How to do justice, in such a short article, to the range of excellent scientific research that has developed at La Trobe? The task seems impossible. The University has, to date, always been in the fortunate position of being able to appoint first-class researchers to its staff. And it has reaped the benefit of their collective abilities. I have therefore chosen to select a number of projects that seem not only to be of international repute, but also of general interest. These, I hope, will provide a 'snapshot' of some of the people and projects that have made significant contributions to scientific research at La Trobe during the first twenty-five years. I will also outline the development of computing at La Trobe, as the computing system during the past twenty-five years has become central to every area of scientific research.

**Early Days**

The initial science disciplines were Botany, Chemistry, Genetics, Mathematics, Physics and Zoology. The first three science professors appointed, Robert J. Magee and Ronald D. Topsom in Chemistry and Alan B. Wardrop in Botany, all brought staff with them and so research commenced rapidly. Technically, the first research directly related to La Trobe was carried out by two research fellows — Dr Bela Temai, who is still on the staff, and Dr P.R. Considine — working with Professor Topsom, in Chemistry. Monash University kindly made a laboratory available, without overhead costs, for much of 1966.

The first buildings at La Trobe were finished in early 1967 and science research was, in that year, located in the basement of the Library. In fact, full service links are still located under the carpet on the ground floor. It is hard to imagine a present day Chief Librarian agreeing to have disciplines such as Chemistry working inside the building.

The laboratories were moved to the Thomas Cherry Building in early 1968. In late 1966, it looked as if this building would be delayed and that the limited capacity of the Library building would necessitate a sharp reduction in the admission of science students in 1967 and 1968. However the Thomas Cherry Building was completed on time and by 1969 separate Chemistry and Biological Science buildings were ready for occupancy. The six initial science disciplines gradually expanded: Agriculture was added in 1968, Psychology and Biochemistry in 1971, Geology in 1972, and Microbiology in 1975.

The first year of teaching saw an enrolment of three postgraduate students in science, and the total number of science postgraduate enrolments over the first quarter century rose rapidly to 105 by 1971, 309 by 1978 and 418 by 1987. Likewise, research funding from outside the normal Government research and equipment grants increased rapidly. Only some $171,000 in 1972, it reached $5.7 million in 1987. The first person who qualified for a La Trobe University PhD was Ian McBean in Genetics at the beginning of May 1970, followed three weeks later by Greg Scollary in Chemistry. Both degrees, and also one to Sam Chase in Botany, were conferred in April 1971.

**Computing at La Trobe University: From Floods to Clusters**

Computing began at La Trobe University in 1968 with the appointment of John Edwards as Computer Centre Manager, now Director of Computing Services, and the acquisition of a
Building La Trobe University

Digital Equipment PDP9 computer. This was the start of two major associations, the first being with Digital Equipment as the major supplier, the second with the tunnel system at La Trobe which was the location of the initial Computer Centre.

Within a few months, the Centre was driven from its basement location by a burst water main which flooded equipment and offices almost waist-deep and left a coating of sticky mud which could only be removed by using a hose. After washing computer logic boards in alcohol and drying out power supplies by fan, the computer system was re-assembled one week later — in a higher and drier location. It ran first time ..... with one logic board left over.

Twenty years later, in 1988, the University Computing Services have returned to the tunnel system with the installation of a major Ethernet communications network. This links Computer Centre equipment to terminals and processors on every floor of every building in the inner campus. The only flood now anticipated is the rapidly rising demand for access to facilities for teaching, research, and administration coming from all areas of the University.

In 1970, the PDP9 was supplanted by a larger PDP15 processor, although the older machine continued to supply limited computing for teaching, research and even a rudimentary payroll system, until 1973. In that year, La Trobe jumped to the forefront of computing facilities available at Australian universities with the establishment of the present Computer Centre building, and the acquisition of what was, for that time, a large scale timesharing machine — a DECSYSTEM 10. Terminals were installed in departments in all areas of the campus and wired to a patch panel in the Centre. Demand for access to the sixty-four possible job slots grew over the years until it was calculated that one ‘phone call each minute was being received in the Computer Centre for a patchboard connection.

The DECSYSTEM 10 provided facilities for large-scale research tasks and many departments became dependent upon its capabilities, particularly its sophisticated numerical and statistical software packages. Extensive undergraduate access was also supported and computing skills were built into many courses. Administration, too, became dependent upon this system as procedures for payroll, student records and finance were implemented. Overnight batch processing capability and the acquisition of dial-in modems ensured twenty-four hour operation, seven days per week, without any dependence on operators being present.

By 1979, the demand for computing could no longer be satisfied, despite significant incremental growth in the capacity of the 'TEN'. At this time, the University acquired one of the first of Digital's newly announced VAX 11/780 to be released in Australia. It had 1.25 megabytes of memory and could support thirty-two users simultaneously. Virtual memory capability meant that the largest computational programs could be accommodated. It soon became heavily used for both teaching and research. Additional VAX computers were purchased in 1981, and 1983, and each was expanded internally as demand rose. Administrative systems were progressively migrated to one of the VAX. Then, in 1986, the DECSYSTEM 10 was finally retired, to the great regret of all who had used and relied upon it.

Also in 1986, the University switched from Digital and purchased a Data General computer for research. With approximately twelve times the speed of the VAX 11/780, it was considered a major acquisition, but incompatibilities with existing software packages, and a marked reluctance by users to migrate to a whole new way of computing, left it under-utilised, while the old research VAX continued to carry its previous load. In retrospect, the cost and effort of changing operating systems was seriously underestimated.

This unsatisfactory situation was finally resolved towards the end of 1987, when Digital Equipment made a dramatic offer: it would trade in the Data General and supply a cluster of machines comprising a VAX8700 for administration, a dual processor VAX8800 for research, and a VAX 11/785 for teaching. This would mean that there would be both a new VAX 11/785 and the existing VAX 11/780 available for teaching purposes. The cluster would provide approximately twenty times the power of a single VAX 11/780, include seventy-two megabytes of memory and over seven gigabytes of disk storage. Within one month of the offer being made, the equipment was installed and operational.
A policy statement recently approved by Council, advocates a computer rich environment, and La Trobe is well on the way to achieving this. Existing facilities provide a growth path to meet demand for the next five years and incremental acquisitions will ensure that we never need to experience a performance crisis again.

Elsewhere on campus, microprocessors and departmental systems have proliferated. With our Ethernet network in place, these can be easily linked together and to the central facility for data exchange, specialised processing, graphics, and quality document production. Links to Telecom provide access to other systems all over Australia and elsewhere in the world. A leased line joins La Trobe to the Health Sciences campus at Carlton, and from there to the University of Melbourne and a variety of other research institutes.

And what happened to all those old machines? They went back to Digital Equipment, of course — to become major exhibits in their computer museum.

So, on to the first research 'snapshot', dealing with our substantial and widely recognised expertise in protein and enzyme studies.

**Development of Protein Chemistry and Enzymology at La Trobe**

Proteins, a class of compounds, have the operational control of cell behaviour. They provide the basic fabric of the cell. Most importantly, proteins are the catalysts of the many thousands of specific chemical reactions performed by cells. The study of enzymes — enzymeology — is central to any biochemistry department. Therefore, it is not surprising that the first appointments to the Department of Biochemistry's staff, Dr Roger S. Holmes and Dr Robert K. Scopes, were two enzymologists. Dr Holmes subsequently took up an appointment at Griffith University.

Dr Scopes came to La Trobe in 1972 with a distinguished record in enzymology, particularly in respect to enzymes involved in energy production in the muscles. During his time at La Trobe, Dr Scopes has further enhanced his reputation by developing procedures for enzyme purifications based on separating enzymes from materials subject to chromatographic analysis and the innovative use of textile dyes immobilised on resins to purify enzymes. This is called dye-ligand chromatography. These techniques have most recently been applied to carbohydrate metabolising such as in the production of enzymes in ethanol-producing bacteria with potential industrial applications particularly for fuel alcohol. Dr Scopes' book *Enzyme Purification*, now in its second edition, is on its way to becoming a classic in the field.

Because of the central role of proteins in biological systems, other academic staff were appointed for their expertise in protein and enzyme technology. Dr Nicholas J. Hoogenraad's research deals with errors of metabolism in biosynthesis, the specific targeting of proteins into discrete structures within cells, known as organelles, and investigations into proteins relating to the effect of interferon on cells grown in culture. These studies have required the establishment of highly sensitive immunochemical and molecular biological techniques. In the early days of their development, Dr Hoogenraad introduced monoclonal antibody technology into his laboratory and this continues to be applied to his research and that of others. Exquisitely specific reagents, monoclonal antibodies, allow us to detect and quantify minute amounts of compounds. They are the basis of many modern diagnostic procedures for disease causing organisms and are also used for investigation into the effects of various hormones and pesticides.

Dr Hoogenraad and his colleague, Dr Geoffrey B. Fincher have also been instrumental in introducing recombinant DNA techniques to La Trobe University. These techniques have revolutionised modern biology and are being used to study proteins and enzymes, particularly the relationship between the structure and function of proteins.

Many proteins are modified during or after their synthesis by the addition of different chemicals. For example, adding or removing some phosphates provides a mechanism for controlling the activity of key 'rate limiting enzymes' in the metabolism of certain proteins. These have been the subject of Dr Gideon M. Polya's studies on metabolic 'signalling' in
Building La Trobe University

The biological properties of each protein are determined by its unique amino acid sequence which is encoded in DNA. The connection between protein sequence and DNA sequence is the initial link between protein chemistry and molecular biology. Thus, by obtaining the protein sequence from purified proteins scientists can obtain information on the DNA sequence, based on a knowledge of the genetic code, which can be used to isolate the gene encoding the protein. Conversely, using sensitive DNA sequencing procedures, the protein sequence of an enzyme can be predicted without directly sequencing this protein. The first protein sequence was achieved manually by Federick Sanger at Cambridge University in the late 1950s. Automated protein sequencing was developed at St Vincent's Hospital, Melbourne, by P. Edman and G. Begg in 1964. More recently, improvements in sensitivity and in speed of automated sequencing have been achieved through the introduction of commercially available, gas-phase sequencing.

Protein and enzyme research at La Trobe received an enormous boost when funds were provided in 1985 by CTEC for an automated, gas-phase sequencer, DNA synthesiser and amino acid analyser. This highly sensitive and specialised sequencing equipment has been operated by Dr Wettenhall, and has provided partial or total sequences of proteins used in research by several groups at La Trobe University and in other institutions. These sequences have provided information for the chemical synthesis of oligonucleotides, small segments of DNA, or co-enzymes, used, for example, to isolate the correct clones to help identify certain genetic structures. Dr Donald R. Phillips has contributed extensively to these developing technologies. His expertise in physical biochemistry relates particularly to the interaction of drugs and proteins with DNA and the regulation of gene transcription.

This involvement with proteins and enzymes, and the obvious potential of such research in medical, industrial and agricultural applications, led to the creation, in February 1988, of the Special Research Centre for Protein and Enzyme Technology. It was one of seven new research centres established in Australian universities by the Commonwealth government after nation-wide competition.

In addition to all members of the Biochemistry Department, the Centre includes Dr Anthony G. Wedd, whose interests are in metallo-enzymes and who has collaborated with Dr Scopes on enzyme purification, Dr Robert T.C. Brownlee, an expert in nuclear magnetic resonance spectroscopy, Dr James A. Reiss, an expert in organic synthesis, all from the Department of Chemistry, and Professor Roger W. Parish, of the Botany Department, whose research interests are in proteins affecting invasiveness of cancer cells.

Space Research at La Trobe

Mention space research at La Trobe, and immediately the name of Professor Keith D. Cole comes to the fore. When Professor Cole joined La Trobe as a foundation professor of Physics in 1966, he brought with him a background of many years of theoretical research in space physics. Originally, he had entered this field a decade earlier when, in 1956, he spent a year on an Australian National Antarctic Research Expedition to Macquarie Island as an auroral physicist. In the first few years of the University he was joined on the staff by Dr Eric C. Butcher, Dr Elizabeth A. Essex and Dr Peter L. Dyson, who had initially come to La Trobe on a Queen Elizabeth II Fellowship, and later by Dr Peter Hammer.

It was not until 1970 that the group conducted its first experiments in ionospheric physics using a ‘cosmo’ ionosonde from a location at Yarrambat on a private block of land. In 1971, the University purchased a 34 acre block of land at Beveridge, on which the group established its field station. The Beveridge field station is now the site of operation of an ionospheric 'Chirp-
Research: the Science Schools

sounder', a digital ionosonde, a Fabry-Perot Interferometer, a Faraday ionospheric polarimeter, and geomagnetic pulsation equipment. Soon it will have a new device to measure the electrostatic field of the earth.

Since the early 1970s, various experimental and theoretical studies of the upper atmosphere and ionosphere have been conducted including research on the wind speed and temperature of the atmosphere at 300 kilometres altitude, the ionospheric electric currents at 100-120 kilometres altitude, the total electron content of the ionosphere, geomagnetic pulsations, and internal gravity waves in the thermosphere, a region where satellites make their orbits. The experimental work of the group has expanded from ionospheric physics into upper atmosphere physics generally, magnetospheric research, and studies of the electric field of the Earth.

The group has attracted extensive funding from the Australian Research Grants Scheme (ARGS), the Australian Telecommunications and Electronics Research Board (formerly the Radio Research Board), and the Department of Defence. Papers of the group in the refereed literature number more than 300. In addition the group currently has twenty postgraduate students and has graduated sixteen MScs and twenty-two PhDs since its inception — a considerable achievement in a highly specialised and relevant field of scientific endeavour as we urgently need to find out more about the forces and phenomena that shape our biosphere.

The group hosted the first scientific meeting of the Australian National Committee on Solar-Terrestrial Physics in 1976. It has also conducted extensive collaborative research with the Australian government's Antarctic Division on geomagnetic pulsations and ionospheric physics as well as collaborating with the Institute of Physics of the Earth, Moscow, and with the Institute of Geomagnetism, Bombay, on ionospheric physics. In recent times, Dr Peter Dyson has been one of an eleven-man North American team developing a special new space radar for deployment of the Space Shuttle in the 1990's. Professor Cole was a co-investigator associated with NASA's Dynamics Explorer program, a double satellite experiment to probe the depths of space in the distant geomagnetic field and in the ionosphere.

Professor Cole's involvement in the international scientific scene highlights the extremely wide and co-operative nature of university research, in which La Trobe has played a significant part during the past twenty-five years. Recognised internationally as a leader in his area, he was appointed a 'discipline representative' to the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP) in 1977. This is the principal body in the world responsible for the conduct of international, interdisciplinary programs in Solar-Terrestrial Physics and is a Committee of the International Council of Scientific Unions. He was elected President of SCOSTEP in 1977 and for a second term ending in 1986. During his terms, SCOSTEP conducted the International Magnetospheric Study (IMS) and the Middle Atmospheric Program (MAP). The IMS was a satellite rocket and groundbased study of the distant parts of the Earth's magnetic field and its entrapped fully-ionised gases — and La Trobe University hosted the first major symposium on the scientific results of the IMS in December, 1979. This attracted about 100 overseas scientists to the campus. MAP was a similarly wide-ranging study of the stratosphere and mesosphere of the Earth. Presently, Professor Cole is co-chairman of one of SCOSTEP's major programs, known as the World Ionosphere-Thermosphere Study (WITS).

Keith Cole was elected President of the International Association of Geomagnetism and Aeronomy (IAGA) from 1979 to 1983. IAGA is the chief international forum for presenting results of scientific research dealing with space physics and the Earth's magnetic field. He has received many honours for his contributions to space research. These include election to the Australian Academy of Science in 1983, election as an Associate of the Royal Astronomical Society in 1982, and the award of the Appleton Prize of the Royal Society of London for his contribution to ionosphere physics in 1984. Presently, he is Foreign Secretary and Member of the Council of the Australian Academy of Science and Australian delegate to the International Council of Scientific Unions.

With his great interest in the scientific questions relating to changes in the global environ-
Building La Trobe University

ment, Professor Cole has been heavily involved, at both the national and international level, in planning scientific programs. One of his tasks is to Chair the Australian National Committee for the International Geosphere-Biosphere Programs (IGBP). The IGBP is now being planned for the 1990s and La Trobe will thus play a key role in one of the most comprehensive attempts ever made to understand man's impact on the environment, both locally and globally, and to compare it with natural changes. The long-term objective of the IGBP is to develop both a better understanding and proper management of natural resources and of the environment.

Key Centre in Statistical Sciences

The Key Centre in Statistical Sciences was established by the Commonwealth Tertiary Education Commission (CTEC) in 1985 with a grant of $450,000 over three years. Along with La Trobe University's Department of Statistics, the Centre comprises the Statistics Department at the University of Melbourne, and the statistics sections of the Mathematics Departments at Monash University and at RMIT. The aims of the Centre are to develop statistical consulting as a major activity of the various Statistics Departments and Groups, to establish a coursework Masters degree program drawing on the combined talents of the Key Centre departments to offer a broad range of courses in applied statistics, and to give students practical experience in statistical consulting by involving them in the consulting activities of the Key Centre. It had long been recognised by statisticians at La Trobe that traditional courses in statistics were often not adequate for the education of fully-fledged professional statisticians. The ordinary BSc course involves only two years of statistics and the only requirement for second-year statistics is first-year mathematics. Students undertaking an honours degree have traditionally been prepared for postgraduate study rather than to be practising statisticians. The range of courses which can be taken by students in one year is not broad enough for the extensive knowledge now required. Rectifying this state of affairs based on additional teaching by La Trobe staff alone, was clearly impractical with only six teaching staff other than tutors. Thus, the creation of the Key Centre offered one of the most exciting prospects since the Department of Statistics was established.

MSc by coursework courses were first offered in 1986, with some twenty-five participating students. This number included honours students from La Trobe and the University of Melbourne, who now take courses offered by the Key Centre. Forty-five students enrolled in 1987 and twenty-five in 1988. These figures are quite sizeable, considering that in 1985, in the whole of Australia, only thirty students obtained honours degrees in statistics and, of those, twelve were from Monash. The number of courses offered in 1988 had risen to twenty-four, giving students a statistical education without parallel in Australia and rare anywhere else in the world. Having established the MSc course, the Key Centre departments are now seeking to attract fee-paying students from overseas.

Staff in the Department of Statistics have undertaken a considerable amount of consulting work. At La Trobe, most consulting work has been done for internal clients, mainly from the School of Biological Sciences. External clients have included Ford and Alcoa and various hospitals. The Key Centre has mounted some short courses, such as 'Time Series Familiarisation for Business and Industry', held in 1987, and involving La Trobe participants. In 1988, the course 'Statistics for Research Workers' was held at La Trobe and this is intended to be offered annually.

Apart from such links with business and industry, another benefit of the establishment of the Key Centre has been the increase in contact between statisticians in the different institutions. There have been one-day meetings on research and consulting activities, and the regular meetings of the Key Centre Executive have led to increased co-ordination and co-operation.

To varying degrees, staff of the Statistics Department at La Trobe have been involved in virtually all of the Key Centre's activities. Notable contributions have been made in particular by Dr Niels G. Becker, who was Director of Training when the MSc coursework program was being developed — his term being ended by a serious motor accident — and Professor J.
Stephan Maritz (recently retired) who took over as Director of the Key Centre in September 1986.

Students in the MSc program at La Trobe have undertaken consulting projects at CSIRO, the Royal Children’s Hospital and the Repatriation Hospital, and have been involved in the lunchtime consulting sessions organised by the Department of Statistics. At these sessions, staff or students of La Trobe can obtain free advice on statistical problems. In some cases, students have also suspended their courses to gain more practical experience in statistical consulting. Graduates of the course have been in very strong demand.

A history of the Key Centre is premature, but its establishment represents an important step in the history of research at La Trobe University. Much has been achieved by the Centre and there is much work in progress. As far as our national research strategy is concerned, statistics is an increasingly important field with widespread applications. Many further initiatives are needed to promote the study and use of statistics.

Island Colonisation and Ecosystem Assembly — the Krakatau Zoology Project

Moving from statistics to zoology, the following discussion deals with a project that, in a world concerned about ecological damage and the green-house effect, examines how our fragile — and dwindling — tropical forest eco-systems are formed. Professor Ian Thornton is a biologist particularly interested in the special problems, and special insights, that island systems can provide for students of evolution and ecology. During an outside studies project in 1982, he spent a short time on the island of Krakatau (Krakatau), in the Sunda Strait between Java and Sumatra. This volcano achieved world fame in 1883 when its eruption and accompanying tsunami (tidal wave) was the first natural disaster in recorded history to affect the whole planet. The explosion was heard in South Australia; sea level changes were recorded in Alaska and the English Channel, and meteorological effects caused by the globe-encircling dust cloud were seen in Europe and America. Biologists became particularly interested in the way the remaining third of the island and its two close companions were being recolonised by plants and animals. The sterilisation resulting from the deposit of some seventy metres of red hot ash by the catastrophic eruption, made Krakatau a classical ‘natural experiment’ in colonisation and ecosystem assembly. Professor Thornton’s visit to the archipelago in 1982 was partly out of curiosity but was also to collect Pscoptera, the group of insects in which he specialises. He wanted to know which species had managed to establish themselves there in the past century.

Whilst there, he realised that botanists had monitored the succession of plant communities fairly frequently, most recently in 1979. However, colonisation by animals had not been studied since the expeditions of the Dutch zoologist Dammerman ended in 1934, apart from a survey of birds in 1951. Animal colonisation of the young island Anak Krakatau (Child of Krakatau), which emerged from Krakatau’s submerged caldera in 1930 and is still active, had not been studied at all. On his return to La Trobe, Professor Thornton suggested an expedition to systematically survey the fauna for the first time in fifty years. About the same time, Neville J. Rosengren, a Research Fellow in the University of Melbourne’s Geography Department, also gave a seminar on his work on the island’s shifting coastlines and dynamic landforms. Both he, and several of the staff and senior students in our Zoology Department, were enthusiastic.

During Professor Thornton’s visit to the Krakatao Centenary Congresses, held in London and Jakarta in 1983, he formally announced that La Trobe University would be mounting a zoological expedition in 1984. To a tight deadline, the group sought funds, obtained permits, gathered equipment and selected participants. La Trobe provided an expedition photographer, sufficient entomologists, and some specialists in birds and reptiles. Two other bird specialists were found who were familiar with the S.E. Asian fauna, one a Melbourne-based conservation biologist, the other on the staff of the National University of Malaysia at Kuala Lumpur. Also included was a specialist in parasitic wasps and a botanist from the University
of Hull, England, and mollusc specialists from the National Museum, Melbourne (now the Museum of Victoria), one of whom was a qualified nurse, as well as Indonesian counterpart scientists from the Zoology Museum at Bogor, West Java.

On the second expedition, in the following year, a bat specialist from the Australian National University was included as was an expert in the technique of detecting and recording ultrasonic calls, and on the third expedition in 1986, a zoologist from the Western Australian Museum was added. All honours and graduate student expeditioners undertook first aid courses. The second expedition also included a microbiologist who was completing his final year in medicine at the University of Melbourne. Altogether, in the major and the two smaller subsequent expeditions, eight graduate students and seven staff from La Trobe’s Zoology Department took part, as well as eleven Indonesians — thirty-eight scientists in all, from twelve institutions.

There was not time to apply for an ARGC grant for the initial expedition in 1984, so support was sought from the community. The Zoology Department set aside some funds for the expedition, some other departments in the School contributed, and The Age newspaper launched a public appeal. Substantial support came from Mr Dick Smith, who was about to launch the Australian Geographic Magazine, CRA Ltd, the Ian Potter Foundation, The Age itself, Friends of the University, the CSIRO Division of Entomology, the Museum of Victoria, and many private individuals in Victoria both within and outside the University. In a rare example of direct public enthusiasm about, and financial support for, university research, donations of two dollars came from pensioners; collections were made in school classrooms, and some donations of equipment and expedition supplies were also received. Expedition members bought all their own personal requirements, such as tents and rucksacks, paid for their injections and visas, and contributed a further $200 each to the expedition. The later expeditions, in 1985 and 1986, were supported by ARGC research grants.

The first expedition, in 1984, involved simultaneous work in southern Sumatra, the Javan Rhino reserve (Ujung Kulon) in West Java, and the Krakataus. Conditions were tough; water had to be taken out to the Krakataus and boiled before drinking; sea water was used for washing and food was local. However, team work and morale were excellent. During the visit, several earth tremors started landslides from Rakata’s peak which fell to one side of the camp, and one day a water spout — an aquatic, mini-tornado — moved through the islands passing very close to the campsite. Trapping and collecting schedules were adhered to whatever the weather, even when this entailed the difficult climb to Rakata’s summit along a narrow ridge of partially consolidated ash at the top of the island’s almost sheer 800m cliff. One expeditioner, who suffered from vertigo, was excused from this duty; a graduate student, also a vertigo sufferer, only mentioned his problem after the climb. Others were reassured, and more determined, when told Professor Thornton’s wife had accompanied him to the summit in 1982.

Many young zoologists had their first taste of work in a tropical rain forest, and saw flying lizards, gliding snakes, Rusa deer, Siamang gibbons, forest oxen, leaf monkeys and many exotic tropical birds such as hornbills, jungle mynahs, peafowl and jungle fowl for the first time. Enduring international friendships were formed through hardship recalled with pleasure, not only between scientists, but also with the crews of fishing vessels used by the expedition, and with the Indonesian cook, Syerif. Staff and students from the Zoology Department, linked in pursuit of a common aim, and many of the technical staff worked enthusiastically on expedition matters both before and after the expeditions.

Preliminary results have generated considerable interest in Europe and in the USA, with post-expedition ‘collaborating specialists’ now located in some fifteen countries. The final results are beginning to appear in the more than twenty papers that have already been published in the Philosophical Transactions of the Royal Society of London.

Much has been learned about the process of colonisation of islands and about the way in which a tropical forest ecosystem is reassembled naturally from a zero base-line. However, this
natural process continues. Consequently, this very long-term project will need recruits from today's schoolchildren — and from zoologists yet unborn. We hope that the work will serve as a firm basis for comparison in the future, and that zoological monitoring of Krakatau will be continued at intervals of five to ten years, if possible from La Trobe University.

Research Centre for Electron Spectroscopy

With perhaps not the same sense of romance and anticipation associated with an expedition to the tropics, a group of academics of the School of Physical Sciences waited in March 1978 to hear if the Academic Board and Council had approved the formation of a proposed Research Centre for Electron Spectroscopy (RCES). The proposal was approved and it formalised a research co-operation in Photoelectron Spectroscopy (PES) which had developed over previous years between members of the Physics and Physical Chemistry Departments.

Like research on Krakatau, photoelectron spectroscopy has a long history dating back to the turn of the century, to heady days when physicists were unravelling the microscopic mysteries of the atom and the nucleus. La Trobe’s science historian, Dr John G. Jenkin of the Department of Physics, has described this pedigree. The development of the area waxed and waned for seventy years, affected by wars and technological breakthroughs. However, in the early 1960s, Professor Kai Siegbahn in Sweden and Dr David Turner in England independently made crucial improvements to the experimental methods; the former in x-ray and the latter in ultraviolet techniques. At the same time, vacuum technology also dramatically improved, and these developments combined to give the impetus for the rapid development of photoelectron spectroscopy and related techniques.

Members of the La Trobe Physics and Chemistry departments noticed the reports of the ‘newly developed’ technique, saw its potential and started building their own spectrometers. The need for discussion of ideas and collaboration in the development of techniques led to the co-operation which, in turn, led to the formation of the Research Centre. Workshops for users of PES from around Australia first met at La Trobe in February 1976. These meetings have continued, although more recently, the increasing diversity of areas of application of PES has reduced the overlap of interests in the Australian electron spectroscopy community.

The Centre was formed at a time when emphasis was being placed by Governments on the funding of larger research groups and when La Trobe University was attempting to fulfil its earlier ambitions to establish structures which would enable interdepartmental and interdisciplinary collaboration. Its aims were many and covered all the varied activities of research, including the promotion of joint projects, the initiation of funding applications, the organisation of seminars, conferences and special teaching programs, and the collaboration with scientists outside La Trobe University.

An international conference on electron spectroscopy was organised by the Centre and held at La Trobe in August 1978. Ten invited speakers from outside Australia gave plenary lectures, though one eminent scientist arrived in Hawaii only to discover that a visa was required to enter Australia and was forced to spend some time in that out-of-the-way place. The eighty-five delegates filled the remainder of the four days with shorter research reports. The proceedings of the conference were reported in a large, special edition of the Journal of Electron Spectroscopy. This established La Trobe as an important centre for Electron Spectroscopy and provided the basis for overseas collaborations for many years to come.

The subsequent history of the Centre has been of collaborations, both internal and external, which have been both stimulating and fruitful. Members of the Centre have links to scientists in the USA, in Germany, China and the UK. Within Australia, collaborations exist with CSIRO, Telecom Research Laboratories, the Electronic Research Laboratories in Salisbury, South Australia, RMIT, and the University of Queensland.

Funds have been obtained from the University and the ARGS for an elaborate spectrometer system, which Dr Graeme L. Nyberg of Chemistry and Dr John Liesegang of Physics are using for surface studies. Both x-ray and ultraviolet techniques, along with a number of
Building La Trobe University

others, are used to examine the complex behaviour of atoms and molecules at surfaces. This co-operative research is directly attributable to the Centre and has led to further collaboration with other members of the Chemistry Department in the analysis of complex inorganic compounds using X-ray photoelectron spectroscopy (XPS). They have also used XPS as an analytical tool for industrial samples and have had useful input on plastics, ceramics, polymers and metal products.

Also under the auspices of the Centre, Dr Robert C.G. Lockey and Dr John D. Riley from the Physics Department, have developed a novel, angular resolving analyser which forms the basis of the University's first patent. Two of these analysers have been sold to European groups and two are at other Australian universities. Collaboration with a group at the Max Planck Institut in Stuttgart has enabled the researchers to obtain access to the angular resolving spectrometer on the BESSY synchrotron storage ring in Berlin, which allows ultraviolet PES at a wide range of wavelengths. This angular and wavelength variation has enabled detailed studies of the electronic structure of metals and semiconductors.

One of the most recent collaborations has been between China's Academia Sinica and Dr J. Barrie Peel of the Chemistry Department, whose research is the ultraviolet photoelectron spectroscopy of gaseous molecules. Discussions are currently under way for La Trobe to supply a complete gas-phase ultraviolet spectrometer to Beijing.

Brain-Behaviour Research Institute

In the twenty-five year history of La Trobe, the Brain-Behaviour Research Institute (BBRI), as a formal entity, can only claim a life span of less than seven years. However, the informal beginnings of co-operation with scientists of many disciplines and the endeavour to implement scientific findings to serve the community, date back to the very beginnings of the School of Behavioural Sciences.

There are many institutes of neurosciences, but the BBRI is unique in both its combination of the study of biological processes and behaviour, and in the diversity of behaviours which are covered by its researchers. It is also unique in the wide application of occupational psychobiology to industrial problems, in particular to shiftwork. Many thousands of workers have benefitted by changes in work organisation designed to improve their health and quality of life, as have a number of organisations, through improved productivity resulting from researcher intervention. In addition, the Health and Behaviour displays, a joint project of the Brain-Behaviour Research Institute and the School of Behavioural Sciences, have provided a valuable resource for the health education of high school students, as well as attracting them to La Trobe University. More recently, the BBRI, with the support of the Victorian Football League, has designed and built a fitness track which will help to improve the physical fitness of the La Trobe community.

The BBRI has not received funding directly from the University, itself, but has had generous support from the University's Department of Psychology. In 1986, the BBRI received $463,986 of outside research grants, many from private organisations. More recently, the Institute launched the Dame Phyllis Frost Fund for memory research, with a target of $250,000.

Over the years, the Institute has arranged a number of public seminars and workshops. These have included: 'Stress at Work', 'Work Effectiveness', 'Shiftwork', 'Occupational Pain (RSI)', 'The Preventions and Management of RSI,' 'Managing Shiftwork,' and 'The Pros and Cons of 12 Hour Shifts.' The seminars have been well supported by the community and, in some cases, attendances have exceeded 200. Many thousands of copies of the printed proceedings of these seminars have been distributed world wide.

Neuroimmunology and Multiple Sclerosis

Matters of community health, this time relating to the particularly debilitating illness of multiple sclerosis, bring us to Dr Claude C.A. Bernard. He was a joint-appointment to the School of Agriculture and the Department of Psychology in 1979 as the first La Trobe Univer-
Research Fellow, having come from the Basel Institute of Immunology, in Switzerland. Upon his appointment as a Senior Research Fellow of the National Health and Medical Research Council (NH & MRC) in 1981, his major goal was to establish a Neuroimmunology Laboratory devoted to the study, in humans and experimental animals, of facets of immunology, biochemistry, microbiology and behaviour relating to the cause of various acute, progressive and destructive diseases.

Support for this came from the NH & MRC, the National Multiple Sclerosis Society of Australia, the University, the School of Agriculture, the School of Behavioural Sciences and, in particular, the Department of Psychology which provided the equipment, facilities, postgraduate students and a limited backup staff. From the outset, the thrust of the Neuroimmunology Laboratory has been broad and multidisciplinary. The purpose of these wide interests has been to dissect the development of Multiple Sclerosis (MS), taking several approaches and with as many modern techniques as feasible. Fundamentally, they have all addressed the same question but from different perspectives.

These studies have now established that one of the characteristics of MS is the presence in the cerebrospinal fluid of an elevated level of compounds known as immunoglobulins. While most of a particular immunoglobulin (IgG) in the cerebrospinal fluid of patients with neurological infections represents antibodies directed against the infectious agent, the nature of the process leading to the increased levels of these immunoglobulins in MS remains unknown. To try to find out what role these 'anti-neural antibodies' play in MS, new assays were developed to detect antibodies to myelin. Myelin is a fatty substance that acts as an insulating sheath around nerve fibres in the brain, and its breakdown causes the neural 'short-circuiting' reflected by the disease's progressively crippling symptoms. Applied to the cerebrospinal fluid, these assays indicated that small amounts of anti-myelin antibodies were present in some MS patients. When used to test extracts of brain from patients diagnosed with definite MS, they also revealed the presence of significant levels of anti-myelin activity. Analysis of brain extracts indicated that this activity was specifically mediated by IgG. As a consequence, a study was undertaken to assess whether the increased level of both anti-viral and anti-brain antibody in MS patients was the result of common features shared by certain viral proteins (e.g. measles antigens) and brain antigens. This important issue was tackled by testing the anti-myelin basic protein and anti-viral antibody activities of immunoglobulins (purified from sufferers of MS and other neurological disorders and from healthy subjects) and checking whether they reacted against viruses which have been incriminated in MS. The results revealed no evidence for shared determinants between myelin basic protein and viral antigens, including measles. This helped to dispel a long-held theory by showing that the reduced immunological responses to measles virus in MS patients could be the result of a sequestration due to cross-reactivity with a myelin antigen.

A further study, carried out to assess the degradation of myelin in the brain of an MS patient, showed that one form of the myelin basic protein was degraded at a faster rate than in the control brain. This indicated that certain enzymes may be involved in the rapid degradation of myelin basic protein. However, studies undertaken to assess such a possibility have revealed no significant differences in the extent of degradation in myelin isolated from MS or control brains in the presence of calcium.

Immunogenetic studies of MS designed to identify genetic links between immune capacity and the disease process are continuing. One series of investigations is concentrating on the immune response of patients with MS to a number of antigens, including myelin basic protein and synthetic peptides, in order to assess if these responses depend upon the interactive effects of certain genetic coding. The results obtained so far indicate that in MS, immunoglobulins present in the brain have a specificity which is not found in patients with other neurological diseases or in healthy subjects. Work carried out to assess the possible pathogenic role of the MS immunoglobulins has identified a new and as yet undescribed mechanism by which myelin damage may occur. To further characterise the specificity of the MS immuno-
globulins and to assess how they are synthesised, antibodies specifically directed against certain regions of MS immunoglobulins have been prepared.

More recently, molecular biology techniques have been set up in the Neuroimmunology Laboratory to further investigate the possible role of immunoglobulin gene products in causing, or making people susceptible to contracting MS.

As well, lymphocytes called T-cells, have been shown to be present in the vicinity of the breakdown of myelin and these, too, are the subject of genetic studies in Dr Bernard's laboratory. The results demonstrated a clear association between a T-cell receptor genetic marker and MS. These findings are considered to be of great importance because the identification of a T-cell receptor gene that contributes to autoimmune diseases may make it possible to design immunotherapeutic reagents which could block the autoimmune T-cell response.

As a parallel study to the MS investigation, experiments have been performed to assess the peripheral nervous disease, Guillain Barre Syndrome. Also, research is being carried out on animal disease models of MS such as Experimental Autoimmune Encephalomyelitis (EAE), to try and help our understanding of the mechanisms involved in the origin of these diseases and their clinical-pathological correlations.

Finally, major initiatives have been taken by Dr Bernard's laboratory with the development of new assays. One enables the measurement of antibodies to neural antigens involved in experimentally induced and naturally occurring demyelinating diseases. A second allows us to measure antigenic fragments released from the whole central nervous tissue as a consequence of inflammatory processes. In addition, a new method for raising monoclonal antibodies to selected proteins and their fragments, which either exist in small quantities or are difficult to purify on large scale, has been developed.

Twenty-Five Years On

La Trobe now has an international reputation for research across a wide range of areas. The stories and people introduced in these pages provide only a brief overview. Statistics, likewise, can only illustrate part of the total picture: for example, in 1987, research in science produced eight books, forty-one chapters in other books, four edited books and no less than 364 papers in scholarly journals, apart from many other miscellaneous publications. More than $5 million in research funds came from outside grants. Much other excellent work, in areas such as botany, chemistry, electronics, genetics, geology and microbiology, to mention just some areas that come readily to mind, would fill this entire volume.

As I have tried to show by the approach taken in this chapter, research is basically about people. People with ideas and with the extraordinary talent and tenacity required to follow those ideas to their conclusion. They do this for their own personal and professional satisfaction — and very often the whole community benefits, sometimes greatly.

Of the science professors who took up duty in 1966-1967, only three are likely to remain into the 1990s. These are Professor Keith Cole, of Physics, Professor Ian Thornton, of Zoology and Professor Ron Topsom, of Chemistry. Others have either retired or moved on to positions elsewhere. However, the appointment of first class researchers to replacement chairs offers great confidence that scientific research at La Trobe will build on the firm foundations laid in the first twenty-five years and go on to develop greater strength and diversity in the years to come.