# 6 The Fourth Decade 1990 - 2000 – facing the challenges in the 90s

In December 1991 Paul Keating replaced Bob Hawke as Prime Minister of Australia and held the position until March 1996. The Federal election in 1996 was won by the Liberal Party under the leadership of John Howard who remained in office until November 2007. The inflation of the 70s and the recession of the 80s gave way to a period of relative economic prosperity and stability. Despite this, major changes driven by a new Board and Executive Director at ANSTO would have consequences for AINSE.

The ANSTO Board and its new Executive Director, Dr David Cook, who was appointed on 2 May 1988, had commenced the process of implementing major change in this organisation. As part of this process, ANSTO quickly commenced realigning its research areas and mode of operation and was quite creative in doing so. In 1989 ANSTO purchased a Tandem Accelerator from Rutgers University in the USA at a total cost, with support equipment, of $2.3 million[68]. The creativeness in this respect was not so much the purpose for which the instrument would be used – initially for $^{14}C$ dating – rather that the accelerator was purchased second-hand for little more than the excavation, transportation and installation costs. It was announced that *the accelerator will be used for the establishment of a national radiocarbon dating service for applications in geology, and oceanography*[69].

Barely two years after the announcement of the purchase of the accelerator, the Australian National Tandem Accelerator for Applied Research (ANTARES) was officially opened at ANSTO in September 1991 by the Minister for Science and Technology, the Honourable Ross Free[70]. Access for academics and their students, was facilitated by AINSE, and as a result ANTARES attracted new groups of researchers.

In 1993, despite all the positive appearances created by robust interest by university researchers and the continuous development of facilities at ANSTO, a threat started to loom over ANSTO. This crisis arose initially because the government indicated that it was considering merging ANSTO with CSIRO.

The ANSTO Annual Report of 1993 indicated the first hint of crisis when Dick Collins in his Chairman's report stated

> *... recent months have seen moves initiated to merge Ansto* [sic] *into CSIRO. I, and my Board, are opposed to this plan for several reasons*[71].

ANSTO now was on record as opposing Government policy and relations between ANSTO and the Government became openly hostile.

With a change of the Board and management at ANSTO in 1994 the relationship between ANSTO and the Government improved. Helen Garnett, ANSTO's new Executive Director, advised the AINSE Executive Committee in November 1997 that the Government had made a decision to replace HIFAR with a new research reactor.

AINSE was invited to be part of a consultative group on beam facilities for the new reactor. The first meeting of the group was held on 7 November 1997and AINSE continued its close association with the group as the years progressed.

## 6.1 AINSE in crisis

Professor Jim O'Donnell, AINSE President, in his foreword to the AINSE Annual Report stated that *1992 was a year of great change for AINSE*. What were the events leading up to this great change?

David Cook had been appointed by his Board as an agent of change to bring ANSTO into a more efficient and a more commercially focused mode. In 1990, he directed his attention to AINSE. At the July 1990 AINSE Council meeting, held at the University of Newcastle, a Minute Paper addressed to Council Members dated 2 July 1990 entitled 'The Future of AINSE' was tabled on behalf of David Cook who was not present at the meeting. In the Minute, he stated that *AINSE had not recognised the changes that are occurring not only within universities but also at ANSTO.* He also contended that AINSE had not appropriately

68 ANSTO Annual Report 1989, p13
69 Ibid, p14
70 ANSTO Annual Report 1992, p11
71 ANSTO Annual Report 1993, p5

facilitated interaction in new areas of ANSTO operations (such as the *tandem accelerator, AUSANS, the supercomputing bureau, the medical cyclotron and the largest isostatic press in the country*) and that it had done little to *cease or limit grants in projects that are peripheral or outside ANSTO's business.*

The paper then outlined three areas that Cook believed needed to be addressed:

- administration costs were too high
- AINSE had a poor profile within universities
- grants, scholarships and fellowships should be more closely linked to areas of ANSTO interest.

The matter did not remain within Council. Professor Ronald MacDonald, the Councillor for the University of Newcastle, was, at this time, the Editor of the Australian Institute of Physics Journal, *The Australian Physicist*. In his editorial column in August 1990, entitled 'AINSE – To Be or Not To Be', MacDonald examined the relationship between ANSTO and AINSE and he strongly supported the Institute's continued existence[72].

The editorial was strongly supportive of the continuance of AINSE and the spirit of collaboration between AINSE and ANSTO. It did not use any material which was not clearly in the public domain.

He was subsequently delegated by the Council to meet with David Cook to discuss ways in which the differences might be reconciled. They developed a proposal to transfer the AINSE equipment to ANSTO and to move the technical staff to the ANSTO payroll. In return ANSTO would provide AINSE with administrative support – primarily in the areas of communications, finance, and human resources.

Ron MacDonald reports that

> *my driving force in developing this agreement was to secure the future of the AINSE staff and ensure they had an ongoing career prospect*.

While there was some discomfort with David Cook's methods, AINSE ultimately benefited from the new arrangements. Member benefits became more clearly quantified in dollars and, as a result, the benefits could be more easily identified; and ANSTO's financial, and communications resources were made available to AINSE. The research scientists transferred from AINSE had an opportunity to advance within ANSTO much more than they would have if they had stayed with AINSE. Of the eight technical staff who were transferred to ANSTO four were still employed there in mid 2008: Dr Michael Hotchkis as a principal research scientist in the Accelerator Group; Dr Shane Kennedy as Technical Director of the Bragg Institute and Mervyn Perry as a technical officer in the Bragg Institute; and William Kyu as a health physics surveyor in the Safety and Radiation Science Group.

The new structural arrangements were achieved after extended negotiations between AINSE and ANSTO and culminated in a Memorandum of Agreement (MOA) that documented the relationship between ANSTO and AINSE. This five-year agreement came into effect on 1 January 1992.

The change in AINSE following the implementation of these arrangements was dramatic. At the beginning of 1992, AINSE had 14 staff comprising an Executive Officer, five researchers and technicians in the AINSE Neutron Scattering Group, three researchers and technicians in the AINSE Accelerator Group, three Secretariat officers and two consultants. By 1993 this was reduced to an Executive Officer and an Executive Assistant assisted by two temporary part time staff and one consultant. Administrative costs for AINSE were also significantly reduced: In 1992, wages, salaries and superannuation were $561,537. In 1993, this was reduced to $154,106. As part of the new arrangements, AINSE's scientific equipment assets with an historical cost value of $2,454,000 were transferred to ANSTO.

During 1992 and 1993, AINSE proceeded to implement the terms of the new MOA. The new arrangements were discussed in a positive light in the annual reports for these years and both the number of grants awarded and the membership increased in the two years of upheaval.

A Special Meeting of Council was held on 7 May 1993 to amend the Rules governing AINSE to comply with both the Memorandum of Agreement and to meet the legal obligations under incorporation. These changes were purely procedural/legal and did not affect the overall functioning of the organisation.

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Events at ANSTO in late 1993 eventually overtook the dissatisfaction of ANSTO management with AINSE. Following a short period of turmoil characterised by dissension between the ANSTO Board and its Minister, Senator Chris Schacht's plan to merge ANSTO and CSIRO, the entire ANSTO Board resigned on 6 April 1994. This was followed shortly by the resignation of the Executive Director, David Cook.

It would be a mistake to view the ANSTO/AINSE furore as being only about David Cook. The first ANSTO Board had been focused on implementing rapid and fundamental changes in its direction and mode of operation. It is also pertinent that David Cook acted in accordance with the directions from his Board.

While AINSE and university interactions were mentioned in ANSTO's strategic plans, such interactions were *not regarded as critical components of the organisation's suite of critical activities. AINSE was only peripherally consulted as the Strategic Plans were developed*[73].

AINSE's Annual Report for 1994 displayed a return of optimism. A sense of composure now re-entered the scene though AINSE viewed the catastrophic eruptions at ANSTO with concern. Perhaps with an eye to a more optimistic future, AINSE added some colour to that year's Annual Report!

## 6.2 Membership - a surge

In parallel with the turmoil discussed above, the 90s was characterised by a surge in membership.

In the early 90s the Australian Colleges of Advanced Education (CAEs) commenced their evolution into universities. The process started with a number of these colleges combining to form a single university on several campuses. They also began to confer degrees and then started to offer higher research degrees. The University of Western Sydney, which became a member of AINSE in 1993, for example, was an amalgamation of the Macarthur CAE, Nepean CAE, Milperra CAE and the Hawkesbury Agricultural College.

As other CAEs became universities, they too joined AINSE: the University College of Central Queensland became the University of Central Queensland and along with the University of South Australia joined AINSE in 1991; Queensland University of Technology joined in 1992 and Victoria University of Technology and Southern Cross Universities in 1994.

In early 1995, the Executive Committee set a goal to make AINSE a national body that represented all Australian universities. As a result Charles Sturt University joined in 1995, Northern Territory University (Charles Darwin University from 2003) joined in 1995; Edith Cowan University, the University of Canberra and the University of Southern Queensland became members in 1996 and Deakin University and the University of Ballarat joined AINSE in 1997.

Membership grew steadily and by the end of the decade AINSE had 37 university members plus ANSTO. In this period, three joined in 1991, one each in 1992 and 1993, two in 1994, three in 1995, three in 1996 and two in 1997. No Australian university that applied for membership of AINSE was ever refused. It was a busy time for the Executive Officer and AINSE Presidents, in particular Professor Bob Breakspere, who had more universities join during his Presidency, 1965-6, than any other President - six in total.

During 1995 the possibility of AINSE becoming an international organisation and not merely an Australasian one came one step closer to reality. The Executive Committee meeting held on 3 February heard that Nanyang Technological University in Singapore had expressed an interest in joining AINSE. The Executive Committee noted that there was nothing in the constitution that prevented an overseas university becoming a member and welcomed the university's enquiry. However, by 4 May Nanyang Technological University had decided not to apply because their *administrative procedures are too complicated to come up with funds for membership of AINSE*.

### 6.2.1 New Zealand membership II

In 1988 David Cook, possibly not fully cognisant of a prior saga of negotiations with New Zealand institutions wishing to obtain access to AINSE membership and ANSTO facilities, advised the July 1988 Council meeting of *the need for ANSTO to establish commercial links*

**Emeritus Professor Bob Breakspere**

Bob Breakspere was the 21st President of AINSE in 1995 and 1996.

He represented the University of Technology, Sydney and then Central Queensland University on AINSE Council for a total of nine years from 1988 with a period as Vice-President 1993 and 1994 and then President 1995 and 1996. During his time as President he instigated the push for the membership of AINSE to represent all universities and he formalised the introduction of the AINSE Winter School at ANSTO.

Bob Breakspere commenced his academic career reading for a PhD (University of Exeter, UK) funded by the United Kingdom Atomic Energy Authority (Harwell) in which he investigated aspects of the incident at the Windscale Nuclear Reactor. He was appointed lecturer at the University of Wales where he developed two research groups, one investigating the effects of nuclear radiation on solid surface activity and the other on fuel cell sensor technology. He was appointed to the Foundation Chair of Chemical Technology at the University of Technology, Sydney and then Foundation Dean of Science, before taking up the appointment of Pro-Vice-Chancellor (Operations) at CQU in 1992. He retired in 1998 to become a Research Consultant.

He was appointed as Emeritus Professor of UTS in 1992 and elected a Fellow of the Academy of Technological Sciences and Engineering in 1997. In 1998 he was awarded the Murphy Medal of the Royal Australian Chemical Institute and a Centenary Medal in 2001 for his contributions to nuclear science and technology.

73 Interview with John D C Studdert, ANSTO's Head of Strategy Development in the period.

*with New Zealand*.

Following this meeting an informal enquiry was received from the New Zealand Department of Scientific and Industrial Research (DSIR). The Executive Committee in April 1990 agreed to *warmly encourage* the DSIR to apply for membership. AINSE in its 1990 Annual Report noted that *for many years, New Zealand universities and research organisations have sought to find appropriate mechanisms by which they could become members of AINSE. ….Extension of AINSE membership to include organisations in the Asia-Pacific region was identified as a future objective*. Finally in 1993, thirty years after the initial enquiries, the February 1993 Executive Meeting considered a membership enquiry from *one of the new Institutes formed in New Zealand from the DSIR.* This Executive Committee meeting agreed *that membership of AINSE was not appropriate for the New Zealand Institute for Industrial Research and Development and that access to Ansto's (sic) facilities should be a matter for Ansto to negotiate.*

In August 1994, the Executive Committee received a letter from the University of Auckland seeking AINSE membership. The Executive Committee made a number of recommendations:

- *the University of Auckland be admitted to membership from 1 January 1995*
- *the initial subscription level be set at level 3*
- *the New Zealand government or other New Zealand sources pay a matching amount (i.e. level 3 subscription)*
- *that ANSTO or an Australian source pay a matching amount*
- *the period of payment of these initial subscriptions be guaranteed for 3 years rather than the customary 5 years for Australian universities.*

In May 1995, the Executive Committee noted that the Institute of Geological and Nuclear Sciences Ltd (later named GNS Science) in New Zealand had agreed to contribute an amount equal to that from the University of Auckland, and ANSTO agreed also to contribute the same amount.

Finally, in late 1995 the University of Auckland became the first New Zealand University to join AINSE. With the membership came an agreement to make the Febetron accelerator located at the University available to other members through the AINSE research grant and scholarship schemes.

## 6.3 Finances

One of the drivers for Cook's dissatisfaction with AINSE was possibly his belief that insufficient funds were finding their way back to ANSTO through the research grants, fellowships and studentships. For instance in the 1990 grant round, of a total of $221,498 awarded, only $46,300 (21%) was returned as Lucas Heights costs. At this stage ANSTO was contributing about $341,000 in membership fees. David Cook's return on investment, by this measure, was 14%. Of course, then as now, other factors were in play and AINSE had made significant financial contributions to infrastructure development. However, if AINSE's investment in the SANS and other facilities in 1990 ($260,951) is taken into account, the funds returned to ANSTO were still below the membership fee.

The issue of the inclusion of Lucas Heights costs in applications for ARC funding was discussed at the first Council meeting in 1990. While it was not envisaged that university researchers should apply for full cost recovery for the use of facilities at Lucas Heights, it was hoped that individual researchers would incorporate the cost of analyses at Lucas Heights into their ARC large grant applications. The President reported from the earlier Executive Committee meeting of *the need for ARC Grant applicants to make provision for Lucas Heights costs*. David Cook defended ANSTO's approach by stating that *the contributions to cost recovery sought by ANSTO were in relation to the real costs of providing ANSTO staff and material in support of these projects.* The ARC was, however, reluctant to fund such costs.

AINSE was able to supplement income in the 90s when it became possible to apply for ARC Infrastructure Grants. The funding was related to infrastructure development and totalled $3,954,000 for the years between 1992 and 1998. The success rate for these grant applications was 100% to this point. This is discussed in more detail in Section 6.5.

In the 90s, the ARC funded 100% of infrastructure costs and they imposed no requirement

on collaborating organisations to make cash contributions. The $3.9 million therefore represents a substantial contribution by AINSE to ANSTO.

In 1990 membership subscriptions were being reviewed every three years and were based on the benefits received over the preceding ten years. By 1994 membership subscriptions were reviewed annually and based on the benefits received over the preceding five years.

AINSE Council in November 1991 reviewed the subscription levels and added two levels at the lower end. The lowest subscription level was for new universities that were at an early stage in building up postgraduate research activities. This was to encourage the newly formed universities to join AINSE. The next level was for those universities who were joining AINSE that year (Table 10).

**Table 10. Membership subscription levels for 1992**

| Membership Level | ($) |
|---|---|
| Level 1 | 5,000 |
| Level 2 | 7,500 |
| Level 3 | 11,200 |
| Level 4 | 13,000 |
| Level 5 | 17,700 |
| Level 6 | 22,400 |
| Level 7 | 31,300 |
| Level 8 | 40,200 |

The MOA between AINSE and ANSTO which came into operation in 1992 led to a new financial agreement between ANSTO and AINSE. ANSTO agreed to match the total university subscription to AINSE on a 2:1 basis, and from this point there would be no separate contribution from the federal government for education and training. ANSTO's subscriptions would be made once a year and would not be changed retrospectively.

It was at this time that ANSTO suggested that there should be a review of the mechanism by which AINSE membership subscriptions were to be set. In August 1993, the Executive Committee decided that in future the annual subscription

> *will be determined by Council during the immediately preceding year using as a basis for that determination, the annual inflator set for ANSTO by the Department of Finance, excluding any downward adjustments.*

The AINSE index that had worked for almost twenty years was now defunct, and a new formula was developed which has remained in operation to the present day.

The dialogue on membership subscriptions continued in the AINSE Executive Committee for two more years as a new formula evolved. In December 1994 the Council agreed to 12 levels of membership subscriptions which would be indexed each year according to the Commonwealth parameter adjustment which was applied to ANSTO. The formula set a benchmark benefit ratio of 3:1 for university members averaged over the previous five years, to be reviewed annually. When the average benefit deviated by more than 20% from 3:1 the membership level was adjusted by one level accordingly. ANSTO's membership fee was set at twice that of the total of the university contributions.

**Table 11. Membership benefit ratios 1994-1999**

| Benefit ratio | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|
| One year | 2.67 | 2.75 | 3.86 | 3.35 | 3.53 | 3.05 |
| 5-year avg. | 2.96 | 2.91 | 3.15 | 3.16 | 3.24 | 3.32 |

Membership levels were established such that each successive level was 20% higher than the one below it and member benefits were calculated each year by averaging the benefits accrued by each university over the preceeding five years (Table 11). Later, when GNS Science joined AINSE in its own right the benefit ratio for New Zealand members was set at 2:1, reflecting the non participation of the New Zealand government.

## 6.4 Governance and process

The retirement of Bill Palmer, and the commencement of the new Scientific Secretary, Roger Gammon, coincided with a number of reforms. By the end of 1989 increased efficiencies in the secretariat included computerised administrative procedures; plans for the first decadal strategic plan; readjustment of membership subscriptions; the first mention of preparation of ARC funding applications; a promotional video 'The Vital Link'; the first issue of the newsletter 'AINSE Activities'; acquisition of skills and subcontracting of services formerly provided through ANSTO such as printing and graphic design; a review of AINSE Grant procedures and the design and introduction of new application forms; and the establishment of guidelines for determining costs for the use of Lucas Heights facilities.

The AINSE Council decided in 1991 to reduce the number of Council meetings per year from four to three. Shortly after signing the MOA, in an effort to further cut costs, the Council meetings were reduced to one per year in 1992. This proved to be unsatisfactory from the universities' point of view and the Council, in December 1994, agreed *that a second meeting of Council be held each year in a regional centre.* This practice continues today.

### 6.4.1 AINSE's mission and objectives

Shortly after taking up his position 1988, Roger Gammon was involved in the initiative of raising the public profile of AINSE which was discussed at the Executive Committee meeting in November 1988. The Council decided to allocate *$20,000 but no more than $30,000 … for promotional purposes*. A pamphlet and an information booklet describing the functions of the organisation, as well as a set of 35mm slides and a 6-minute video were produced. In 1990 funds were made available to publish three issues of a newsletter entitled *AINSE Activities*.

In July1989, Council determined that Council resolutions, in future, would be in the form of motions put and seconded by individual members. This formalisation of Council decisions was the first of a number of major changes to the AINSE organisation. Another was the incorporation of AINSE. The ANSTO legal adviser had reported to the final Council meeting of 1989 that *incorporation should proceed without delay.*

In 1990 AINSE became subject to the provisions of the NSW Associations Incorporation Act 1984. The Rules of the Institute were updated and changed to incorporate inclusive language and the Scientific Secretary was nominated as the Public Officer. AINSE was incorporated on 9 August 1990.

As part of this process of incorporation, and in line with the prevailing view of company organisation, AINSE produced its own Mission Statement that included a set of AINSE goals and the strategies by which these would be achieved. AINSE now came in line with other educational institutions and companies.

AINSE's Mission was to

> *... advance nuclear science and associated technology research, development and training in Australia by being the link between Australian universities, ANSTO, CSIRO, and other components of the scientific community.*

Objectives were to

1. *Ensure a high standard of research in nuclear science and associated technologies relevant to Australia's needs*
2. *Foster an environment for productive collaboration between universities and ANSTO*
3. *Provide support to university students and their research endeavours with particular emphasis on the utilisation of the special facilities at Lucas Heights*
4. *Assist in ensuring that equipment and facilities at Lucas Heights are appropriate for national research requirements.*

A draft set of performance indicators for AINSE was prepared by the Centre for Technology and Change (TASC) in November 1991. The Executive Officer continued the development of such indices[74] until the final set was adopted by Council in 1997 with the signing of a new Memorandum of Agreement with ANSTO.

Another issue that became apparent at this time was the fact that AINSE paid no overtime to technical staff; they were compensated by time in lieu. The Executive Committee in January 1991 agreed to *… make reasonable overtime payments to technical and secretarial staff should circumstances warrant it*. The Executive Committee also agreed to give AINSE staff employment conditions parity with ANSTO staff.

In 1989/1990 AINSE staff superannuation arrangements were overhauled to bring AINSE staff superannuation benefits up to the level enjoyed by ANSTO and university staff and to reduce the administration time and effort required in managing the existing AINSE staff's superannuation scheme. Within the universities a new superannuation scheme was introduced in January 1990 (the Superannuation Scheme for Universities, SSAU) and in July 1990 AINSE became part of that scheme. Under the former scheme with the AMP Society, staff contributed 5% of salaries with the Institute contributing 15%. Under the SSAU, staff contributed 7% of salaries and the Institute contributed 17%.

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## 6.5 Facilities and infrastructure investment - AINSE is a key element

In 1990, discussions between AINSE and the ARC indicated that joint applications by AINSE and ANSTO could be a means by which additional funding for equipment might be sourced. With the advent of the Infrastructure Grants, AINSE, as an umbrella university organisation, was able to tap these funds for the development of neutron instrumentation for university use.

Sensing a potentially beneficial opportunity, the Executive Committee decided in December 1990 that AINSE and ANSTO would seek ARC funding for the Australian Small-Angle Neutron Scattering Instrument (AUSANS).[75] The application was successful and in 1991 the ARC provided $250,000. Following this success another ARC grant for $374,000 was awarded for 1992 to enhance the neutron scattering and accelerator infrastructure. These grants came through 'Mechanism C' funding for infrastructure support. The AINSE campaign for funding approval was initiated in meetings with the Chairman of the ARC and delegation visits to AINSE by the Australian Vice Chancellors' Committee (since renamed as Universities Australia).

The success of the joint submission to the ARC for the AUSANS facility referred to above was reflected in the project management arrangements where John Boldeman, ANSTO and Roger Gammon, AINSE were joint managers of the project. AINSE scientist, Dr Lindsay Davis, played a major part in its design in collaboration with ANSTO research scientists Margaret Elcombe and Robert Knott.

The first external grant from the ARC to pay for costs of AMS $^{14}C$ dating of samples on ANTARES was won in the Research Infrastructure and Equipment Fund (RIEF) scheme by AINSE in 1993. It was submitted through the University of Western Australia by Dr John Dodson, and was prompted by seeking to offset the 'clawback' of university funds by the government and reductions in real terms of the 'Research and Training Grant' from ANSTO. Subsequently grants were won in the same way in 1995, 1996 and 1997. The total funding for the four RIEF grants, being $1,331,100, was then assessed by the AMS Specialist Committee in special competitive rounds. Just over 183 separate Research Awards were made. This funding increased the use made of ANTARES by AINSE researchers.

In the instances above and others that followed, AINSE, in working through these opportunities for funding, acted as champion for both university and ANSTO-based researchers to achieve tangible benefits for all stakeholders.

Investment in this infrastructure was further underpinned by a regular series of Quaternary dating conferences and workshops. The first one was held in 1994, then 1999, 2003 and 2008.

Each of these meetings was devised by David Fink and Henk Heijnis from ANSTO and with the participation of about 100 people they made a significant contribution to the understanding of AMS $^{14}C$ dating as well as $^{210}Pb$ techniques amongst researchers.

In 1996 and 1997 AINSE raised $210,000 from two RIEF grants for the development of a Secondary Ion Mass Spectrometer (SIMS) facility. These funds paid for infrastructure and, in part, for a technician for a limited period. At the end of this period AINSE contributed to the salary for another two years. This is another tangible way in which AINSE was able to return value to ANSTO. This support was small in comparison with the funds raised to support neutron scattering.

John Dodson in his ANSTO office in 2008

### Professor John Dodson

John Dodson held a string of 15 research awards commencing in 1992, with the last one in 2005. He was initially at the University of New South Wales and then moved to the University of Western Australia in 1995. His AINSE-supported research was associated with human-megafauna and environmental change and human impact and his AINSE-supported research has ranged across North Western NSW, central Australia, south-western Australia and New Caledonia.

His research projects have been undertaken in Australia, New Zealand, New Caledonia, Micronesia, China and the United Kingdom. He served on the National Committee for Quaternary Research of the Australian Academy of Science, International Geosphere Biosphere Program (PAST Global Changes) and is currently Chair of the International Year of Planet Earth for Society (Climate Change Group) for UNESCO. He has an impressive publication record and has served on Editorial Boards of *Quaternary Research*, *The Holocene* and the *Singapore Journal of Tropical Geography*. He has held 15 AINSE research awards between 1992 and 2005 and this resulted in 27 publications.

John Dodson has been head of university departments at the University of New South Wales, University of Western Australia and Brunel University, London. In 2007 he was appointed as Head of ANSTO's Institute of Environmental Research.

75 AINSE Annual Report 1990, p11

## 6.6 Research achievements

### 6.6.1 Neutron scattering

During the decade, AINSE acted as a peak body on behalf of its member organisations in applying for and administering major infrastructure grants. Neutron scattering was a major beneficiary. In 1992 the first ARC grant of $374,000 was awarded to AINSE for the construction of the AUSANS 2-D area detector. AINSE had already contributed $300,000 over three years from 1988 for the development of AUSANS. Other ARC grants followed in subsequent years (Table 12).

**Table 12. ARC RIEF Grants for neutron-scattering instruments**

| Year | Amount ($) | Details |
|---|---|---|
| 1992 | 374,000 | AUSANS 2-D area detector |
| 1994 | 275,000 | For the Medium Resolution Powder Diffractometer (MRPD), the long length polarised neutron polarisation analysis instrument (LONGPOL), hardware and software support |
| 1995 | 181,418 | For the High Resolution Powder Diffractometer (HRPD), single-crystal furnace |
| 1996 | 225,000 | For MRPD, LONGPOL, monochromators |
| 1998 | 150,000 | For LONGPOL, monochromators |
| 1999 | 243,729 | For SANS, cryomagnet, and reflectometer |
| **Total** | **1,075,147** | |

This funding was very much a continuation of the AINSE funds which had been put into establishing and developing neutron-scattering instruments since the early 60s. Indeed, by the end of the decade, AINSE was in a position to report on significant neutron-scattering based research in diverse areas such as mechanical performance of ceramics and microstructures, structures and properties of titanium silicon carbide, pollution, teeth and apatites, and rare-earth transition metal intermetallic compounds. At the same time AINSE made a significant contribution to the upgrades of the medium resolution powder diffractometer, that allowed relatively high-speed *in-situ* neutron diffraction measurements, and to the single-crystal diffractometer.

The continuing burgeoning of neutron-scattering research can be encapsulated by the following list of the most active researchers as evidenced by the number of AINSE research awards. What should always be remembered, however, is that while these names feature prominently in the AINSE awards, there are usually 2 or 3 other named co-investigators as well as research and honours students involved in these research projects. It is clear therefore that a list such as this - as presented here and in other Sections - can only be considered as representative of the persons directly involved in the research work.

Trevor Hicks from Monash with 30 AINSE research awards continued his research from the previous decade. He was a major driver of the continuing upgrade of LONGPOL and its application to studies of the distribution of magnetic moment in superparamagnets, and in alloys with long-range magnetic order.

Other central players in the Australian neutron field were Evan Gray from Griffith University with 15 AINSE research awards which he and his team used to elucidate the structure of metal deuterides by SANS, and to explore interstitial site occupation in $LaNi_5$-$H_x$ and $LaNi_5$-$D_x$ as well as order in CuMn alloys.

Brendan Kennedy from the University of Sydney emerged as a significant and enduring researcher in neutron scattering and applied his 15 AINSE research awards to explore structural trends in metal oxides and transition metal rutiles and Pd-D electrodes.

Brian O'Connor from Curtin University continued his high level of interest and activity with his 15 AINSE research awards embracing topics such as: microstructural studies of zirconia-

toughened aluminas; March-type models for the description of texture in granular materials and high temperature studies of sintering mechanisms for alumina-matrix ceramics.

The growing group of Stewart Campbell at the Australian Defence Force Academy campus of the University of New South Wales in Canberra (ADFA@UNSW) applied their 13 AINSE research awards primarily in the field of magnetic structures of novel rare-earth intermetallic compounds while also tackling issues of the structures of deuterated $Zr_2Ni$ with ANSTO colleagues Chris Howard and Margaret Elcombe.

The two main research areas of interest to Trevor Finlayson and his colleagues at Monash – residual stresses and superconductivity - were reflected by their 11 AINSE research awards in the areas of microstructural studies in relation to creep in partially stabilized zirconia; the influence of residual and/or transformation stresses on the physical and mechanical properties of alloys, and quantitative phase analysis and phase transformations in niobium-tin-based alloys.

Colin Kennard of the University of Queensland continued to employ his 11 AINSE research awards in structure analysis of single crystals using neutron diffraction while also exploring radial distribution functions of glass-ionomer cements.

Erich Kisi was another important newcomer to the neutron-scattering scene in this decade, as evidenced by his ten AINSE research awards. He continued the traditions of the University of Newcastle group which was established by Eric Hall and David Browne in earlier decades via his investigations of ferroelasticity in zirconia ceramics using neutron scattering. In particular, he pushed the capabilities for *in-situ* powder diffraction measurements.

Other researchers who continued to play a significant role in the consolidation of neutron scattering through this decade, several of whom had featured prominently in previous decades, include: Ted Maslen (UWA); Brian Lucas (QLD); Terry Sabine (UTS); Ken Taylor (NSW); Richard Welberry (ANU); and Len Lindoy (JAM). As well, the community continued to grow with the occasional involvement of independent researchers such as David MacKenzie, University of Sydney, in his investigation of $C_{60}/C_{70}$ structures, and Leo Cussen, Victoria University of Technology, who combined his scientific interests in the magnetic properties of V-Fe and V-Mn with technical developments in high transmission neutron collimators.

In summary, it is clear that the 90s proved to be a decade of continued and steady growth in the use of neutron scattering as a critical research tool for Australian scientists in the study of materials. It was, of course, in this decade that the Government made its decision to replace the now increasingly ageing and outmoded HIFAR reactor and its somewhat dated facilities, with a state-of-the-art research reactor – OPAL. In short, while there was a great deal of scientific and developmental work to be carried out, there was a great deal for the Australian neutron community to relish in prospect for the coming decades.

## 6.6.2 Plasma/fusion

The AINSE Plasma Physics Committee, which was established in 1962, provided significant support for research in this field over succeeding decades. Researchers from several member universities regularly had AINSE research grants and postgraduate awards, and participated in the biennial Plasma Physics conferences which continue to this day.

AINSE played a central role in the establishment of the Australian Fusion Research Group in early 1995. AINSE joined representatives from the Australian National University, the University of Canberra, Central Queensland University, the University of New England, Flinders University and the University of Sydney at a meeting held at Flinders University on 12 February 1995.

At that meeting, in response to a statement from Bob Dewar, Australian National University, that

> *A national concerted effort was required to restore Australia's place in the international [Fusion] scene and rejuvenate interest amongst young scientists. The H-1 at the Australian National University was really the only viable facility for a co-operative national effort.*

Roger Gammon said that

> *AINSE supported the proposal. AINSE currently funded nuclear fusion research by the provision of small items of equipment for use within the various universities. It*

*Professor Brian James working in 1998 on his tunable pulsed dye laser at the University of Sydney, purchased with the assistance of an ARC LIEF Grant managed by AINSE.*

*would be more acceptable if those funds could be re-directed towards a national facility from which all members could benefit. Through its established administrative and Specialist Committee structure, support could be provided by helping to manage applications for grants to access the facility, travel and accommodation etc. Since most universities were members, AINSE involvement would ensure a truly national co-operative effort.*

The meeting also requested AINSE to *reconsider re-forming the AINSE Plasma Physics Specialist Committee*[76]. In response to this request, the AINSE Executive Committee in May 1995 agreed to the establishment of the Plasma Science Specialist Committee.

This committee initiated two RIEF grants, one in 1996 ($120,000) and the other in 1997 ($250,000) for infrastructure at the University of Canberra, Central Queensland University, Flinders University, the University of Sydney and the Australian National University.

A much larger grant application was submitted, with AINSE input, to the Department of Industry, Science and Resources Major National Research Facilities Program (MNRF), by the Research School of Physical Sciences and Engineering at the Australian National University. It was successful and provided a five-year (1997-2001) grant of $8.7M to establish the H-1 National Facility at the Australian National University.

In recognition of AINSE's coordinating role, principally through the Australian Fusion Research Group (AFRG), Roger Gammon joined the H1 Board. AINSE still holds a position on this Board as H1 moves beyond the MNRF program.

The establishment of the AFRG is an important example of AINSE drawing on its strength as representing all Australian universities and being able to mobilise groups which are actively engaged in research.

The AFRG embraced researchers in plasma physics and fusion research from the Australian National University, the University of Canberra, the University of Sydney, the University of Western Sydney, the University of New England, Central Queensland University, and Flinders University of South Australia, and with interaction from scientists from Japan, the United States and Europe it developed a global perspective. This story is continued in the next decade.

One of the events of the decade which attracted wide media coverage was the colloquium on 'cold fusion' which was held in the AINSE Theatre on 19 May 1989. AINSE had organised the colloquium to raise the profile of AINSE and ANSTO and to promote ANSTO facilities. Wide media coverage on radio and in the national and scientific press was obtained and 93 people from universities, government departments and industry attended. A review of the colloquium was published in the June 1989 issue of *Laboratory News*.

## 6.6.3 Environmental science

While there was always a trickle of up to six AINSE research awards with an environmental slant, the establishment of an Environmental Science Specialist Committee in 1991 provided a focus which resulted in the receipt of many more applications in this area from 1993 (Table 13).

**Table 13. Environmental Awards 1989-1997**

| Year | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|---|---|
| No. | 6 | 4 | 6 | 6 | 27 | 44 | 42 | 44 | 38 |

Early researchers who have continued with a program of research over many years include Don Bradshaw at the University of Western Australia, Andrew McMinn at the University of Tasmania, John Prescott at the University of Adelaide, Eric Colhoun at the University of Newcastle, Peter Kershaw at Monash University, and Colin Woodroffe at the University of Wollongong.

Peter Parsons from La Trobe University conducted early work on the effects of gamma radiation on *Drosophila* from 1968 through to 1992. Over this period he held 13 AINSE research awards.

During the late eighties it was suggested that increased springtime UVB radiation caused by stratospheric ozone depletion was very likely to reduce primary production and induce changes in the species composition of Antarctic marine phytoplankton. Stratospheric ozone

76 Minutes, Australian Fusion Research Group (AFRG) meeting 12 February 1995

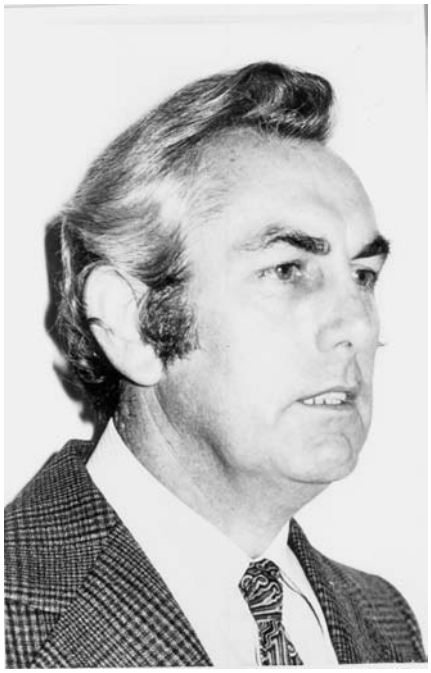


*Photo P9516 courtesy of the Heritage Centre, University of New England*

### Professor Sydney Haydon

Sydney Haydon represented the University of New England on the AINSE Council from 1965 to 1970, and from 1972 to 1992. He was Vice President from 1977 to 1980 and President in 1981 and 1982.

AINSE's first gold medal was awarded to Sydney Haydon from the University of New England in 1992 for his outstanding research in the area of Plasma Science. He was the recipient of 28 AINSE research awards from 1964 to 1992.

His long involvement with AINSE provided quiet and effective leadership over many years, including major input to the AINSE Executive Committee and the Plasma Physics Committee.

Syd passed away in October 1998.

depletion, with resultant increased springtime UVB irradiance, had been occurring with increasing severity since the late 70s. Thus the phytoplankton community had already experienced about 20 years' exposure to increasing levels of UVB radiation. Andrew McMinn and Dominique Hodgson at the University of Tasmania teamed up with ANSTO to establish chronologies for diatom assemblages preserved in high-resolution stratigraphic sequences from anoxic basins in fjords of the Vestfold Hills, Antarctica. They found that compositional changes in the diatom component of the phytoplankton community over the past 20 years could not be distinguished from long-term natural variability, although there was some indication of a decline in the production of some sea-ice diatoms. This research was published in *Nature*[77] and attracted worldwide attention from the popular press, radio and television.

Andrew McMinn has been an active AINSE researcher with 20 research awards between 1993 and 2007 and he has supervised three PGRA scholars. He is now the Director of the Institute for Antarctic and Southern Ocean Studies and he holds the UNESCO Jean Jacques Cousteau Chair for Antarctic Studies at the University of Tasmania. Dominique Hodgson is now program leader at the British Antarctic Survey.

Bob Street suggested to Don Bradshaw, when they were visiting China together, that he write to Stuart Butler, who was at the time Director of the AAEC resesarch establishment at Lucas Heights in 1981, suggesting that AINSE might fund work directed at measuring enrichment levels of oxygen-18 in small biological samples. It had been known since the 50s, that oxygen-18 can be used, in conjunction with either deuterium or tritium, to measure the metabolic rate of free-ranging animals. This is possible because the oxygen of water is in isotopic equilibrium with the oxygen of carbon dioxide, a process facilitated by the enzyme, carbonic anhydrase, which is found in high concentrations in red blood cells. This technique was being used extensively by biologists at the time to measure actual metabolic costs of wild animals, rather than estimate these from laboratory experiments where they are held captive, and probably stressed, in animal chambers. The problem was that sample analysis could only be done in the United States, at UCLA, using a cyclotron-based $^{18}O(p,n)^{18}F$ prompt nuclear reaction. Australia did not possess a cyclotron at the time and the basis of the first AINSE research award to Don Bradshaw and David Cohen in 1982 was to see whether the reaction could be duplicated on the 3 MeV Van de Graaff accelerator at Lucas Heights.

In fact, this required far higher energies than were available at the time and this prompted a search for an alternative approach. After a great deal of effort a new method was developed by David Cohen at AINSE and published in 1987[78], and it has been used since for the routine measurement of oxygen-18 enrichment levels from a wide range of Australian native animals. The majority of samples analysed have been made from lizards, both in Australia and in France, followed closely by the tiny 10g marsupial Honey possum and then snakes, both venomous Tiger snakes from WA and Aspic vipers from France.

Of the species studied, six are officially listed as endangered and the information that has been derived from this AINSE-funded research has been vital in developing management plans for their protection and eventual conservation. This long-term research program has highlighted the importance of nuclear technology in resolving difficult problems in the biological sphere that are intractable by conventional approaches and attests to the value of the AINSE collaboration with Australian universities.

AINSE-funded research has been important in forging links with overseas researchers. In France these have included the Centre d'Etudes Biologiques des Animaux Sauvages at Chizé, in south-western France; L'Ecole Normale Supérieure, l'Université Pierre et Marie Curie; and the Muséum d'Histoire Naturelle, all in Paris. Work just completed this year on the reproductive energetics of Tiger snakes has been done in collaboration with Dr Xavier Bonnet from Chizé and collaborative funding is now being sought for a major program involving both Australian and French researchers.

AINSE funded a novel approach to the measurement of protein turnover in the marsupial Honey possum, a species which is unique in Australia in having a diet composed entirely of nectar and pollen which it collects from *Banksia* blossoms. The Tandem accelerator (ANTARES) at ANSTO is being used to measure $^{15}N/^{14}N$ ratios in microsamples from this tiny possum to quantify nitrogen intake from pollen in its native habitat in the extreme

77 1994 McMinn A, Heijnis H, Hodgson D. Minimal effects of UV-B on Antarctic diatoms over the past 20 yr. *Nature* **370** 547-549

78 Bradshaw S D, Cohen D, Katsaros A, Tom J, Owen F J. Determination of $^{18}O$ by prompt nuclear reaction analysis: application for measurement of microsamples. *J Appl Physiol* **63** 1296-1302 1987

southwest of Western Australia. This study, when completed, will enable environmental managers to predict the extent and density of *Banksia* woodlands that are needed to sustain a viable population of this species.

The Honey possum is not yet listed as endangered in Australia, but it may be listed and, without AINSE support which combines the talents of zoologists Don and Felicity Bradshaw with those of ANSTO physicist Nick Dytlewski, this research would not have been done.

While Don Bradshaw retired at the end of 2004 he continues his research at the University of Western Australia. Since 1982 he has held 38 AINSE research awards.

### 6.6.4 Radiation chemistry

Jim O'Donnell died in 1996 after a lifetime of research in polymer science, including significant contributions to his profession through the RACI, IUPAC, the Pacific Polymer Federation and, of course, AINSE. In 1996, Jim O'Donnell, David Hill and Peter Pomery were awarded the AINSE Gold Medal for their studies of the effects of high energy radiations on polymers and radiation-induced polymerization reactions. Both Jim and David received strong support from AINSE for their research over several decades, Jim held 31 AINSE research awards in the period 1967 to 1995, and David held 22 between 1979 and 2002.

More recently, other polymer scientists with an interest in radiation chemistry have been appointed at universities and other institutions in Queensland – for example, Andrew Whittaker, Firas Rasoul, Idriss Blakey and Heping Liu (the University of Queensland); Clive Baldock (who later moved to a Chair at the University of Sydney) and Tim Dargaville (Queensland University of Technology) and Zainuddin (Queensland Eye Institute). In recent times the major areas of research have been in radiation grafting of polymers for biomedical applications and in the development of new low-energy electron beam resists for computer-chip manufacture. Thus Queensland is still the major centre for polymer radiation chemistry in Australia.

While the major focus of radiation chemistry in Queensland has been on polymers, other chemists have also utilised the facilities available through AINSE in their research. For example, Martin Lavin and co-workers at the Queensland Institute of Medical Research (QIMR) have studied the applications of radiation chemistry in biomedicine and Drs Paul Bernhardt (the University of Queensland) and Richard Keene (James Cook University) have carried out pulse radiolysis studies of various oxidation-reduction reactions in inorganic chemistry. Martin Lavin held 15 AINSE research awards between 1978 and 1992.

In the 90s one of the major research interests of the Polymer Group focused on the radiation chemistry of fluorinated polymers, including perfluorinated polyolefins. In 2001 this work attracted the attention of Sematech, USA, which is a research organisation for the microlithography industry. At the time, irradiation tools were being developed for use in 157nm microlithography in which fluorinated polymers were being considered for use in protection of the machine optics. The initial collaboration on fluoropolymers has resulted in further research projects with both Sematech and Intel, involving the design of materials for future technologies based on immersion and 13eV microlithography. These research collaborations have resulted in the Polymer Group receiving many millions of dollars in grants from the USA and Australia in support of both personnel and equipment.

Thus, the radiation chemistry of polymers has been a major research focus at the University of Queensland for almost 45 years, and today the Polymer Group is recognised internationally as a major centre of excellence in this area. Over this time the Group has graduated well over fifty students who have worked on radiation-based projects. AINSE has been intimately involved in their research and has contributed significantly to the training and development of all those students who have graduated from the Polymer Group.

The gas phase radiolysis studies at the University of Melbourne developed a strong overlap with the Physics Division at ANL in the area of the time-dependence for electron energy degradation in gases. From the chemistry side this was the time taken for primary chemical species to be generated. The fast response of the Febetron electron beam generator at the nanosecond time level coupled with the fast response LINAC at ANL, about 10 picoseconds, enabled the slowing down of electrons to be observed via the concomitant production of electronic excited states. The ANL theoretical physics group led by Mitio Inokuti proposed a time-dependent Spencer Fano theory to model the results. An AINSE

student, Manuela Burgers, travelled to Chicago to use the Cray system to calculate the timescales for electron energy loss as well as performing experiments to generate new data to test the model. This was done with remarkable success.

Simultaneously, a new technique, microwave conductivity, was added to the radiolysis facility at ANSTO. This technique can sense free electrons and can analyse the energy distribution function. It was initially used to observe the last stages of electron energy degradation - so called thermalisation. It was also used to measure electron loss by ion electron recombination. Rate coefficients for this process at high pressure were determined for the first time for the noble gases. This new technique was enthusiastically welcomed by plasma physicists.

Eventually usage of the Febetron dwindled and the instrument was relocated to Ron Cooper's group in Melbourne where an identical instrument was in operation. Very soon after, ANSTO's solid state division scientists realised that work published by the Melbourne group on alumina and other ceramics was of great use to the ANSTO program studying new materials to immobilise fission product waste. A collaboration produced results on the stability of perovskite and similar mixed oxide systems.

Following Ron's retirement in 1996 the pulse radiolysis systems were decommissioned.

## 6.6.5 Heavy ion physics

The acquisition of the ANTARES Tandem accelerator by ANSTO in September 1989 and attaining more than 7MV on the terminal by mid 1992 opened the possibility for Australian universities through AINSE to expand the ion and energy range of IBA techniques available for research. One of the major long-term international materials research collaborations on ANTARES involved researchers at the Royal Melbourne Institute of Technology (in 1992 the institution's name was changed to RMIT University), the University of New South Wales, ANSTO and the University of Lund in Sweden. The group involved more than 15 researchers from the two countries. It commenced in mid 1992 when the Swedes lent ANSTO a timing mirror system to perform heavy ion recoil time-of-flight (RToF) experiments using 77MeV iodine beams. These beams were used to study a variety of thin metallised films on GaAs and reactions in metal-III-V semiconductor systems in order to develop more stable electrical contacts to these materials. The first RToF spectrum was obtained at ANSTO in September 1992 using the Swedish mirrors. By June 1993 ANSTO had constructed its own timing mirrors based on the Swedish design.

Between 1992 and 1998 the collaboration produced more than 65 journal and conference publications and six PhDs directly related to experiments performed on the ANTARES RToF facility. These collaborations continue today with Australian universities through AINSE, looking at ferroelectric materials, studying heavy-ion straggling and multiple scattering in thin films and characterising interfaces and multi-layered structures.

In the late 90s the RToF collaborations were expanded to include the University of Auckland and GNS Science in New Zealand with research on solar cell surfaces and in March 1997 the first joint IBA experiments with the University of Auckland as an AINSE member were successfully completed. These collaborations continue today.

## 6.6.6 Materials science

Using the AINSE-supported Vacuum Arc Project, a MEVVA II ion source constructed by ANSTO in 1987, the first routine MEVVA ion implantations were performed in 1990. In 1992 the first AINSE research award for access to the MEVVA facility was made. Since then more than 60 AINSE projects have been carried out on the MEVVA implanter and numerous PhD and MSc students trained. RMIT University has been a major user of this facility through research driven by Dinesh Sood and his students who received eight ion implantation research awards between 1992 and 2000. There was a modest program involving Professor Dou from the University of Wollongong and John Boldeman on high-temperature super conductors. This involved an attempt to improve the performance of high-temperature superconductors based on bismuth compounds by incorporating uranium into the complex and aiming to use the fission products from thermal radiation as pinning centers.

## 6.6.7 Archaeology and anthropology

The work commenced by Wal Ambrose in the mid 70s, see Section 4.4.2, was continued by Professor Glenn Summerhayes from the Australian National University 1996 - 2005 and then the University of Otago from 2006, and Dr Robin Torrence from the Australian Museum. During the late 80s the 'Lapita Project' was assisted by a large number of PIXE analyses undertaken for various archaeologists who channelled their submissions through Wal Ambrose's AINSE research awards. Most of this work was done in collaboration with Roger Bird at ANSTO.

Professor Ian McDougall is one of Australia's most internationally distinguished earth scientists. His pioneering work in the fields of potassium-argon and $^{40}Ar/^{39}Ar$ dating have made fundamental contributions spanning a broad spectrum of applications over four decades.

It would be difficult to over-estimate the importance of these methods to modern earth sciences as they provide much of the foundation upon which the numerical geological time scale is based. The work of Ian McDougall's team on $^{40}Ar/^{39}Ar$ dating, in particular, represents an important application of nuclear science in Australia and has been supported by AINSE over many years. The $^{40}Ar/^{39}Ar$ dating technique requires that geological samples be irradiated in a fast neutron flux to produce $^{39}Ar$ from $^{39}K$, which acts as an excellent proxy for $^{40}K$, and enables high-precision age measurements to be made on appropriate samples, commonly to better than 1%. The neutron fluence received by a sample of unknown age is determined by separate experiment on a sample of accurately known K/Ar age co-irradiated with the unknown. The technique is based upon the quantitative accumulation of daughter product, radiogenic $^{40}Ar$, from the decay of naturally-occurring radioactive $^{40}K$, which has a half-life of 1250 million years. The $^{40}Ar/^{39}Ar$ technique is a variant of the conventional K/Ar dating method, in which separate aliquots of the sample must be measured to obtain the potassium content and the radiogenic argon. In the $^{40}Ar/^{39}Ar$ variant, only a single isotopic ratio measurement in a mass spectrometer of the argon extracted from the sample needs to be made to derive an age; this also effectively overcomes problems of heterogeneity in the sample. In fact with improved sensitivity of mass spectrometers and the advent of laser fusion techniques, precise ages commonly can be measured on single crystals.

The fast neutrons are most conveniently available in nuclear reactors, usually in-core, because of the need for a high flux of fast neutrons, and with as low a thermal neutron flux as possible, because thermal neutrons cause undesirable and unnecessary reactions. In fact, an irradiation facility just outside the core of HIFAR was able to be used, despite the much lower fast neutron flux than desirable, and they were able to show that it was possible to overcome problems associated with the relatively low flux of fast neutrons, the large flux gradients across the irradiation facility, and the neutron interferences as a consequence of the high thermal neutron fluxes in the facility, such that fluence monitoring to better than 0.5% was routinely achieved.

In addition to his role in developing these dating techniques, Ian McDougall's contribution has been particularly significant in: establishing the geomagnetic polarity time scale as one of the foundations of the theory of plate tectonics; characterising the evolution of oceanic volcanic island chains and demonstrating their relationship to underlying plate motions; development of a highly-precise time framework for hominin evolution in East Africa; helping to develop $^{40}Ar/^{39}Ar$ step heating methods as a powerful tool for understanding time-temperature relationships in the evolution of geological terrains; and application of noble-gas geochemistry to study mantle-derived materials, including the identification of a primordial solar noble gas component within the Earth. With a coauthor, two editions of a monograph on the $^{40}Ar/^{39}Ar$ dating of geological samples have been published.

Ian McDougall's first AINSE research award was in 1971 and he was able to gain support every year until his retirement in 2000; he continues to be associated with proposals to AINSE. These AINSE research awards, which enabled irradiations to be done in HIFAR on geological samples, crucial for the $^{40}Ar/^{39}Ar$ dating technique, were utilised by all members of his research team at the Research School of Earth Sciences at the Australian National University. His many publications of this research include five papers in *Nature*. In one of these, the research describes how sediments exposed at Kanapoi in the Turkana Basin, northern Kenya, have yielded a suite of hominin fossils that has led to the definition of the new species, *Australopithecus anamensis*. The nature of one of the fossils, a leg bone (tibia), indicates that this species walked upright. Three beds within the sequence

at Kanapoi have been isotopically dated at the Australian National University using the $^{40}Ar/^{39}Ar$ method on single crystals of feldspar from contemporaneous volcanic pumice clasts. These results are consistent with the stratigraphic order and demonstrate that the hominin fossils are between 4.17 and 4.07 million years old, these are amongst the oldest known examples of well-authenticated hominin fossils exhibiting bipedality. Subsequent studies at Kibish, about 100km north of the present northern margin of Lake Turkana in southern Ethiopia, have shown that our own species, *Homo sapiens*, was extant at least 195,000 years ago, providing the oldest record presently known for *H. sapiens*. In addition, this work has demonstrated that links can be established between sediment deposition at Kibish and deposition in the Mediterranean Sea, some 3500km to the northwest, through enhanced monsoonal activity in the highlands of Ethiopia at particular times in the past. These studies are part of a much larger project dating volcanic beds within the sedimentary sequence over 500m thick that comprises the infill in the Turkana Basin of northern Kenya and southern Ethiopia. The sediments are justly famous as the source of a large number of hominin fossils and many other vertebrates, such that the time scale of hominin evolution has been a major driving force in these investigations. We now have precise $^{40}Ar/^{39}Ar$ ages, mainly measured on single crystals of alkali feldspar, from more than 30 volcanic levels (tuffs and pumices) within the sedimentary sequence. These results show that sedimentation began in the basin about 4.2 million years (Ma) ago, and has continued intermittently until almost the present time. The age for each volcanic bed is known to better than 1% in most cases. There is enormous confidence in the ages as all are concordant with the independently determined stratigraphic order. From this work, any new fossil found can usually be assigned an age to better than 100,000 years, and commonly to better than 50,000 years, provided that the stratigraphic position of the fossil can be determined relative to one or more of the tuffaceous (volcanic) beds in the sequence, and this is usually the case.

Ian McDougall's AINSE-supported work has contributed to 19 doctoral theses.

By 1990 the AINSE archaeological research community had grown to include researchers from many universities.

PIXE analysis of obsidian by researchers from the Australian National University in their study of the chronology of early settlement in the Island Pacific continued from the previous decade, and they started using the new AMS $^{14}C$ dating technique. This technique caused an explosion of archaeological activity at AINSE and was commonly used with PIXE or NAA.

The most prominent users of AINSE resources during this decade include researchers at the University of Sydney: Michael Barbetti who dated tree rings, pollen and log coffins from Southeast Asia; and Dan Potts whose research awards related to samples from cultures in the Middle East also used PIXE; Peter White who sourced prehistoric artefacts in West New Britain PNG; and E G D Robinson who characterised South Italian ceramics by PIXE/PIGE analysis.

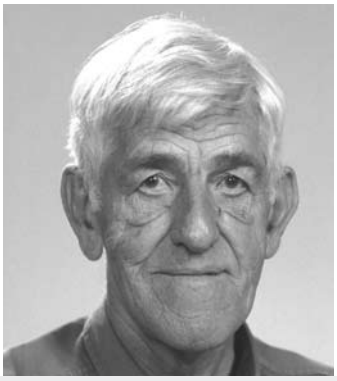
At the University of Queensland, research student Bruno David worked on a grant in the name of David Hyndman, in collaboration with Claudo Tuniz from ANSTO, to understand the origins of and cultural changes in Aboriginal society in the Ngarrabullgan area. Between them they have had 14 other AINSE research awards for various projects.

AMS dating of rock art and excavations at Aboriginal sites across the country was undertaken by many groups including John Campbell at James Cook University, Ian Davidson, Michael Morwood and Peter Grave at the University of New England, D Moyle at Flinders University, Matthew Spriggs at the Australian National University; and research student Bruno David, from the University of Queensland, who dated charcoal paintings from Chillagoe and the Mitchell-Palmer limestone zone in North Queensland.

Donald Pate at Flinders University commenced research into dating bone collagen by AMS in 1994.

John Prescott at the University of Adelaide continued with his use of NAA throughout the decade.

Other archaeological researchers at La Trobe University, Macquarie University, Monash University, the University of NSW, Northern Territory University, Queensland University of Technology, University of South Australia, the University of Tasmania, University of Southern Queensland, and the University of Western Sydney also availed themselves of these three techniques.



## Professor Trevor Ophel

Trevor Ophel's connection with AINSE began in 1961 when he received a travel grant to attend the Gordon Conference on photonuclear reactions, a research area in which Australia was very active. He contributed to AINSE through service on the Executive Committee from 1987 to 1999, as Vice President in 1995 and 1996 and President in 1997 and 1998.

At the Australian National University (ANU) he fostered the role of AINSE as an avenue for supporting a broad range of research at ANSTO and argued successfully (often unofficially) the merit of supporting AINSE through the ANU institutional subscription.

He was a stalwart supporter of the biennial AINSE Conferences on Nuclear and Particle Physics, as a regular contributor, as a member of the organising and program committees on various occasions and as chairman of the 1986 Conference. Later he took an increasing role in the nuclear techniques of analysis conferences.

He was recognised worldwide as an expert in hybrid detector systems developed as part of leading research work on the study of the measurement of masses of exotic nuclei. Such detectors, and his understanding of the physical processes in the transport and measurement of heavy ions, were an important part of the knowledge brought to the collaborations between the ANU and ANSTO /AAEC which led to the first Australian forays into accelerator mass spectrometry. While initially developed on the ANU facility, which maintains an independent program, it is now a fully-fledged operation at ANSTO in the guise of ANTARES, an integral part of the research and facilities supported by AINSE.

By virtue of his experience and expertise in accelerators and in a broad range of detection techniques, he was Convenor of the specialist Group on Accelerator Applications since 1988.

Trevor Ophel retired from the ANU at the end of 1999 and passed away in June 2000.

## 6.6.8 Biomedical science

While the primary focus of biological research is oncology, Professor Jim Camakaris worked through the 90s and 00s using $^{64}Cu$ to understand several acquired and inherited diseases that are due to either copper deficiency or copper toxicity. His first AINSE research award was in 1992 and he has had continuous AINSE support for his research since then.

The inherited diseases provide 'experiments of nature' which allow the normal genes and proteins involved in copper transport to be identified and characterised. Jim Camakaris and his research group, in collaboration with Professor Julian Mercer from Deakin University, have focused on the function of the Menkes (MNK) protein. Mutations in the gene coding for this protein cause the usually fatal inherited copper deficiency disorder in humans, Menkes disease. Using $^{64}Cu$, Jim Camakaris and research colleagues have discovered that the Menkes protein functions as a molecular pump that drives copper across biological membranes. This has laid the framework for current studies where mutant forms of the MNK gene have been introduced into cells and the activity of the various mutant proteins is being assessed. This allows detailed structure-function analysis and will also be important in determining which Menkes patients may benefit from copper therapy. Using radiocopper kinetic studies, the researchers found that a normal copy of the MNK gene introduced into Menkes mutant cells can correct the fault in copper metabolism. This is an important and exciting finding in terms of possible future gene therapy. *Drosophila* has also been developed as a model system to identify new genes and proteins in copper homeostasis.

The Camakaris group is currently using $^{64}Cu$ to investigate the role of copper in Alzheimer's disease. These studies utilise cultured cells and transgenic Alzheimer's mouse models and are collaborative with researchers at Bio21, the Mental Health Research Institute and the Austin Hospital. These studies suggest there is a functional copper deficiency in the Alzheimer's brain and should lead to better diagnostic and treatment modalities.

Jim Camakaris was presented with the 1999 AINSE Gold Medal for excellence in research at a plenary meeting of AINSE Council and Specialist Committees on Thursday 25 May 1999 held at Lucas Heights. He has published his work on copper homeostasis in 95 papers in refereed journals, and presented it at innumerable national and international conferences. In July 2008 he was honoured at the Biometals 08 meeting in Spain with the presentation of the Igor Stojiljkovic Memorial Lecturer Award, which rewards his outstanding contributions to the biometals field.

Other prominent researchers supported by AINSE in biomedical science include

- Professor Brian Yates, from the University of Tasmania, who used the computing facilities at ANSTO in his modelling of ligands designed for dopamine transporters, benzodiazepine receptor subtype selectivity, and for tumour diagnosis and therapy. He held 12 AINSE research awards between 1992 and 2002, and a PGRA
- Professor Alan Sargeson, from the Australian National University, who has synthesised through-designed metal ion cage complexes for use as radioisotope transporters. This work with Dr Suzanne Smith (ANSTO) resulted in one patent on a potentially useful complex for use in oncology. Alan held 26 AINSE research awards between 1976 and 2002
- Associate Professor Chris Rowe, from the Austin and Repatriation Medical Centre, who conducted research on SPECT imaging with a number of chemicals including $^{123}I$ iododexetimide (IDEX) and $^{123}I$ Bretazenil for epilepsy. He held 17 AINSE research awards between 1994 and 2003
- Professor Trevor Hambley, from the University of Sydney, who worked on rhenium-based pharmaceuticals as anti-cancer drugs. He held three AINSE research awards between 1994 and 1996
- Professor Leon Kane-Maguire, from the University of Wollongong, who experimented with asymmetric synthesis of chiral drugs and radiolabelled pharmaceuticals and novel routes to fluorinated radiopharmaceuticals. He held four AINSE research awards between 1993 and 1997.
- Professor Barry Allen and Peter Martin from the University of New South Wales, who studied boron neutron capture therapy on the Moata reactor using nude mice.

*AINSE President Professor Ron MacDonald (left) presenting Professor Jim Camakaris with the 1999 AINSE Gold Medal*

## 6.7 AINSE support for a new reactor for ANSTO

At the November 1997 Executive Committee, Professor Helen Garnett, who had been appointed ANSTO's Executive Director in April 1994, reported on the Commonwealth Government's decision to replace HIFAR with a new research reactor, to be named OPAL. At this meeting it was agreed that it would be helpful for AINSE to provide a separate submission to the Environmental Impact assessment process.

In January 1998 AINSE, with the endorsement of the Council, provided input to a Senate Economics Reference Committee inquiry into the need for a replacement reactor. AINSE continued its support for the reactor during the approval process and provided representations to the environmental impact assessment hearings in Sydney and Perth.

Meanwhile, ANSTO established a Beam Facilities Consultative Group and AINSE was invited to nominate two members. The AINSE representatives, nominated by the Neutron Scattering Specialist Committee, were Brian O'Connor from Curtin University of Technology, and Evan Gray from Griffith University. John White from the Australian National University, and Trevor Hicks from Monash University, two other strong AINSE supporters, had been appointed to the group in other capacities. The first meeting of the group was held on 7 November 1997.

## 6.8 Specialist Committees

Progressive restructuring of the specialist committees continued through the fourth decade.

In 1990, the five Specialist Committees at AINSE were: Radiation; Neutron Diffraction; Engineering and Advanced Materials; Nuclear Physics; and Plasma Physics. In addition, other committees were established to align structures more closely with ANSTO's research interests. These were: the AINSE/SANS Committee and the AINSE/IARR (International Association for Radiation Research) Sub Committee.

By 1991 the Specialist Committees had been restructured and comprised: Nuclear Physics – Neutron Scattering; Radiation (Biology, Chemistry and Physics); Engineering, Materials and Plasma Science; Nuclear Physics – Accelerator and Environmental Science; Biomedicine and Health as well as the AINSE/SANS Committee.

As a result of the crisis in the relationship between AINSE and ANSTO previously discussed, further changes were made to the Specialist Committees. By October 1992 the committees were: Neutron Scattering; Radiation; Accelerator Science; Engineering, Materials and Plasma Science; Biomedicine and Health; Environmental Science as well as the AINSE/SANS Committee.

In 1993 an AMS committee was established for the first time and the immediate task for the committee was to assess applications for dating using AMS $^{14}C$ analyses. Many of these were funded by the sequence of ARC RIEF grants from 1993 to 1997. In addition other research awards for AMS $^{14}C$ analyses were funded by AINSE directly. There was so much activity in this area that the committee considered applications in two rounds each year until the last of the ARC grants for AMS dating were allocated in 1997. The initial applications to the ARC were submitted on AINSE's behalf by Professor John Dodson at the University of Western Australia and are summarised in Table 14.

**Table 14. RIEF funding for AMS $^{14}C$ dating**

| Year | RIEF Grant ($) |
|---|---|
| 1997 | 300,000 |
| 1996 | 300,000 |
| 1995 | 265,000 |
| 1994 | 265,000 |
| 1993 | 201,100 |
| **Total** | **1,331,100** |

**Professor Helen Garnett**

Helen Garnett grew up in the Sutherland Shire, going to school at St George Girl's High School and then studying at the University of Sydney. While at Sydney she spent the summer of 1965/66 as a vacation student at the AAEC undertaking environmental sampling and analyses and working on Fortran code. Helen undertook her PhD studies in the UK, with the Universities of London and Wales. She was an early user of radioisotopes to study enzyme kinetics and the impact of viruses on membrane enzyme kinetics. She then spent key portions of her career at Brookhaven National Laboratory, the University of the Witwatersrand and the University of Wollongong. In 1992, she moved to ANSTO, first as Deputy Executive Director and then from 1994 to 2003 as Executive Director. This was a crucial time in ANSTO's and AINSE's history as the decision was made to build the Replacement Research Reactor, or OPAL, as it was later known. While many others contributed to the train of events leading up to the first operation of OPAL in 2006 and its opening by Prime Minister John Howard in 2007, there is broad consensus that none of this would have occurred without Helen's drive, energy and leadership. A particular facet of this was her vision for a leading-edge scientific program at OPAL, along with the best possible suite of neutron beam instruments.

Helen was strongly engaged with AINSE throughout this period, and she was an important partner in managing changes that had to happen. She left ANSTO and AINSE in 2003 to become Vice-Chancellor of Charles Darwin University, where she remained a strong supporter. Indeed the AINSE Council met in Darwin for the first time in 2006, partly in honour of Helen's key role with AINSE in the preceding years.

All the funds were allocated to facility costs in 201 AINSE research awards for $^{14}C$ analyses, that is an average of $6622 per research award. The funds were distributed amongst 109 researchers from 27 universities. The work produced 88 refereed publications.
The demand from the AMS community was so great that the ANSTO facilities were unable to cope with the flood of samples for analysis and a considerable backlog developed. The last RIEF-funded project for AMS analyses was completed in 2000.

In 1996 there were eight Specialist Committees: Accelerator Mass Spectrometry; Environmental Science; Biomedicine and Health; Radiation (Biology, Chemistry and Physics); Accelerator Science; Neutron Scattering; Engineering, Materials and Plasma Science; and Plasma Fusion.

In 1998 the ANSTO Executive Director, Helen Garnett, suggested at an Executive Committee meeting that there may be a possible conflict between ANSTO and AINSE concerning the funding of projects. She suggested that the Specialist Committees should be set up in a way that allowed each one to focus on a group of ANSTO facilities. Consequently, while the Specialist Committees considered applications on specific facilities, the applications would be submitted by people from a variety of disciplines. For instance the SIMS facility, which is widely used by both materials scientists and biological scientists, became even more multidisciplinary than previously. The Specialist Committee structure was again modified so that in 1998 they comprised: Accelerator Science; Accelerator Mass Spectrometry; Radiopharmaceutical and Neutron Irradiation; Engineering Materials and Nuclear Technology; Environmental Science; Neutron Scattering; Plasma Fusion; and Radiation Science.

## 6.9 AINSE research awards

Over the decade, the number of AINSE research awards grew from about 100 in 1990 to 159 in 1999. Many of Australia's most eminent and respected researchers have been recipients of AINSE research awards. Researchers were not limited in the number of applications they could submit in any one year. Commonly senior researchers with several teams working with them would appear on several grant proposals and might even be successful with all of them. Further, the rejection rate was, and is, lower in comparison with the other major grant schemes.

A problem arose in 1990 when several universities adopted the user pays principle regarding the annual membership subscription. For example, at the April 1990 meeting, the Executive Committee considered advice from Professor Ken Taylor from the University of New South Wales who had declined a small AINSE research award ($200 for computing costs) since it was determined by the University that the real or commercial value of the neutron diffraction facilities that he required would be approximately $44,300 and hence he was expected to pay a pro rata contribution of $7,000 towards the University of New South Wales subscription to AINSE of $28,100. At the time there was no charge for the facilities at Lucas Heights. This precedent caused some alarm within AINSE, however, this was not long lasting. By the 15 February 1991 meeting of Council both the Scientific Secretary and the Councillor, Professor Hans Coster had lobbied the University with the successful outcome that the university had stopped its user pays approach for AINSE membership.

AINSE Councillor, Ronald MacDonald in his article in The *Australian Physicist* referred to in Section 6.1, stated that he believed that AINSE was under threat from the government sector, due to a reduction of government funding of universities, specifically mentioning that universities could be tempted to charge their subscriptions back to successful AINSE grant holders[79].

The University of Melbourne sought to distribute the AINSE subscription down to grant holders via individual departments. The issue was fought out by the science faculty which was traditionally the sole provider of the AINSE subscription. The solution was that all faculties having AINSE research awards shared the subscription based on an uptake model similar to that used by AINSE to determine subscriptions. The Deputy Vice-Chancellor provided some of his funding towards the final mix.

79 *The Australian Physicist* **27**(8) p159 1990

## 6.10 Cessation of postdoctoral fellowships

Applications for Postdoctoral Fellowships were assessed from 1960 by the Executive Committee for 30 years on both the academic merit of the applicant and on the novelty and relevance of their project. The applicants determined their own project and when chosen were given the freedom and the academic and research support to pursue it. Further, even when AINSE was in financial crisis, Postdoctoral Fellowships were maintained and suffered no reduction in stipend or number.

At the November Council meeting in 1992 it was decided to suspend the AINSE Postdoctoral Fellowship Scheme. The Council made this decision with due cognisance of the need to reduce the pressures on the AINSE budget. Existing Fellows would remain attached to AINSE under the terms of their appointments but extension to a third year was not allowed. AINSE Postdoctoral Fellowships were thus phased out by the end of 1994. These Fellowships, which had allowed some of Australia's most gifted early career academics to pursue research of their own at Lucas Heights, were now no longer available.

In taking the decision to discontinue the Fellowships, the Council acknowledged that the scientific output of the Fellows had been impaired by their increasing reluctance to spend sufficient time at Lucas Heights. Since the commencement of the program, Fellows had been expected to spend 25% of their working year at Lucas Heights. There had also been comment that the cost of Fellowships distorted membership fees at participating universities.

The scheme was to return in a slightly different form in 2006, in conjunction with the commissioning of the OPAL reactor and its neutron beam instruments.

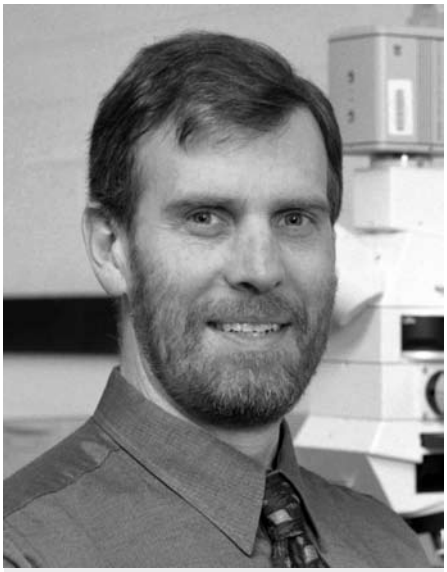
## 6.11 Studentships

During the 90s the number of studentships gradually increased from an average of ten at the beginning of the decade to 22 in 1998. This trend is a clear indicator that AINSE Council believed it was getting good value from these Awards, and it is a trend that continued into the next decade.

This increase was partly facilitated by the gradual phasing out of the fully supported scholarships and concurrently phasing in supplementary 'top-up' scholarships, the AINSE Postgraduate Research Awards (PGRAs) from 1991. By the end of 1993, all AINSE Studentship Award holders had completed their PhDs. The unit cost of PGRAs to AINSE was much less than that of the studentships as the supplementary stipend for the PGRAs was $7,500 pa instead of a full stipend of $13,019 in 1989. The PGRAs also included a payment to ANSTO of $5,500 pa as a nominal payment in recognition of the involvement of ANSTO staff and facilities, as well as a travel allowance intended to cover two return trips to Lucas Heights and one month's accommodation pa. Selection of the students remained with the Executive Committee.

The career paths of PGRA scholars from the 90s have been varied, for instance:

- Andrew Wildes, who commenced his PGRA in 1991, is a research scientist at the Institut Laue Langevin (ILL) in Grenoble, France;
- Manuela Burgers, who commenced her PGRA in 1991, undertook a postdoctoral fellowship at Max Planck Institute Leipzig then joined the Environment Protection Authority Victoria (EPA);
- Antony Whittaker, who commenced his PGRA in 1991, undertook a postdoctoral fellowship at Austin Hospital Melbourne; and then took up a post in private industry and then the Australian Therapeutic Goods Administration Canberra;
- Richard Tinker, who commenced his PGRA in 1994, joined the National Radiation Laboratories New Zealand and then Australian Radiation Protection and Nuclear Safety Agency Melbourne (ARPANSA);
- David Belton, who commenced his PGRA in 1996, joined CSIRO;
- Mark Pitt, who commenced his PGRA in 1996, received a Gas Research Institute postdoctoral fellowship at the Institute for Energy Technology, Norway;
- Alison Funston, who commenced her PGRA in 1998, completed a postdoctoral fellowship at Brookhaven National Laboratory, USA, prior to joining the University of Melbourne as a Chemistry Research Fellow;



**Professor Andrew Gleadow FAA**

Andrew Gleadow completed both undergraduate and postgraduate studies at the University of Melbourne, graduating with a PhD in Geology in 1974. He subsequently held a variety of research positions at the University of London and the University of Melbourne. From 1988 to 1998 he was Professor of Geology and Head of the Department of Earth Sciences at La Trobe University and also served as Dean of Physical Sciences in 1993 and 1994. Since 1999, Andrew Gleadow has been Professor and Head of the School of Earth Sciences at the University of Melbourne. He was also a Research Coordinator and Deputy Director of the Australian Geodynamics Cooperative Research Centre from 1993 – 2000, and is currently a Research Coordinator in the Predictive Mineral Discovery CRC. He has researched and published extensively on all aspects of the development and application of fission track dating in geology, especially in thermochronology, tectonics, sedimentary basin analysis and hydrocarbon exploration, and landscape evolution. More recently he has also overseen the establishment of laboratories for Ar/Ar and (U-Th)/He thermochronology and Optically Stimulated Luminescence (OSL) dating.

He has worked extensively on the geology, thermochronology and extensional tectonics of Australia, Antarctica, Africa, and North America.

- Darren Goossens, who commenced his PGRA in 1996, is currently an AINSE Research Fellow at the Australian National University. He was awarded an AINSE Gold Medal (Student) in 2000 for his work on magnetic ordering;
- Rose Amal and Robert Haworth 1991, Joachim Ribbe, 1995, Peter Southon, 1996 all have posts in Australian universities; Two of them (Amal and Haworth) have supervised their own AINSE PGRA scholars (Tim Tan and Ros James, respectively);
- Tracey Hanley, who commenced her PGRA in 1993, joined ANSTO's Bragg Institute as a research scientist;
- Brendan Brooke, 1995, is now at Geoscience Australia; and
- Michael Law, who commenced his PGRA in 1995, joined the University of Technology, Sydney and subsequently joined ANSTO Materials Engineering Division.

## 6.12 AINSE Winter School at ANSTO

In the early 90s, the Executive Committee discussed the possibility of allowing undergraduate students to participate in experiments at Lucas Heights utilising some of the ANSTO facilities. It was thought that this approach may encourage undergraduates to take an interest in nuclear science and technology and it was thought that these opportunities could be made available to all universities that were members of AINSE.

On 9 May 1996 the Executive Committee decided to call this activity the 'AINSE Winter School at ANSTO' thus giving both AINSE and ANSTO recognition for supporting the activity. When Council met on the 31 May 1996, the Winter School was endorsed and travel, food and accommodation expenses of participating students would also be covered.

Dr Ken Doolan, from the University of Western Sydney was asked to convene a small subcommittee to develop a program of experiments. AINSE Councillor Associate Professor Ron Cooper, from the University of Melbourne, agreed to provide guidance for the Winter School. Ron played a pivotal role in developing the concept of the Winter School and in developing a workable program.

The first Winter School was held from Saturday 5 July to Tuesday 8 July 1997 with Ken Doolan as Convenor. It consisted of a series of lectures and hands-on experiments. These were devised and delivered by ANSTO staff, Ken Doolan and Ron Cooper.

A student from each member university was selected by the Councillor for that university. Thirty eight students participated in the first Winter School with 19 being physics majors, eleven chemistry majors and the remaining eight scattered across engineering, palaeontology and environmental science. The school was voted a success by students as well as the participating staff. The students made it clear that the ability to use equipment was integral to their satisfaction with the Winter School.

The following two Winter Schools were convened by Ken Doolan, then in 2000, Gerald Laurence, Councillor for the University of Adelaide, was appointed Convenor, a post he held until his retirement from Council in December 2007.

Each year a student survey is conducted. The three examples below, from students attending the 2000 Winter School, exemplify the qualitative responses.

*... the gathering of young scientists from universities all around the country, encouraging them to interact, was one of the most enjoyable aspects.*

*Many experiments in disciplines other than my own was one of the highlights and this accentuated the point that science today is very cross disciplinary.*

*I loved it! Still extremely excited.*

*Ken Doolan, from the University of Western Sydney, whose action of bringing his senior physics class to Lucas Heights to conduct specialised experiments initiated the Winter School. Ken passed away suddenly in June 2007, just before that year's Winter School*

### Dr Gerald Laurence

After completing a masters degree in 1957 at the University of Western Australia, Gerald completed a PhD under the supervision of Don Stranks in Chemistry at Leeds University, on chemical consequences of neutron capture by iodine-containing compounds. He was part of an embryonic program of collaborative research between UK universities and the UK Atomic Energy Authority at Harwell. He used the reactor there to further his research and was one of the first students to participate in the beginning of such a program. Interestingly at this time AINSE was well and truly founded. At this stage he was awarded a prestigious Ramsay Memorial Fellowship to support his research. He completed the research in 1961 and returned to Australia to take up a position at the University of Adelaide.

Since then Gerald has been a substantial contributor to AINSE for 47 years, from the first Radiation Chemistry Conference in 1963 and his first AINSE research award in 1961. He has held than 40 AINSE Research Awards in Radiation Chemistry and Environmental Science. Gerald has been a member of several AINSE specialist committees, Radiation Science, Radiopharmaceuticals, and most recently Environmental Science. He was on the inaugural committee which established the Winter School and has been the school's active and popular Headmaster 2001 - 2007. He was the Councillor for the University of Adelaide from 1990 to 2007.

In the late 60s the new Pulse Radiolysis Facility on the 1.3MeV electron accelerator at Lucas Heights enabled microsecond time-scale chemistry experiments to be performed. Gerald and his research group provided a computerised data processing system which provided rapid on-the-spot analysis of chemical rate data. More recently Gerald was one of the team which established, only a few years ago, the new pulse electron beam facility on the 20MeV electron linac operated for AINSE at ARPANSA in Melbourne.

Gerald conducted a 1997 review, commissioned by AINSE, on neutron-scattering usage by Australian universities with a focus on student activities.

## 6.13 AINSE Gold Medal – recognition of excellence in research

*AINSE President, Len Lindoy (left) presenting Syd Haydon (right) with the AINSE Gold Medal in 1993*

The introduction of the AINSE Gold Medal in 1992 was an initiative intended to raise the profile of AINSE. The criteria for the award have not changed from those set originally; the key criteria being *research excellence, including publications with emphasis on recent work which acknowledges AINSE.* The complete list of AINSE Gold Medallists can be found in Appendix 4.

The first gold medal was awarded to Syd Haydon from the University of New England in 1992 for his outstanding research in the area of Plasma Science.

In 1994 the first graduate student gold medal was awarded to Xing-Sheng Li, a former AINSE Postgraduate Research Award holder, from Curtin University of Technology for his research in neutron scattering. In recommending this first award to Council the AINSE President Brian Stone commented on Xing-Sheng Li's *outstanding publication record*. He had published seven papers in refereed journals and an additional nine in conference proceedings

In 1997 a Gold Medal was awarded to the La Trobe University Fission Track Research Group led by Professor Andrew Gleadow. The group has acknowledged AINSE in more than 340 journal articles and conference papers.

While the Gold Medal is not an annual award, one has been awarded in most years since 1992. The awards have been for research excellence over a broad range of disciplines.

## 6.14 AINSE honorary fellows– recognition of service

The purpose of the honorary fellowship is to give recognition to appropriate persons for distinguished and dedicated service to AINSE and to encourage their continued interest in and support of AINSE and ANSTO activities. In introducing the title it was intended that Honorary Fellows would have a continuing practical role in providing additional advice to students, providing support to AINSE Councillors, providing comments on grant applications and in promoting AINSE.

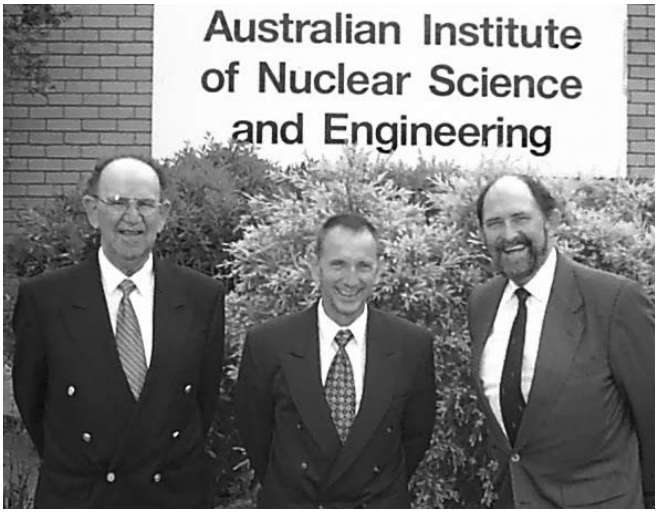
The first honorary fellowships were conferred in 1991. The recipients were Max Brennan, Peter Parsons and David Sangster all of whom had contributed to the organisation in very different ways.

Between 1991 and 2007, 15 honorary fellowships have been awarded (Appendix 5).

## 6.15 A third scientific secretary

Roger Gammon retired at the end of January 1998 after ten years at the helm.

The new Scientific Secretary, Dr Dennis Mather, joined AINSE in March 1998. Equipped with a PhD in Inorganic Chemistry, his prior experience was in education: as a science teacher in NSW, and as coordinator for the setting of Higher School Certificate examination papers in NSW; in commerce, as an accounts manager with ICI; and in association management as a member of the executive of the NSW Science Teachers Association; Manager of Industry Groups for the Plastics Industry Association; and as Executive Officer of the NSW Chemicals and Oil Industry Training Board.




*Bill Palmer, Dennis Mather and Roger Gammon in 1998*

In its entire history AINSE has had only three executive officers/ scientific secretaries. The strength and stability of the organisation has been, in part, the result of the commitment and longevity of the three executive officers. These three, each in his own unique way, have made the organisation a place with a strong emphasis on, and determination to support, the research students to achieve their research goals, while optimising benefits for the universities and ANSTO.

AINSE would not have achieved its successes in providing a vehicle for fulfilling its charter without its dedicated administrative staff over the past 50 years.