed, but externally, growth had to convince sceptics.

STUDENTS: School students, of the right calibre and interests, had to be persuaded to launch themselves into new, unknown, and untried courses. For the schools an alliance was set up with teachers, most closely with the Science Teachers Association. They were early convinced that the ideas made good sense, with some teachers becoming really enthusiastic supporters. They would be joined as advocates in due course by our own graduates who pushed the cause wonderfully.

Material was prepared for circulation including, as the years rolled on, case-histories of graduates and what they actually did in industry and what they accomplished. One such (Figure 3) produced annually for biotechnology, (including, for example, in 1995 all 404 graduates to that date) was available for school students to see examples of a career which they might find attractive for themselves. Staff, particularly the Dean, spent a good deal of time and effort tending the school-student sources.



Massey University

26

GRADUATE CAREERS
1969 - 1995

This gives the 26 year record of those who graduated between the years 1969 and 1995

DEPARTMENT OF PROCESS AND ENVIRONMENTAL TECHNOLOGY
1995

The Listing

This contains a listing of all who graduated from the Department of Process and Environmental Technology, or its predecessor the Department of Biotechnology, at Massey University. It adds a brief record of their working careers to date so far as information has reached the University.

The Record

One of the purposes of the booklet is to establish and maintain a record. To this end, any additions or corrections will be welcomed as the list is only as accurate and complete as the information available.

The Careers

Another purpose is to show, so far as we know, just what these graduates have done. A group to whom this could be of special interest is those looking from school towards a career. The technology courses are designed to train people for a professional vocation, so it is very important to understand what this vocation is. What better way could there be to appreciate this than to know what those taking the degrees have actually done? So they are all here.

Some have been more adventurous, more successful, more gifted that others. So the accounts show a wide variety of responsibilities, technical, managerial, design, regulatory and so on. One third have taken or gone on to further qualifications. In the present times it is even sadly significant that they have all been employed. They are all meeting challenges and contributing, and most are involved directly in the export economy.

The Department

Following on the development of degree options in Chemical Technology and Environmental Engineering, as well as Biotechnology and Bioprocess Engineering, in 1993 the Departmental name was changed from Biotechnology to Process and Environmental Technology, to reflect this change.

This list depends on often rather sketchy information and on sometimes inaccurate memory so that errors and omissions must be expected. However it should give some indication of the positions taken by former students and of the extent of their work and interest. (Graduates are BTech unless otherwise shown by *).

FIGURE 3: SCHOOL PROMOTION: CASE-HISTORIES OF BIOTECHNOLOGY GRADUATES
Booklet prepared annually at graduation, and showing graduates current jobs, amended later

INDUSTRY: Showing relevance to the industries was a key step in building the Faculty's credibility. One key initiative was to hold conferences, the first being the Food Industry Conference in 1964 which was also the foundation of the NZ Institute of Food Science and Technology which held its first ten conferences at Massey. Conferences grew their numbers and diversity, in time across a whole range of appropriate industries. For example, the Biotechnology department ran annual conferences for 20 years, with a different industry each year. An example is the 19th Biotechnology Conference in Cost Effective Refrigeration in 1987. There were over 80 attendees who were almost all from industry, and a 160 page Proceedings (Figure 5). The Departments ran industry specific workshops and short courses; some them extending throughout NZ and to Australia, some becoming regular industry features such as Low-acid Canning and Cost-Effective Refrigeration.

Other professional groups, such as the NZ Organisation for Quality Assurance, and the NZ Biotechnology Society, were started and encouraged. Where there was an important unfilled national gap, new undergraduate courses and diplomas were offered such as courses for Government Health Inspectors, and sometimes against internal opposition from a university seeking to grow academically as with the introduction of Diploma in Meat Technology.

Co-operative research with the food industry beyond the dairy industry, where it had been long established, was continuing to build, for example with the fishing industry and this led to a continuing research unit at Nelson. The industry connections were powerful reinforcement for employment and acceptance of our graduates: as well as extending technology in industry. Graduate success in job-finding was monitored to ensure that there was no oversupply, quantified by the UGC graduate surveys. Graduate careers were followed for feedback. And this was duly extended to the other industries as the brief expanded more widely beyond food.

PREDICTIONS: An early task in 1966 was data projections for the next University of NZ 1970-74 Quinquennium. Relevant Industry had to be surveyed. In 1967 a nation-wide exploration of the food industry was organised: food was the first focus as it is the largest manufacturing industry in this and every country. The fundamental priority was therefore to set and justify numbers of new technical staff needed by industry annually, and thence the number of graduates that would meet this need.

A target of 165 total undergraduate students was selected and considered achievable in 1972. These predictions were the basis of a justification report which went to Wellington: to come back covered in scepticism. The numbers were far too optimistic! Discussion ended with numbers being cut by 30%. But at least there was a concrete outcome – acceptance both of Faculty existence and of need.

One thing was proved clearly: a sensible methodology had been developed, and numbers were the demonstrable key to resourcing. There was some further checking and refining, acceptance of undergraduate student numbers as the key indicator, and our adoption of a target compound growth predictor.

As an aside, the original growth predictions for 1975 were well below actual achieved undergraduate student numbers of 214.

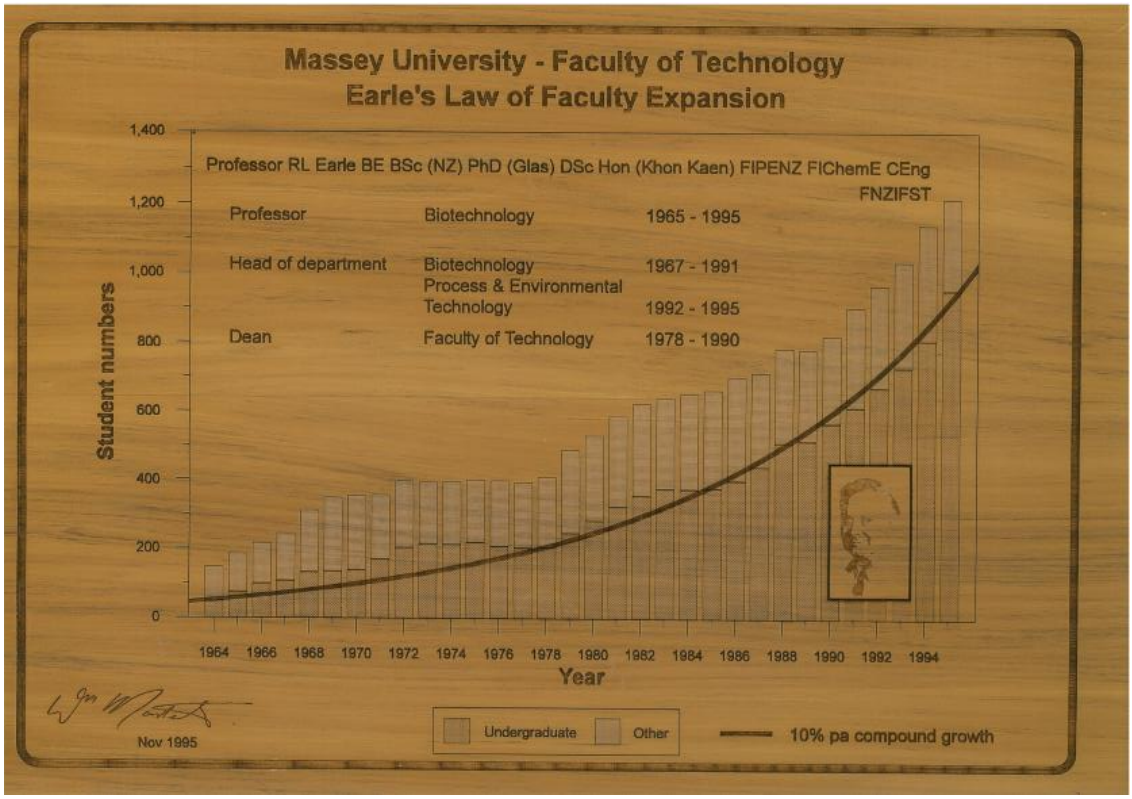
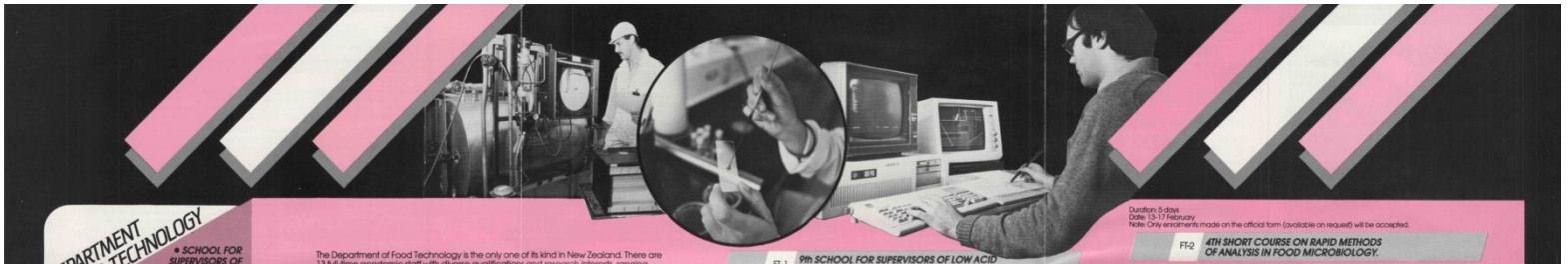


FIGURE 4: STUDENT GROWTH CURVE FOR TECHNOLOGY
Growth copied from plaque presented to Dick Earle on retirement

DIVERSIFICATION

NEW DEPARTMENTS: The next new department was Industrial Management and Engineering. It was the first non-biological option offered and dealt with manufacturing in a wider, but still quantitative, sense and with a strong emphasis on management and quality assurance. Then, reinforced by events and influenced by the muscular push of computer developments, a wider selection emerged. Established in due course by 1995, there were thirteen B.Tech. degree options: in Biotechnology and Bioprocess Engineering, Chemical Technology, Computer Systems Engineering, Engineering and Automation, Environmental Engineering, Food Engineering, Food Technology, Food Science, Industrial Operations Research, Information Engineering, Manufacturing and Industrial Technology, Packaging Technology, and Product Development. The options all had significant differences, but were all nested around a vital Technology core. They were designed to meet the present and future needs of industry and the aspirations of the students. They indicated interests and some specialisation. But the essential concept remained - the systematic quantitative treatment of the “industrial arts”.

There was also a substantial emphasis on building quality management, manifested as the NZ Association for Quality with its own diplomas. A poster from 1989 shows the varied and considerable extension activities offered in that year, right across the Faculty.



DEPARTMENT OF FOOD TECHNOLOGY

- SCHOOL FOR SUPERVISORS OF CANNED FOOD THERMAL PROCESSING SYSTEMS
- RAPID ANALYSIS IN FOOD MICROBIOLOGY

The Department of Food Technology is the only one of its kind in New Zealand. There are 13 full-time academic staff with diverse qualifications and research interests, ranging from chemistry and microbiology to food engineering and nutrition. There are excellent facilities for teaching, including a well-equipped pilot plant. A wide range of modern instruments and equipment enable the Department to offer extension courses, research and consulting work in all aspects of modern food technology. Enquiries on all aspects of the Department should be addressed to:

The Professor of Food Technology,
Massey University, Palmerston North.

FT-1 9th SCHOOL FOR SUPERVISORS OF LOW ACID CANNED FOOD THERMAL PROCESSING SYSTEMS

The New Zealand Food Regulations state that any low acid canned food must have been produced in a factory in which supervisors have attended a course approved by the United States Food and Drug Administration. The New Zealand Ministry of Agriculture and Fisheries has a similar regulation.

This course has FDA approval and uses the FR text "Canned Foods — Principles of Thermal Process Control, Acidification and Container Closure Evaluation" 4th Edition. Multiple choice examinations are held during the course and certificates issued to those who achieve a pass rate of 85% or higher.

Duration: 5 days
Date: 13-17 February
Note: Only enrolments made on the official form (available on request) will be accepted.

FT-2 4TH SHORT COURSE ON RAPID METHODS OF ANALYSIS IN FOOD MICROBIOLOGY.

With the availability of monoclonal antibodies and other engineered biological products, and advances in instrumentation, the development of new analysis techniques in food microbiology has rendered obsolete many of the techniques demonstrated at the first short course (run in 1983). The accent of this course is on practical application of new methods, particularly the very fast latex agglutination and ELISA techniques. Participants will carry out microbiological techniques in the laboratory as well as listening to lectures. A number of manufacturers have agreed to demonstrate their equipment and the course offers participants a unique opportunity to compare new methods with existing techniques and to discuss the products with suppliers.

Duration: 2 days
Date: August.

PACKAGING TECHNOLOGY

- PLASTIC FILMS FOR PACKAGING
- SHELF LIFE OF FOODS

The Sub-Department of Packaging Technology was established within the Faculty late in 1987, and a degree option in Packaging Technology commenced in 1988. Packaging suppliers and users have pledged over $600,000 toward the course over the first five years, and a Professor of Packaging Technology is to be appointed in late 1988. The establishment of a degree course recognises the increasing importance and sophistication of Packaging Technology in the New Zealand economy. Further enquiries (including suggestions on short courses) should be addressed to:

The Professor of Packaging Technology,
Massey University,
Palmerston North

PAK-1 PLASTIC FILMS FOR PACKAGING

A large number of thermoplastic polymers are used in film form for packaging, either singly or in laminated or coextruded combinations. Selecting the most cost-effective film for a particular application requires knowledge of the nature and properties of the various films. This course will cover the essential points.

Duration: 1 day. Course will be offered in Auckland, Palmerston North, Christchurch and Dunedin if there is sufficient demand. Dates to be advised.

PAK-2 SHELF LIFE OF FOODS

The choice of packaging has an enormous influence on the shelf life of foods. This workshop will discuss the techniques which can be used to evaluate the shelf life of foods, including accelerated shelf life testing and temperature function integration.

Duration: 2 days. Course will be offered in Auckland and Palmerston North if there is sufficient demand. Dates to be advised.

FOOD TECHNOLOGY RESEARCH CENTRE

- MANAGING RISK IN FRESH, CHILLED AND FROZEN FOODS
- FOOD PRODUCT DEVELOPMENT TECHNIQUES
- FISH QUALITY CONTROL WORKSHOP
- FOOD QUALITY CONTROL WORKSHOP
- SMALLGOODS PROCESSING
- PETFOOD MANUFACTURE

The Food Technology Research Centre provides a technical and marketing consultancy to the food and biological industries. Professional technologists, consumer and market researchers, and information analysts provide an integral service aimed at increasing client competitiveness in the local and international market place. Services offered include project management; product design and development; information research and analysis; quality assurance and control; consumer and market research, sensory evaluation, management and technical seminars; and energy resource management.

For further information please contact Gary Putt, Food Technology Research Centre, Massey University (063) 69099 ext. 8674.

FR-1 MANAGING RISK IN FRESH, CHILLED AND FROZEN FOODS

Chilled, fresh and frozen food products are playing an increasingly important role in retail and institutional food purchases. Chilled and fresh foods are not stabilised by traditional food processing techniques and provide a greater opportunity for microbial growth if appropriate manufacture, packaging and distribution practices are not observed. This seminar addresses these issues from a management and technical viewpoint and will provide participants with skills necessary to manage these risks in their own food production, distribution or retailing activities.

Auckland — February 1989
Christchurch — May 1989

FR-2 MANAGING NEW FOOD PRODUCT DEVELOPMENT

Planned management of all areas of the product development process is critical to the successful integration of a new product in the market place. By using an organised approach from inception, research and development, through to production and marketing techniques, a company's new product will be more effective in satisfying the needs of the consumer. It is this integrated approach in developing new products that will be considered at this 2½ day workshop.

Palmerston North — May 1989

FR-3 FOOD PRODUCT DEVELOPMENT TECHNIQUES

The use of more rigorous techniques and skills in the technical development of new products has shown that the probability of developing a successful product can be improved greatly. These new techniques have already been used in the USA, Japan, and at Massey University.

This workshop will give emphasis to skills in product idea generation, product concept development, mixture design, linear programming, factorial design, consumer research, sensory evaluation and the development of formulations. These skills and techniques have shown the greatest improvements in the time and cost effectiveness of new product development.

Palmerston North — May 1989

FR-4 FISH QUALITY CONTROL WORKSHOP

Quality control of fish processing and fish products is important for two key reasons — profitability and consumer protection. This practical training workshop is specifically designed for the fishing industry and aims to develop participants skills to a stage where they can develop and implement a quality control programme. It includes the preparation of specifications, sampling and testing of raw materials and product, developing a process control plan, and interpretation of information gathered during the QC process. The workshop is designed for QC supervisors/technicians, production supervisors and leading hands.

Palmerston North — November 1989

FR-5 FOOD QUALITY CONTROL WORKSHOP

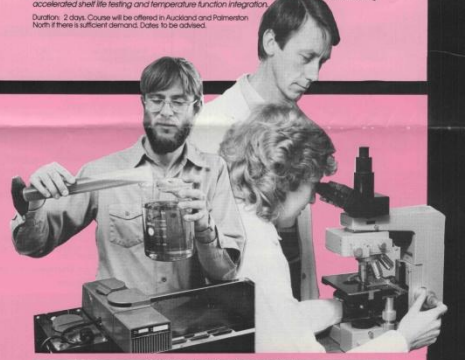
Quality control of foods is important for two key reasons — profitability and consumer protection. This practical workshop aims to develop participants skills to a stage where they can develop and implement a quality control programme. It includes preparation of specifications, sampling, and testing of raw materials and products, developing a process control plan, and interpretation of information gathered during the QC process. The workshop is designed for QC supervisors/technicians, production supervisors and leading hands.

Auckland — March 1989

FR-6 SMALLGOODS PROCESSING — KNOWLEDGE FOR PROFITS

The smallgoods industry together with many of New Zealand's agricultural, horticultural and biologically based industries is suffering in the present constantly changing environment. Profits are being eroded rapidly and this situation must be reversed if the industry is to survive. One method of improving plant profitability is to improve product formulations and minimise processing costs. The seminar will address the twin problems of product formulation optimisation and process cost minimisation.

Auckland — April 1989
Palmerston North — June 1989
Christchurch — July 1989



FR-7 STAYING IN THE PET FOOD INDUSTRY

The New Zealand pet food industry has always been a fiercely competitive industry with a wide diversity of product forms. With the arrival of the major Australian pet food manufacturers the scene has been set for even fiercer competition. Only those firms that have ensured that they have a competitive edge either through product/price quality or marketing will survive. This seminar will address the problems of product costs. It will cover the nutritional requirements of pets and the development of products that match these requirements. Procedures for product testing will also be covered.

Palmerston North — October 1989

POST GRADUATE DIPLOMAS FOR INDUSTRY

- DIPLOMA IN FOOD QUALITY ASSURANCE
- DIPLOMA IN QUALITY ASSURANCE
- DIPLOMA IN INDUSTRIAL PRODUCTION
- DIPLOMA IN TECHNOLOGY (MEAT TECHNOLOGY)

Four postgraduate diplomas are offered as extramural courses to suitably experienced and qualified people in industry. They provide additional theoretical and experiential background to support previous experience. Taken, normally one or two papers a year, by correspondence, there is little interruption of full time employment. Educational qualification for the course is normally taken to mean a university degree, although other tertiary qualifications may be acceptable. All courses have a limited intake of students.

Enrolments must be completed between 1 December 1988 and 15 January 1989. Enquiries and requests for enrolment should be addressed to:

Centre for Extramural Studies,
Massey University,
Palmerston North.

DIP-1 DIPLOMA IN FOOD QUALITY ASSURANCE

Offered by the Department of Food Technology, this diploma provides specialised training and a qualification specifically in the area of food quality assurance. Two years' experience in quality assurance is a prerequisite for the course. There are six papers, one of which is an industrial project undertaken in your own company. The diploma was developed at the request of the N.Z. Institute of Food Science and Technology Inc.

DIP-2 DIPLOMA IN QUALITY ASSURANCE

Offered by the Department of Production Technology, this diploma provides training and a qualification in Quality Assurance suitable for a wide range of industries. Two years' experience in quality assurance is a prerequisite for the diploma. There are six papers, one of which is an industrial project in your own company. The diploma was developed after consultation with the New Zealand Organisation for Quality Assurance.

DIP-3 DIPLOMA IN INDUSTRIAL PRODUCTION

Offered by the Department of Production Technology, the diploma provides an opportunity to gain a post-graduate level qualification tailored to suit people working in manufacturing. Candidates should be graduates, or have demonstrated ability to succeed in industrial management positions. The six papers cover aspects of production management, quality assurance management, materials planning and control, industrial engineering, general management and computer aided manufacturing. A popular feature is the use of assignments which ask students to study aspects of the operation of the company for which they work. One paper is an industrial project carried out in the student's own company.

DIP-4 DIPLOMA IN TECHNOLOGY (MEAT TECHNOLOGY)

Offered by the Department of Biotechnology, the diploma is intended primarily for veterinarians employed in the meat industry division of the Ministry of Agriculture and Fisheries, or equivalent personnel. Practical experience in the meat industry is essential. The course comprises four papers and a dissertation.

DEPARTMENT OF PRODUCTION TECHNOLOGY

- QUALITY SYSTEM ASSESSMENT
- DEVELOPING QUALITY SYSTEMS
- STATISTICAL PROCESS CONTROL
- SYSTEMATIC PROCESS MANAGEMENT
- MACHINE VISION
- EXPERT SYSTEMS WORKSHOP
- COMPUTER AIDED DESIGN AND SIMULATION
- PROCESS MODELLING
- PACNET SWITCHING
- ENERGY COST MANAGEMENT
- ENERGY DECISION SUPPORT

The Department of Production Technology has particular interest in technology associated with the manufacturing and processing industries and in the management of that technology. This has led to a multi-disciplinary industry-oriented approach to technology and management of plant, process, product and service. Undergraduate and postgraduate work, research, consultancy and extension work all reflect this practically based service to New Zealand industry.

Further information may be obtained by telephoning the Departmental Secretary (063) 69 099 Extension 7834, or by returning the enquiry slip.

PT-1 and 2 QUALITY SYSTEM ASSESSMENT

Originally developed by TELARC and NZOQA, this course is designed to train people to assess quality systems to national and industry standards. It covers the skills and organisation required to audit your own system or to assess the effectiveness of other people's systems. Course members are expected to have considerable previous experience working with the quality function or with quality systems. Provision of a pool of trained assessors for the TELARC assessment scheme is an additional purpose of the course.

Dates: 6-9 June, 7-10 November — Enrolment limit: 25

PT-3 and 4 DEVELOPING QUALITY SYSTEMS

With a large practical component this course covers why quality systems are needed and how to identify, plan, implement and then control the elements of a quality system. Equally valuable for those who are developing systems to meet industry or national standards to satisfy customers, or for those who are developing a system to provide the framework for improving their own quality and return on investment.

Dates: 7-10 February, 8-11 August — Enrolment limit: 25

PT-5 STATISTICAL PROCESS CONTROL — THE AMERICAN WAY

With so much emphasis on Japanese methods these days, people tend to forget that Americans were the first to use statistical methods to understand and control quality. Despite all the new ideas and methods in use today the Americans still lead the way in successful control of quality through SPC. This practical course provides experience in when and how to use SPC, which methods to use and what it all means.

Dates: 27-29 June — Enrolment limit: 30

PT-6 SYSTEMATIC PROCESS IMPROVEMENT

Factorial experiments are an efficient means by which the effect of varying many inputs to a process can be evaluated from a small number of trials. Easily used and understood methods are provided for non-statisticians, non-mathematicians to gain real insights into improving their process in a systematic way.

Dates: 17-18 August — Enrolment limit: 25

PT-7 MACHINE VISION FOR PRODUCTIVE INDUSTRY

Machine vision (computers with "eyes") is a high-technology development that has the potential to reduce production costs and to improve the quality and consistency of products. Computer vision technology, that is the combination of computers, solid state cameras and appropriate software, is rapidly becoming affordable and cost-effective and may give a competitive edge to those companies that make timely decisions to adopt it.

This two day seminar is designed to act as an introduction to the technology, application and economics of computer vision systems. Application areas to be covered include the automatic inspection of natural and manufactured items and the use of image analysis techniques for off-line quality control and process monitoring. Demonstrations will be given and illustrations will be taken from the wide range of projects undertaken by the speakers.

This seminar will be of value to industrial engineers, technologists and managers interested in applying machine vision and to quality control specialists.

Dates: 20-21 November

PT-8 and 9 EXPERT SYSTEMS WORKSHOP

Expert Systems are computer programs that can diagnose, analyse and justify prescribed courses of action. They are particularly useful where experts in a company are spread too thinly. Expert systems have been used in many areas, e.g. analysis of financial investments and planning, military systems, engineering and production, government, health and medical, marketing, services, computers, and others. This is a "hands on" workshop where all participants will have access to a micro-computer and learn to use an expert system shell to build expert systems for their own applications.

There will be demonstrations of applications and systems.

Dates: 14-16 August, 22-24 November — Enrolment limit: 24

PT-10 COMPUTER AIDED CONTROL SYSTEMS DESIGN AND SIMULATION

Affordable software packages for mini and micro-computers are now available internationally which can be used for systems analysis and controller design. Such software tools can be invaluable for process modelling, for simulation and for comparing the performance of different control systems. Using industrial case studies, the course will show how one such package can be used for these purposes. Such background material as is necessary to understand how to use the package and what it can do will be supplied.

Dates: 28-30 November

PT-11 PROCESS MODELLING SIMULATION

The course will indicate how to gather appropriate data from processes which will enable dynamical time series models to be determined. Steady state modelling techniques and software packages will also be demonstrated and the use of both dynamical and steady state simulation will be indicated by case studies.

Dates: 9—10 August — Enrolment limit: 30

PT-12 A HITCHHIKER'S GUIDE TO PACNET SWITCHING

An overview of the Telecom packet switching service.

Many New Zealand businesses presently transfer relatively low volumes of data between branches over phone lines. Text data and messages are often sent by fax to economise on the use of phone lines as well.

For situations where a dedicated data line is not warranted, PACNET often provides a much more cost-effective solution than the use of telephone lines. Costs can often be reduced by an order of magnitude e.g. a typed page sent from Auckland to Wellington by fax will cost about $1.50 — the corresponding charge for sending it over PACNET is about 10c.

This one day course is aimed at EDP managers and financial controllers. The aim is to provide a user-oriented overview of PACNET applications in New Zealand business. The course will include case studies from New Zealand applications plus "hands-on" use of data and text transfer systems based on PACNET.

Date: 10 May

PT-13, 14, 15, 16 and 17 EXPERT SYSTEMS IN ENERGY COST MANAGEMENT

The one-day seminar will provide a practical understanding of energy cost management methods for government, industrial and commercial concerns. The seminar will use an Energy Cost Management Expert System developed by Professor Monteith as the result of several years experience in energy cost management in U.K. and N.Z. and based on standard PC systems. The seminar includes the interactive use of the Expert System by all delegates throughout the day providing first hand experience of the use of the system in realising profit improvement. Practical data from case studies will be used throughout and there will be an opportunity for delegates who register early to process personal energy data as part of the programme.

The seminar will be offered in several centres according to demand.

Dates: 8 February — Palmerston North
8 March — Auckland
24 May — Wellington
14 June — Hamilton
23 August — Christchurch

PT-18 ENERGY DECISION SUPPORT SYSTEMS

— FOR GOVERNMENT, PLANNERS, ENERGY SUPPLY, INDUSTRY AND COMMERCE — A THREE-DAY CONFERENCE

This major conference will be concerned with the development and operation of computer based expert systems for energy decision makers in government, industry and commerce. The conference will include detailed presentations on national energy demand modelling based on systems engineering and an active research programme in collaboration with the electricity supply industry in New Zealand. The aim is to bring together a wide range of energy users, planners, suppliers and researchers in discussion of the major strategic issues facing New Zealand energy policy, pricing and substitution into the twenty first century.

Date: December 1989, full details to be published.

DEPARTMENT OF BIOTECHNOLOGY

- COST EFFECTIVE REFRIGERATION
- RADS DEMONSTRATION
- CFC REFRIGERANTS
- WASTEWATER TREATMENT
- ANAEROBIC WASTE TREATMENT WORKSHOP
- MEAT TECHNOLOGY
- COST AWARENESS IN THE MEAT INDUSTRY
- QUALITY ASSURANCE IN THE MEAT INDUSTRY
- DIPLOMA IN MEAT TECHNOLOGY AWARENESS
- SLAUGHTER AND DRESSING
- CASINGS AND FELLMONGERY OPERATIONS

The Department of Biotechnology is a multi-disciplinary Department concerned with the industrial processing of biological materials. It teaches undergraduates for technical careers in the biological processing industries, and is widely involved in relevant industrial research and consultancy. Using this broad base it can offer extension courses within five general areas:

(1) meat technology
(2) refrigeration and applications
(3) waste treatment
(4) fermentation technology/biochemical engineering
(5) product and process development related to advanced biological products.

The Department welcomes suggestions for new courses, and comments on its offering. General enquiries can be made by using the attached slip, or by telephoning Mr Mike Stevens (063) 69-099 ext 8251.

BT-1 COST-EFFECTIVE REFRIGERATION

A course for users and suppliers of industrial and commercial refrigeration equipment plus consulting engineers. Specifications and tender evaluation for new equipment will be examined with emphasis on quantitative decision making. Techniques for reducing energy costs on existing plants, use of micro-computers and commercial refrigeration software to aid quantitative analysis. This course will run again in New Zealand in 1990, but those who wish to participate in 1989 may wish to travel to Australia.

Proposed Venue and Dates: Australia, probably May, 4-5 days.

Course Fee: $600 (tentative)

BT-2 RADS DEMONSTRATION

This will be a one day demonstration of the software package RADS — "Refrigeration Analysis, Design and Simulation" which has been developed at Massey University. The demonstration is intended for industrial refrigeration contractors, suppliers and major industrial refrigeration users. Participants will be able to see the capabilities of the package in a variety of applications. The demonstration will precede the annual conference of the N.Z. Institute of Refrigeration and Air Conditioning Engineers, who are charging a small fee ($5.00) for attendance.

Proposed Venue and Dates: Palmerston North, 10 March.

BT-3 CFC REFRIGERANTS

Subject to sufficient demand several one-day seminars may be run for those involved in refrigeration at any level backgrounding the issues and needs for technological change as a result of restrictions on CFC refrigerant imports. Replacement refrigerants and measures for minimising loss to the environment will be covered.

Possible Venues and Dates: Auckland, Hamilton, Wellington, Christchurch, Dunedin; November.

Course Fee: $180.00 (tentative)

BT-4 WASTEWATER TREATMENT: PRINCIPLES AND PRACTICE

A continuing education symposium in waste treatment combining refresher courses in treatment process principles, design and operation of waste treatment systems. Topics include nutrient removal and plant monitoring and control. Recent advances and specific problems discussed by local and overseas experts.

Duration: 3-5 days
Date: July.

BT-5 WORKSHOP ON ANAEROBIC WASTE TREATMENT

First of the proposed biennial series of workshops to review the developments and applications of Anaerobic Digestion for the treatment of high strength liquid wastes and sludges. The programme will include invited plenary lectures and contributed reports.

Duration: one day
Date: July.

BT-6 MEAT TECHNOLOGY

Within the area of Meat Technology the Department co-ordinates its activities with the Meat Industry Training Board. Courses are not normally available for those outside the meat industry. The 1989 offering has yet to be finalised but is expected to include the courses listed below. All enquiries should be directed to

Mr Russell Archer, Executive Training Officer, Meat Industry Training Board
P.O. Box 1828, Wellington. Phone (04) 725-453

and not the the Department of Biotechnology.

BT-6a COST-AWARENESS IN THE MEAT INDUSTRY

The costs of running a department are dealt with in detail. Emphasis will be on identification, monitoring, control and reduction of costs, plus the increase of outputs and yields. Case studies and exercises of direct relevance to meat industry production and processes.

Duration: 3-4 days

BT-6b QUALITY ASSURANCE IN THE MEAT INDUSTRY

Aspects of quality auditing, use of sampling plans, and quality assurance manual design and preparation. Practical exercises drawn from meat industry practice.

Duration: 2-3 days

BT-6c DIPLOMA IN MEAT TECHNOLOGY AWARENESS

A course for training managers and potential students for the Diploma in Meat Technology. The place of the Diploma in career development paths for meat industry personnel, course subject matter, and prerequisite knowledge.

Duration: 2-3 days

BT-6d SLAUGHTER AND DRESSING

A course for middle management on specific aspects of slaughter and dressing with emphasis on recent developments and concerns.

Duration: 2-3 days

BT-6e CASINGS AND FELLMONGERY OPERATIONS

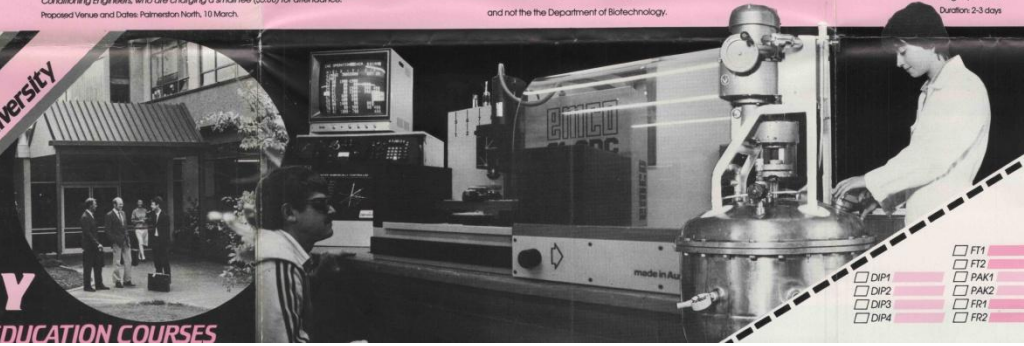
A course on casings department functions including cost control and quality aspects of casings operation.

Duration: 2-3 days

Massey University 1989 Massey University

FACULTY OF TECHNOLOGY

EXTENSION & CONTINUING EDUCATION COURSES



TO:
FACULTY OF TECHNOLOGY,
MASSEY UNIVERSITY,
PALMERSTON NORTH.

PLEASE SEND ME MORE INFORMATION ON THE COURSE(S) MARKED BELOW.

NAME: _____

ADDRESS: _____

PHONE _____

☐ DIP1	☐ FT1	☐ FR3	☐ PT7	☐ BT3	
☐ DIP2	☐ FT2	☐ FR4	☐ PT8&9	☐ BT4	
☐ DIP3	☐ PAK1	☐ FR5	☐ PT10	☐ BT5	
☐ DIP4	☐ PAK2	☐ FR6	☐ PT11	☐ BT6	
	☐ FR1	☐ FR7	☐ PT12	☐ BT6a	Replies to: Mr Archer Address as shown in Biotechnology panel
	☐ FR2	☐ PT1&2	☐ PT13to17	☐ BT6b	
		☐ PT3&4	☐ PT18	☐ BT6c	
		☐ PT5	☐ BT1	☐ BT6d	
		☐ PT6	☐ BT2	☐ BT6e	

FIGURE 5 EXTENSION ACTIVITIES IN THE FACULTY 1989
Both sides of a publicity handout from 1989

Following on from Kelvin Scott, in 1978 Dick Earle became Dean, followed in turn in 1990 by Bill Monteith. In 1988 a new department of Product Development was formed with Peter Robertson as head. Bill Monteith, as Professor of Production Technology, had succeeded Kelvin Scott on his retirement in 1985. Dean Stockwell was appointed Director of the Food Technology Research Centre full-time following on Mary Earle's many years part-time. Planning for the growth of the Faculty continued as its acceptance and demand for its graduates were well demonstrated. This planning was formalised from time, and one planning document from the 80's is illustrated in Figure 6.

FACULTY OF TECHNOLOGY - OUTLINE PLAN

1989 - 1993

Contents

FIGURE 6: FACULTY OUTLINE PLAN 1989 – 1993
First page of a 12-page planning document from 1989

SELECTED DEVELOPMENTS INVOLVING MARY EARLE AND DICK EARLE

There were many developments in the Faculty: as examples three have been chosen which were particularly associated with Mary or Dick Earle. A new teaching area was product development introduced by Mary Earle that was founded in industrial experience and built into an effective teaching structure, in many ways an international first. Applied research is illustrated by the Food Technology Research Centre; and by a major research topic: refrigeration, undertaken in the Biotechnology Department; and by the development of a new industrial enterprise. A vital function of universities is research, and in this case applied to industrial problems and their developments.

Research must also be operated in balance with, and fully related to, teaching as both feed from each other. Engagement with industry showed areas in which research was both needed and practicable. The three examples illustrate what was accomplished over longer-term programmes, close to a range of industries and continued over many years.

PRODUCT DEVELOPMENT: Product development was an example of a totally new course. It is quintessentially multidisciplinary. Needed for it is basic knowledge of chemistry, physics and mathematics including statistics and computer technology, and also of process engineering, operational research, and design of customer-led products. As well there must be understanding of marketing and consumers and industrial users. Overall creativity and problem-solving skills are essential. So the concept fitted easily into the basic technology framework (Figure 7). The stages in the product development process are now well recognised but when courses were started in 1966, there were no textbooks or even many papers – all information was in the large companies such as Unilever. Fortunately the initial students were two Thai women, followed in the next year by two New Zealander women; so there was time to build printed material – the little "Red Books" as they were called (three textbooks on Food Product Development were finally published in the 90's). A scheme for the product development courses from the initial concept to the final product on the market, was designed in co-ordinated stages.

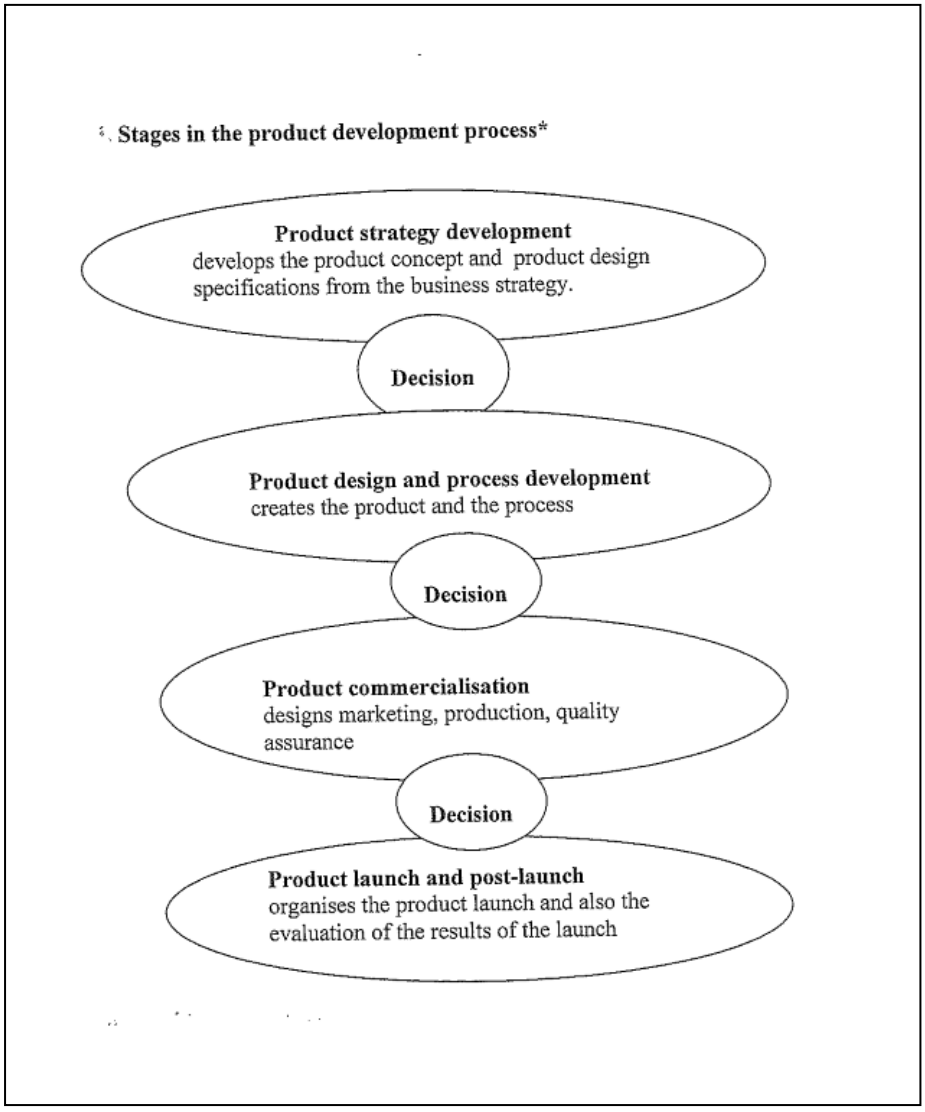


FIGURE 7: PRODUCT DEVELOPMENT
Outline of the Product Development Process, 1970

Techniques had also to be devised for the experimental explorations and for the consumer research so that the whole process was quantitative as far as possible. The essential foundation of the teaching was the practical projects – with small ones in the 2nd and 3rd years; and then a substantial one-year project in the 4th year, sponsored by a particular company so that the students obtained experience in working with industry.

Product Development started as two or three courses in the Food Technology degree. Then it became an alternative specialisation along with food processing, finally emerging as a Product Development degree option suitable for all industries. In the late 1960's, masterate degrees in product development were started, and Ph.D. research began in 1971.

FOOD TECHNOLOGY RESEARCH: In the 60's, the NZ baking industry was undergoing significant change as government controls were removed. The bread industry consisted of medium-sized companies, with one or two in each district, and a Canadian company had started to buy up individual bakeries.

A co-operative company was formed called Quality Bakers. Quality Bakers was very keen to use newly developed bread-making processes with new products such as hot Sunday bread. There had to be new financial controls, quality assurance, and marketing techniques brought to bear. Fortunately there were a few knowledgeable individuals – one who had worked in the Bread Research Institute in Australia and was developing the new process in Ohakune, together with an innovative baker in Palmerston North who could develop new products, and a lively marketing person in Palmerston North.

These three people worked closely together with Mary Earle in the Food Technology department at Massey to refine the new bread concepts and successfully release them to the public, and also to start a Quality Assurance Programme and to organise workshops. This gives some idea of the research and development that was needed in setting an activity for the NZ food industry.

Work progressed across several fronts and for several industries. The Fishing Industry Board provided money for a formal Food Technology Research Centre (FTRC) to start, concentrating initially on developing the fish processing industry. There was never much money, but there was great enthusiasm and knowledge building with the fish researchers. The FTRC was involved in many developments – oyster and mussel farming, as well as other shellfish such as paua and cockles - with a small group based in Nelson, near to the fish supply. The development in the fish industry during the next decades was huge – snapper, hoki, orange roughy, chilled tuna, and the FTRC were involved in all of these. Then there were plant products for example macadamia nuts (a new commercial crop), kiwi fruit, and apples.

There was interest from other industries, for example bacon curing which was evolving from a craft to a technology with new processes and products. Also important was the development of an information group providing regular newsletters with the latest research information, as well as answering individual queries.

The research in other food industries followed a combination of interests from Massey staff (such as winemaking and consumer research), moving for example to jungle rations for the NZ Army, and an energy survey of the whole food industry. To sum up, food technology at Massey by the 1990's was a very significant contributor to research and development over most of the NZ food industry.

REFRIGERATION AND FREEZING: A major research interest, both industrial and academic, was in refrigeration, vitally significant in the New Zealand economy. Freezing of meat for preservation had been established widely back in the nineteenth century. But there had never been an adequate method for calculating the dynamics of freezing rates and times given the geometry of the foods and the ambient imposed conditions. In applied mathematics, this problem had been well characterised, being unsteady-state heat transfer with change of phase; it had been given a name, Stefan's problem. But there had not been an adequate useable solution.

For biological materials, the situation is even more complicated because the liquid phase contains solutes, which concentrate as they freeze and depress the freezing point. For NZ, with urgent need in the 1950's to freeze large tonnages of packaged beef for the US market, practical solutions became of immediate commercial significance.

Over a number of years, and with a succession of students, work in the Biotechnology department developed freezing rate prediction methods, using a numerical approach and producing relatively simple equations for modelling the systems. These take into account size and complex shapes through finite difference and finite element solutions of the differential equations, and were confirmed by fitting to very comprehensive experimental data.

The results were used in operation and design, such as of a novel line of continuous air-blast freezing tunnels for beef. These tunnels, adopted in many countries, have frozen hundreds of thousands of tonnes of cartoned meat. The equations that were produced are now widely recommended in food engineering texts, and applied in industry.

This work was internationally recognised with award of the ER Cooper Medal of the Royal Society of NZ to Andrew Cleland and Dick Earle, the Clarence Birdseye Prize of the International Institute of Refrigeration to Donald Cleland, and the Kammerlingh Onnes Gold Medal of the Dutch Refrigeration Institute to Andrew Cleland.

Also in refrigeration, short 4-5 day courses were set up with comprehensive notes and run in many cities in NZ and Australia, repeated many times, for industry engineers (Figure 8).

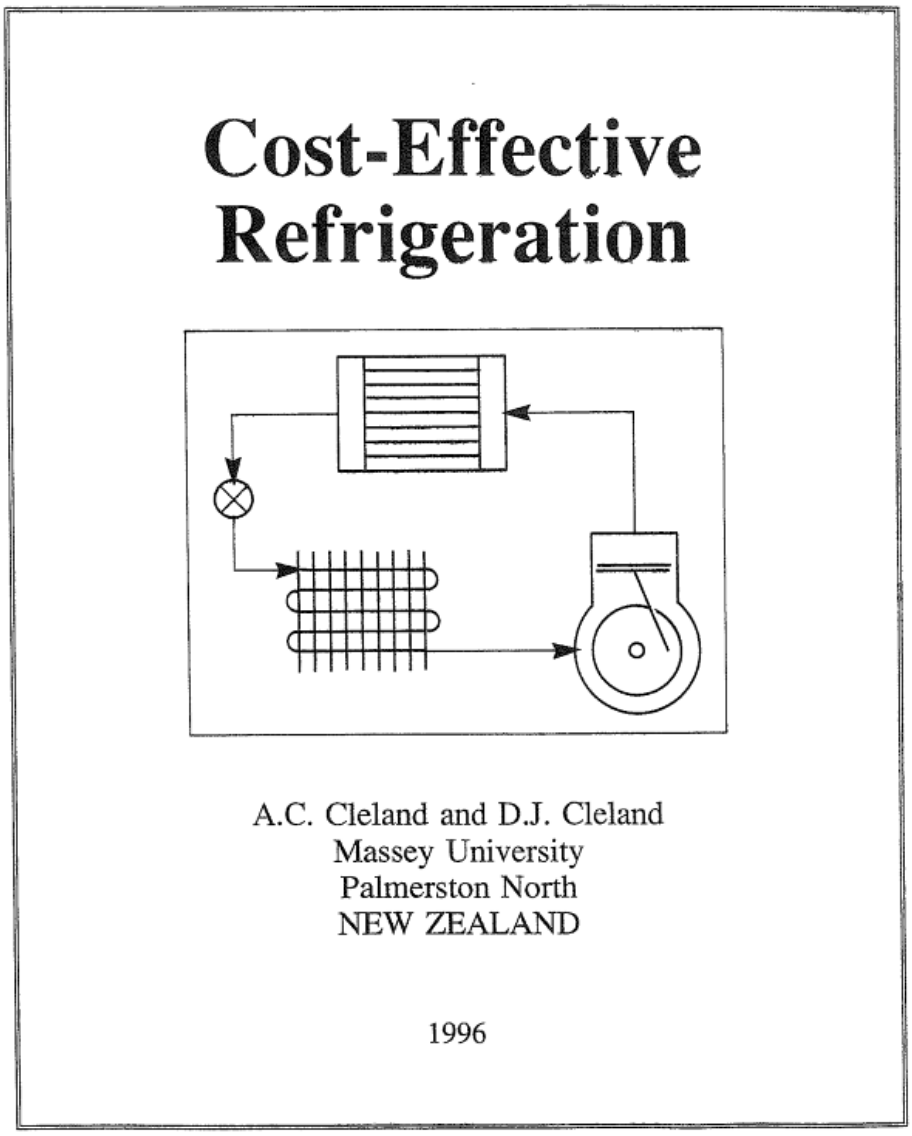


FIGURE 8: SHORT COURSE NOTES - COST-EFFECTIVE REFRIGERATION 1996
Course presented for 20+ years in NZ and Australia to industry technologists: 4+days, 450 pp.notes

NEW INDUSTRY: Involvement in new industries is illustrated by the initiation of New Zealand Pharmaceuticals at Linton. From the meat industry connection, an evident need had emerged to enhance returns by further processing of low value raw materials. In the context of pharmaceuticals, this led to the establishment of NZP. Initiation, investigations, research and process development, initially for the production of pure bile acids, were all carried out in the Biotechnology Department, working with industry. Included were building pilot plant, producing trial quantities of products, and designing plant for building in NZ. This led in time to a substantial manufacturing unit with a world-wide presence.

INTERNATIONAL

The Colombo Plan was influential for initial funding of projects in SE Asia and India, but international interests and connections also spread beyond into Australia, Canada, the UK and the US.

THAILAND: An outstanding connection from the Faculty perspective was with Thailand. This started at a time in the 1960's, when new universities were being established and reaching out into their communities, for example in the North, North-East and South of the country. Connections were established through students, initially with Chulalongkorn and Kasetsart Universities in Bangkok, where food technology was beginning to be taught. It was funded under the Colombo Plan. Involvement was with helping build departments and faculties of agro-Industry, and in training staff. Also founded was a national collaborative programme starting with five universities; this is now still going with now something like 80 universities involved and meeting twice annually. At a personal level there was extensive working together over many years, coming and going throughout Thailand and to and from NZ.

SOUTH EAST ASIA: There was collaboration with two universities in Malaysia, Universiti Sains and Universiti Pertanian; in the Philippines with Los Banyos and Visayas and the national institute for Nutrition; and in dairy engineering at Karnal and throughout India.

AUSTRALIA AND CANADA: There was particular collaboration with Australia developing food technology and biotechnology. Notably with the Victorian Department of Agriculture in educating their staff first in dairy technology and later in food technology; and the University of New South Wales organising conferences, short courses and workshops. In Canada there was involvement with the universities of Waterloo, Alberta, and Arcadia, in product development and in bio-processing.

OUTCOMES

GRADUATES: The number graduating in Technology in 1996 was 143. In the national record of graduates seeking employment at the end of each May following graduation, technology was distinguished by having the highest (except for medicine and dentistry severely limiting numbers, and theology, where almost all already had jobs) proportion of graduates in employment - around 95%.

There were also substantial numbers with post-graduate qualifications up to Ph.D. Graduates moved out successfully into industry. They were well accepted, entering a wide range of careers. They had rapidly became senior technical managers and then chief executives (including of the country's largest manufacturing industries), directors and chairing company Boards and on important government committees.

A substantial proportion acquired higher degrees. Some went into research and development. Importantly, a large proportion of graduates remained in New Zealand. Although no particular effort had been made to align courses with existing professional groups, there was good acceptance, for example by professional engineers into IPENZ.

FACULTY OF TECHNOLOGY: In 1984 the thriving activity was finally given the concise name - Faculty of Technology. It was strongly established in a controlled growth mode. During the thirty two years of growth to 1995 it had grown in undergraduate numbers at an 8% per annum steady exponential rate, and a predictability correlation coefficient of 0.98 as shown in Figure 9.

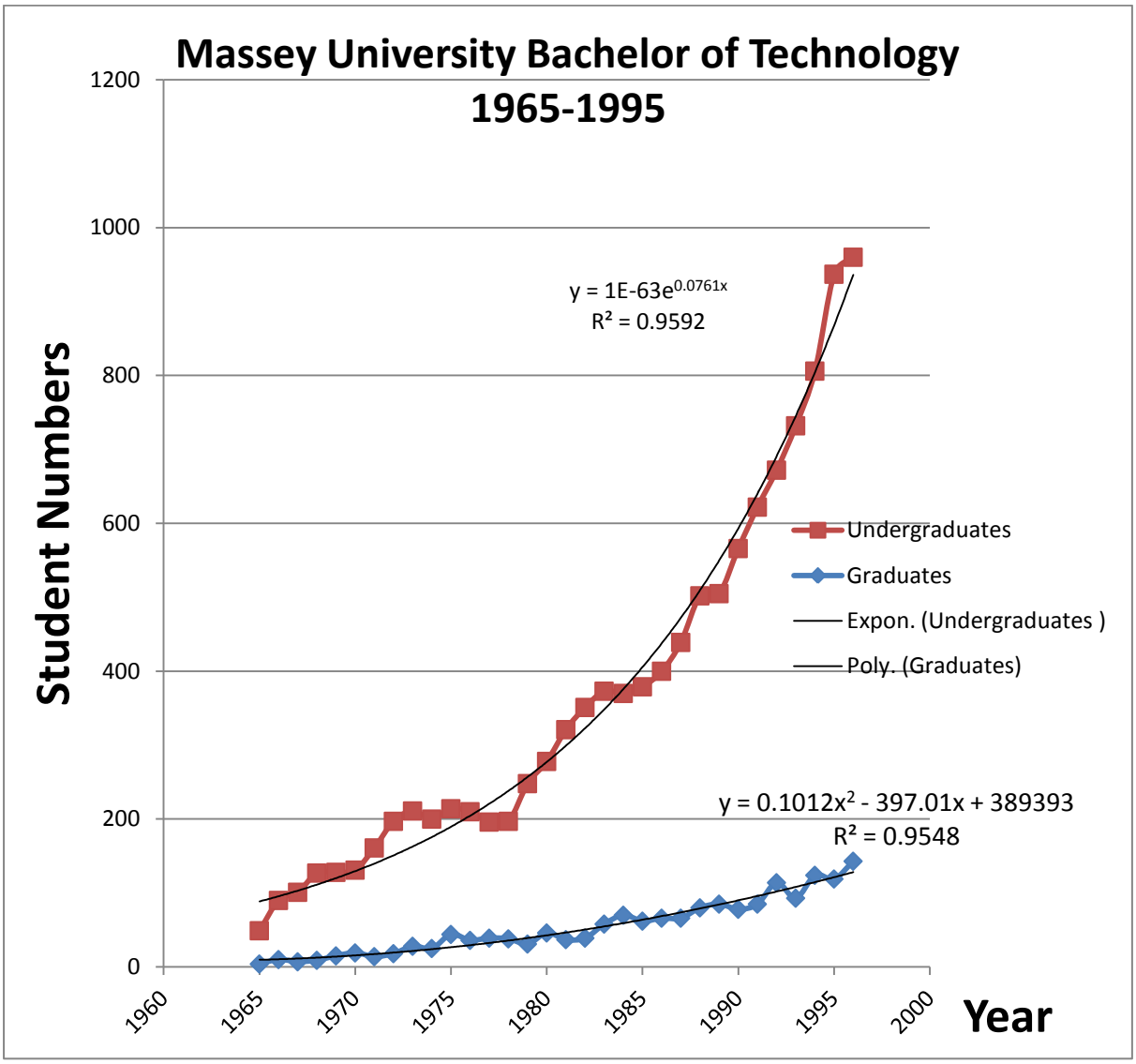


FIGURE 9: FACULTY OF TECHNOLOGY – GROWTH 1964-1996
Data to 1996 from Massey University records, showing regression and correlation

MEETING NATIONAL NEEDS: Politicians, business leaders, and the public have clamoured endlessly over the years - right up to the present - for support to the manufacturing industries. Therefore industrial technology was felt to be totally appropriate to the role of a new state-funded university at the current stage of New Zealand's national development. Once it was in operation, manufacturing Industries were supported, and they called for more and more professional technologists.

Graduates started new enterprises, designed new plants and introduced many new products. The Technology Faculty established a growth pattern that endured through changes in economic cycles and governments. It had academic strength, versatility, and balance. There was teaching, producing growing numbers of successful graduates testifying to their employability and capabilities. There was applied research including the more academic aspects, ranging from the strong and widely accepted FTRC to co-operation with particular industries. There was extension out into the manufacturing sector with specific and continuing workshops and a substantial quality assurance teaching and consulting programme.

All of these were balanced to give necessary mutual support, and combined to give a vigorous and productive activity centre for Massey University and for New Zealand.