

Section 1

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President's Report

The Australian Institute of Nuclear Science and Engineering (AINSE) Council is progressing towards publication of a history volume which will mark the first 50 years of AINSE's proud existence. AINSE will celebrate its fiftieth anniversary on 4 December 2008. The formation of AINSE was approved by the Cabinet of the Australian Government, led by Robert Menzies, in a minute dated 14 May 1958. With the High Flux Australian Reactor (HIFAR) under construction at Lucas Heights, the university community expressed intense interest in accessing the reactor as a research facility. Professor Harry Messel, recently appointed to The University of Sydney, briefly pursued a controversial, alternative strategy which is said would have involved housing a research reactor in the basement of the Physics building at the University. Our history shows that the Messel initiative failed, fortuitously with the benefit of hindsight, primarily for lack of funding. This then opened the door for the broad university community to join with the Australian Atomic Energy Commission (AAEC) (forerunner of ANSTO) in developing a plan which would provide a national access scheme for HIFAR. A remarkably visionary AAEC/universities planning committee, led by Jack Stevens, the first Chairman of the AAEC, and which included Messel, developed in meticulous detail a blueprint for the formation of what was to become AINSE. The planning exercise culminated in the AAEC submitting the Cabinet proposal. The spirit of partnership which underpinned the Stevens committee's deliberation continues to this day and is the key driver for AINSE's grand record over the years. The proud record of AINSE told in the history volume shows that, despite frequent tensions within AINSE over the quest for resources, the partnership has continued producing world class science.



Reflecting on my 5 years as a member of the AINSE Executive, when I have worked closely with the ANSTO leadership, it is a pleasure to emphasise the support given by the two ANSTO CEOs during this time – Professor Helen Garnett and, more recently, Dr Ian Smith. Ian's deputies, George Collins and Ron Cameron have also been enormously supportive as have Dr Rob Robinson, Head of the Bragg Institute, and Professor Lyndon Edwards. I also owe much to the AINSE Presidents with whom I have served – Ron Cooper, Hans Coster and John White – for whom the attainment of research excellence for Australia through AINSE has been at the very centre of the organisation's planning and decision making.

The year 2007 was momentous for AINSE in that our beloved HIFAR reactor was officially shut down on 30 January. The closure was a nostalgic occasion for many of us who had accessed HIFAR through AINSE and collaborated with ANSTO staff on many experiments. This was an intensely emotional experience for me, having performed my first neutron diffraction experiments in 1963 as a University of Western Australia PhD student which led to a career-long involvement in neutron scattering. The HIFAR farewell was followed by the official opening of its replacement, the Open Pool Australian Light Water Reactor (OPAL) by Prime Minister John Howard on 20 April 2008. AINSE neutron scatterers have worked closely with ANSTO's Bragg Institute colleagues on initial "friendly user" experiments which point to OPAL becoming a world class facility. Regrettably, the shut down of OPAL on 27 July to deal with design issues continued through the remainder of 2008 which was a set back for our neutron scatterers. We now look forward to OPAL coming on line in 2008. While we wait for re-start, AINSE is providing travel support to university staff and students who secure access at overseas neutron scattering facilities.

The second half of the year saw AINSE establish the Australian Nuclear Education Council (ANEC) with a view to facilitating cooperation between universities to establish nuclear-

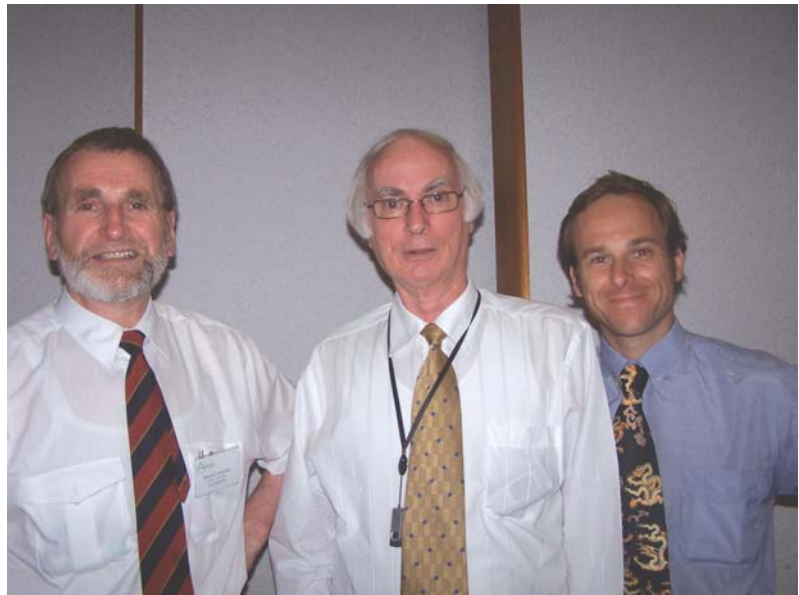
related courses. The focus for ANEC in 2008 was to take advantage of an ANSTO initiative to establish through AINSE a GEN-IV reactor related research program. While funding for this promising initiative was cancelled after the Federal election in November, ANEC planning has provided a framework for cooperation between universities in nuclear education which will be of use to future Executives.

The Executive Secretary's following account and the details chronicled in the annual report show that 2008 has been another wonderful year for AINSE, notwithstanding the neutron scattering community marking time while we wait for OPAL to resume. Undoubtedly, AINSE's most important strategic contribution to the nation is the way in which it is grooming students and early career researchers to become international respected experts in the use of nuclear-related research facilities. First, and foremost, the impact of our support for PhD students through the AINSE Postgraduate Award scheme is widely regarded. I was especially struck by this when I was fortunate to present the AINSE Student Gold Medal to Dr John Daniels of Monash University in January. Remarkably, John's citation listed 13 peer-reviewed papers, and 14 conference papers in neutron scattering related condensed matter research. John has also been acknowledged by Monash University with the 2007 Mollie Holman Medal, which is awarded for the best PhD gained by a student within the Faculty of Science at Monash University in any calendar year. Later in the year, on 6 December, at time of the second Council Meeting AINSE honoured Dr Trevor Hicks for his service to AINSE over many years with an Honorary Fellowship. At the same meeting Professor Stewart Campbell was awarded the AINSE Gold Medal for excellence in research.

The second AINSE initiative related to research training is the AINSE Research Fellowship scheme. The year saw the implementation of this new AINSE scheme, which aims to establish career paths in universities for world class early career researchers who use nuclear related facilities. We now have four Research Fellows, all with remarkable records – Dr Darren Goossens (The Australian National University), Dr Daniel Riley (University of Melbourne), Dr Moeava Tehei (University of Wollongong) and Dr Duncan McGillivray (University of Auckland).

It was with much sadness that I was unable to continue as AINSE President in 2008, following unforeseen family circumstances. This is the formal end of an association with AINSE which has extended over 44 years, and will continue I am sure for whatever lies ahead. I close my report by congratulating Dr Dennis Mather and the secretariat staff for the dynamic way in which they drive AINSE, and to wish every success to my successor as President, Professor Allan Chivas.

Brian O'Connor



Professor Stewart Campbell (2007 AINSE Gold Medal), Dr Trevor Hicks (2007 Honorary Fellow) with Dr Darren Goossens (AINSE Research Fellow) the presentations at AINSE on 6 December



Professor Trevor Finlayson (supervisor) Dr John Daniels (gold medallist) and AINSE President E/Professor Brian O'Connor at the presentation of John's AINSE Gold Medal on Friday 12 January 2007 at Monash University

Scientific Secretary's Report

This year had nearly all the drama of an opera, it started calmly enough then built to a crescendo as the election at the end of the year approached. Details are recorded in the President's report. Following the Federal election we reset our thinking to be more in line with that of the new Labor government. The Research Fellowship program was broadened to incorporate two new areas of research: radiopharmaceuticals, and high-resolution climate records using nuclear techniques. AINSE commenced a review of our Strategic Plan at the December Council meeting. My thanks to Professor Stephen Thurgate from Macquarie University who facilitated the meeting and has prepared the first draft of the new plan. Following an approach by the NSW Department of Fair Trading, the Council decided in December to change the company registration from an incorporated association to a company limited by guarantee. A committee consisting of the President, Vice President and Professor Andrew Cheetham from the University of Western Sydney will present a draft constitution for the new organisation for presentation at the May meeting in 2008.

It has been a challenging year in regard to the provision of member benefits with the shut down of OPAL as well as the SAXS instrument. We attempted to fill the gap in a number of ways: by providing travel support for neutron scattering researchers who were able to gain access to overseas facilities but unable to find sufficient funding for the travel, by converting Provisional Awards into Awards in other specialist areas, and by supporting an extra two neutron scattering workshops.

AINSE provided travel support for three external conferences: the International Congress on Radiation Research (ICRR); Goldschmidt Geochemistry; and the International Union for Quaternary Research (INQUA). The ICRR was the next in the series of international meetings after our very successful conference in Brisbane in 2003 which gave rise to the International Travel Scholarship fund. The first neutron summer school, organised in partnership with ANSTO's Bragg Institute, was a triumph with 30 attendees who were mostly students. The technical program put together by Dr Herma Buttner and her team from ANSTO's Bragg Institute was well received. We have plans to repeat the school in July 2008. Two of our regular conferences were run in 2007 - Nuclear and Complementary Techniques of Analysis and AINSE/ANBUG Neutron Scattering Symposium. More details can be found on the conference pages at the end of this volume. Three workshops were supported: chemical deuteration, polarised neutrons and SANS. The first of these was a direct result of NCRIS funding for a chemical deuteration facility.

AINSE is continuing to lobby the New Zealand Government to participate in AINSE membership so that New Zealand member universities can gain the same benefits as those in Australia.

Face-to-face contact with researchers at member universities is an essential feature of my duties if we are to continue to attract new researchers into the AINSE programs. During the year I visited 15 campuses.

I am pleased to report on the success of AINSE's Winter School at ANSTO held in July 2007. The Winter School continues to be a very effective promotional tool. In 2007 it was instrumental in introducing four of the new cohort of postgraduate scholars to AINSE, that is 35%. Whereas the first-time applicant rate for AINSE Research Awards this year was 28%.

AINSE continues to act as a peak body on behalf of its member organisations in applying for external grants. While our application to the ARC Linkage Infrastructure and Equipment



Fund, to assist Australian Researchers to gain access to ISIS, was unsuccessful for 2007 we have secured a five year grant commencing in 2008 from this scheme for this program which will contribute 50% of the ISIS membership fee.

Following the untimely death of Dr John Ferris from ANSTO we have established a memorial fund which will be used for a named postgraduate scholarship. Contributions from John's colleagues and friends are gratefully acknowledged. The scholarship is not fully funded and we would be pleased to receive further contributions.

Council and Committees

On AINSE Council the following changes occurred during 2007:

Edith Cowen University's Patrick Garnett was replaced by Tony Watson;

Murdoch University's Igor Bray was replaced by James Reynoldson;

Queensland University of Technology's Ray Frost was replaced by Goodwin Ayoko;

University of Western Sydney's Robyn Crumbe was replaced by Andrew Cheetham.

The University of Adelaide's Gerald Laurence announced his retirement at the December Council meeting - after 17 years of service. He will also stand down as convenor of the Winter School. Gerald has been a stand out Councillor for his passion and commitment to the cause.

I remain grateful for the enthusiasm and generosity of all those who contributed to the various committees and to Council throughout the year. Their considerable input is critical to the onward development of the Institute.

Finances

In 2007, operating revenue of \$2,994,386 was made up of \$2,664,807 from membership fees, \$177,825 from interest, \$146,504 from conference income and \$5250 from other sources. In line with practice, membership subscriptions are reviewed on an annual basis to determine AINSE support for each university. On average, for the period 2005 to 2007 inclusive, universities received research and training benefits amounting to 2.93 times their subscriptions, which is the first time the average has been below 3 since 1995. The reasons are primarily the failure of the ISIS application for 2007 and the shut down of OPAL and SAXS instruments which made it impossible to support Awards according to the original budget.

AINSE's operating expenses in 2007 were \$2,754,447, leaving a surplus for the year of \$239,939. The majority of AINSE funds are used to facilitate access and travel to Lucas Heights for university researchers and their research students. In 2007 expenditure on Research Awards was \$1,387,034. Postgraduate Scholarships expenses of \$324,487 include the retrieval of unexpended funds from previous years.

The Financial Statements for the calendar year 2007 in section 2 of this report were prepared by ANSTO Finance and audited by Mr David Aston of Escott Aston and Co.

Awards and postgraduate research awards

A total of 155 Awards were funded in 2007 and another 94 were carried over from previous years. Figure 3 shows the distribution of 2007 AINSE Awards by specialist area. Research highlights in each of the specialist areas are given below on pages 6 to 15. Progress reports for each of the projects can be found on our web site. Of the 155 Awards, 132 or 85% were conducted in collaboration with ANSTO. First-time award holders in 2007 represented 28% of the cohort. I attribute this continuing high influx to the diligence of the AINSE Councillors and to my continuing university visit program; in 2007. My thanks go to the Councillors without whom these visits would be much more difficult to organise and not nearly as effective.

In 2007, 11 of the 54 AINSE postgraduate research award holders received an award for the first time. During the year, 14 PhD theses were received and two candidates withdrew. Twelve doctoral theses are recorded in the publications list, from other doctoral students. These incorporated results of experiments done by students under a Research Award in the name of their supervisor. The AINSE postgraduate research award holders accessed the facilities for a total of 721 days. In addition, another 84 students gained access to the facilities via awards held by their supervisors for a total of 1004 days. The numbers of students and total number of days access to facilities is less than in previous years primarily because of the lack of neutron facilities for the entire year.

In the period we record 359 papers of which 234 were published in refereed journals, 125 conference papers, 17 books or chapters of books; and 26 theses not previously reported. Details of publications can be found in Section 2 of this report.

Acknowledgements

It has been a pleasure to work with AINSE President Emeritus Professor Brian O'Connor of Curtin University of Technology and it is with regret that I will not be working with him in this capacity in 2008. I thank Dr Ian Smith, CEO of ANSTO, who has provided practical advice throughout the year and supported AINSE in many ways; and the President and other members of the Executive Committee who share the responsibility of running the Institute with me. I also extend my thanks to all those from the universities and ANSTO, there are far too many to name individually, for their help and advice throughout the year.

In the AINSE Secretariat, Gillian Blackburn, Nerissa Phillips, Sandy O'Connor, Rhiannon Still and John Studdert have continued to work hard to preserve the long-standing reputation of a friendly, supportive and effective secretariat.

Dennis Mather
Executive Secretary

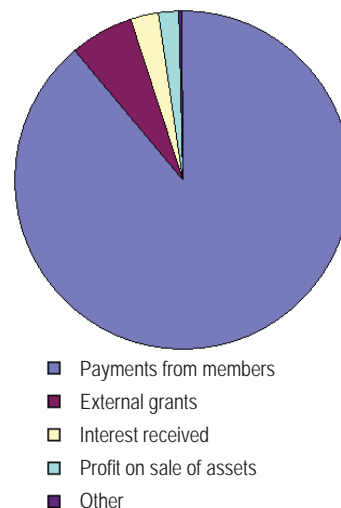


Figure 1 Operating Revenue

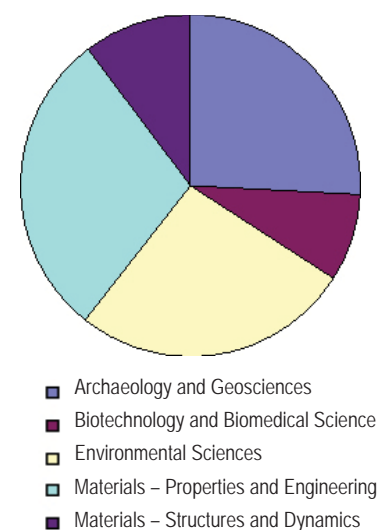
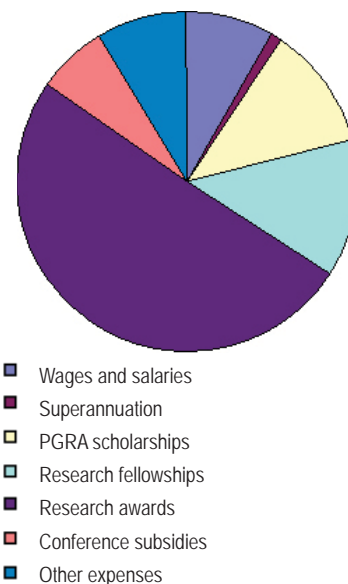


Figure 3 Awards Expenditure by Specialist Area

Research Highlights

Archaeology and Geosciences

The Galapagos Islands and global warming

Santa Cruz in the Galapagos Islands is the most populated and anthropogenically disturbed island in this fascinating archipelago. Its highland area has a string of sphagnum bogs hidden in extinct volcanic craters at about 800m altitude. Ecological managers view the bogs as severely threatened by human activities, including the effects of fire, introduced species and direct disturbance of the sphagnum by horses and people. In palaeoecological terms, the bogs contain an incomparable record of vegetation change and climatic variability for the Eastern tropical Pacific, where El Niño has been a dominant, yet changeable influence in the late Holocene.

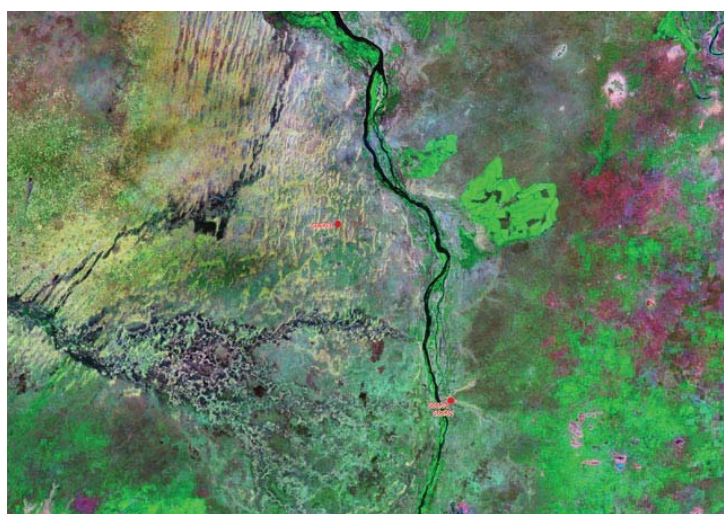
AINSE post-graduate Scholar Iona Flett, and Dr Simon Haberle from the Australian National University, in collaboration with Dr Henk Heijnis from ANSTO's Institute for Environmental Research, and other researchers from the University of Adelaide and the University of Oxford, are working to reconstruct vegetation change, climate variability and human impact in the Galapagos Islands over the last 5000 years. The work involves cutting peat cores from the highland bogs into 1cm slices and determining the age of the slices using the ^{14}C and ^{210}Pb dating facilities at ANSTO. Another analytical technique undertaken at ANSTO measures the differential decomposition of the slices of peat by comparing the colours of extracted humic acids. So far, the researchers have identified several extended wet periods, and intermittent droughts. Microfossils such as pollen and testate amoebae, as well as charcoal, are being used to examine changes to the local environment over the lifetime of the bog.



Coring a bog in the highlands of Santa Cruz Island, Galapagos

The changing course of the River Nile

This AINSE supported project forms part of the program of physics research in the Physical Archaeometry Group at the University of Adelaide in support of luminescence dating. The program helps find ages for archaeological and geological projects. Professor John Prescott and Frances Williams are collaborating with Professor Martin Williams of the Department of Geography at the University of Adelaide, who seeks to determine where the River Nile used to flow and why it flows where it does now. About 400 km south of Khartoum, the White Nile once spread out into long thin lake, not very deep but covering a large area. The region is shown in the picture. The Nile, which flows up the middle of the picture, crosses the former bed of this lake which can be located on the figure by its ancient shoreline. This is seen as arcs of beach dunes extending down river from just above the red dot near the bottom of the picture. The former lake bottom is of uncertain age but much older than the beach dunes, which date from 9 - 18 thousand years (ka). Ages of 2.4 - 9.0 ka were obtained from the wind-blown dune field marked by the red dot on the other side of the river. The implication for climate change is that a period of high-energy flow of the river ended about ten thousand years ago and was followed by a dry period in which the dunes were built from material originally carried by the river.



Satellite image of the Sudan showing the sites described. It is about 250 km from top to bottom. Landsat image by courtesy of Professor Martin Williams



Angkorian temple structures

When did Angkor collapse?

It has long been thought that the medieval city of Angkor, Cambodia, collapsed in the middle of the second millennium CE due to the environmental consequences of urban expansion and the intensification of rice agriculture. Recent archaeological surveys have provided some support for this hypothesis. Studies of remote sensing data have revealed traces of a vast network of village temples, occupation mounds and hydraulic infrastructure stretching between and far beyond the well-known monuments of the central zone. Several hundred of the newly discovered temple sites consist of little more than scatters of brick rubble and are virtually impossible to date using conventional (art historical, architectural, or inscriptional) approaches. An alternative method of dating the most common surface material, brick, has been developed using the rice husks which were added to the clay mix during brick manufacture in order to enhance the structural properties of the fired product. Brick kiln technology was rudimentary, and small traces of this organic material remain within the unevenly fired bricks. In partnership with AINSE, ANSTO, the Cambodian archaeological authority (APSARA) and French researchers, Dr Damian Evans of the University of Sydney, has successfully developed a method of extracting husk material from bricks, and has used the small-mass ^{14}C analysis capabilities at ANSTO to acquire radiocarbon age determinations from extremely small fragments which have the potential to provide direct, absolute dates for Angkorian temple structures for the first time and to add considerably to our understanding of Angkor's growth and decline.

Villages and rituals in Torres Strait

The archaeology of indigenous Australia has long been synonymous with the archaeology of Aboriginal peoples. Yet Australia has another indigenous community: Torres Strait Islanders - those peoples who straddle the narrow sea crossing between Papua New Guinea in the north and mainland Australia in the south. In the mid-1990s, Ian McNiven (now at Monash University) began new multi-faceted investigations into Islander history and its relationship to both southern Papua New Guinean and Aboriginal history.

Prior to these studies it had been thought that Torres Strait was first occupied some 2600 years ago. The new archaeological studies built on these earlier results, and in particular showed that the islands of the Strait had been continually used by people throughout the post-glacial marine transgression when sea level rise created Torres Strait. Around 800 - 600 and again 400 - 300 years ago, new ritual sites such as large dugong bone mounds and shell arrangements commonly associated with male initiation, clan affiliation and the memorialisation of the ancestors and spiritual forces, began to be built. Yet what of the villages, those places where people lived and undertook everyday activities? Dr Bruno David of Monash University aimed to explore the antiquity and dynamics of villages in western Torres Strait, and their changing associations with formalised ritual sites and practices using ^{14}C dating of charcoal samples. The results have shown that 'permanent' villages have a history here spanning 2600 years, and during that time everyday village life has witnessed a spatial segregation from certain sacred rituals (such as those involving hunting magic in the hunting of dugongs, as McNiven has shown, and *Syrinx aruanus* shell initiation sites). It is the nature of these shifting configurations of villages and their associated sacred ritual places that now forms the focus of much archaeological research in the Torres Strait region.



L to R: Dr Ian McNiven and members of the Badulgal community, Paiwan Nona, Benny Ketchell and Frank Nona undertake archaeological excavation at the sacred dugong ritual site KN17 north of Badu

Research Highlights

Biomedical Science and Biotechnology

Improving the sensitivity of small animal pinhole SPECT

Peter Kench of the Brain and Mind Research Institute at the University of Sydney, and Dr Marie-Claude Gregoire, of the Radiopharmaceutical Research Institute at ANSTO, together with staff from both institutions have developed new multiple pinhole collimator designs that achieve the goal of high spatial resolution imaging with improved sensitivity. Single photon emission tomography (SPECT) is used to create a three dimensional image of the distribution of radio-labelled pharmaceuticals in living animals and tissue samples. Imaging small animals, such as rodents, requires a SPECT camera with high spatial resolution and good sensitivity due to the small anatomical size of their organs and reduced amount of radiopharmaceutical that can be administered. Pinhole collimators can be used to improve spatial resolution of the SPECT camera. The pinhole collimator works in a similar way to a photographic pinhole camera in that an inverted image of the object is magnified onto the detector. Increasing the size of the pinhole improves sensitivity but reduces the spatial resolution of the camera. By increasing the number of pinholes the sensitivity of the camera is improved whilst maintaining high spatial resolution. This will benefit preclinical research into new radiopharmaceuticals for the detection and treatment of tumours and neurological disorders.

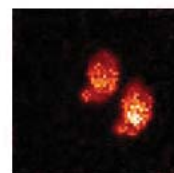
(a) Radio-labelled tumour tissue



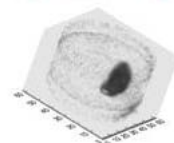
(b) multiple pinhole tungsten alloy collimator



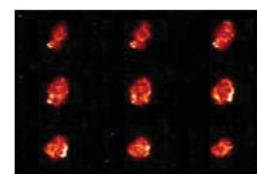
(c) a planar projection of the tumour tissue



(d) surface rendered reconstructed volume of the tissue



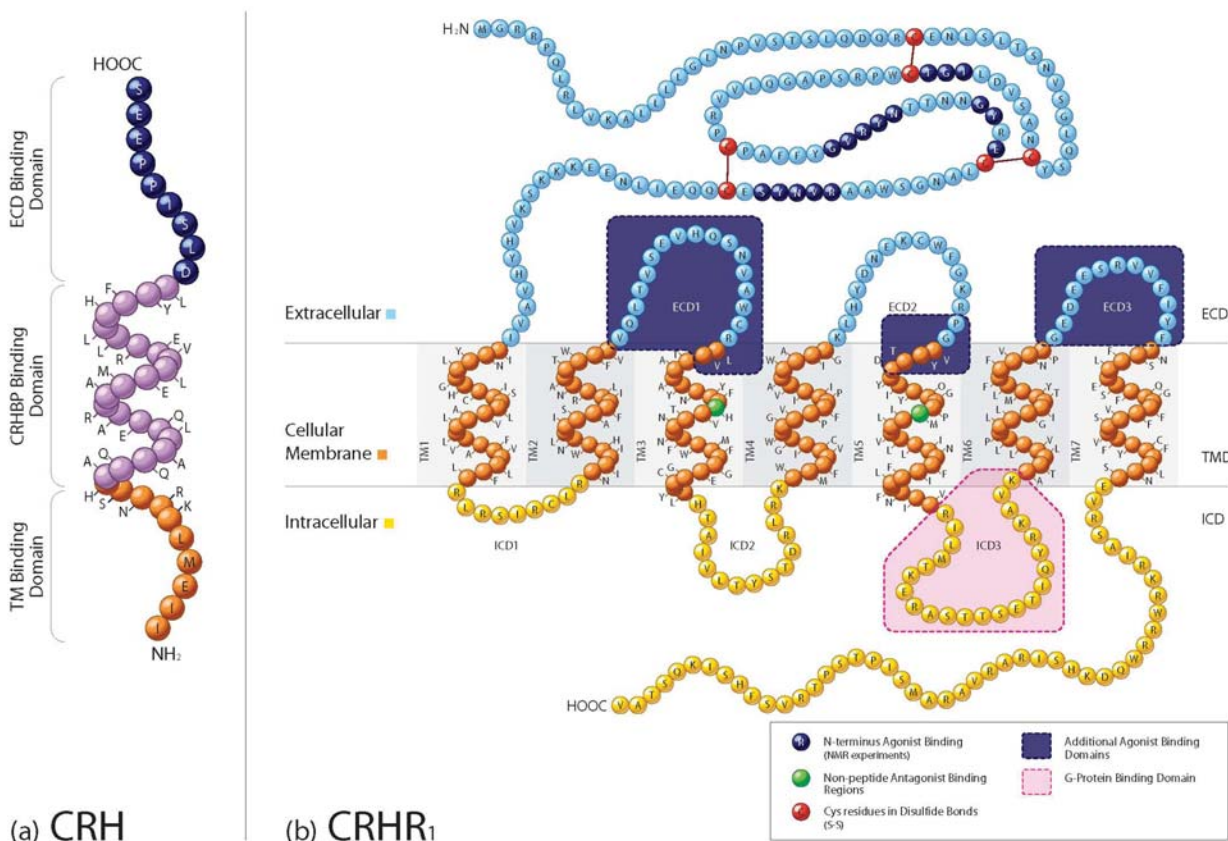
(e) tomographic 0.5 mm slices through tumour tissues showing the non-uniform distribution of the radio-labelled pharmaceutical



Drug design for the prevention of premature birth

In developed countries the most common cause of the death of a newborn baby is premature delivery, and a delay in the onset of labour from 20 to 25 weeks has been shown to result in a 55% greater probability of infant survival (550 fewer deaths per 1000). Current therapies can delay delivery for only 24 hours. Corticotrophin Releasing Hormone is an endogenous 41 amino acid peptide which has a key role in the onset of labour. There is an urgent need for the development of low molecular weight ligands that are active at type 1 CRH receptors either as agonists (which can induce labour) or antagonists (which can delay the onset of labour) since currently available antagonists of the CRH1 receptor are unsuitable as therapeutics.

Supported by an AINSE grant, an innovative drug design program is being developed by Dr Paul Keller of the University of Wollongong, which incorporates the bioavailability factor into the design. Radiolabelled molecules have a unique ability to monitor biochemical reactions, ligand-receptor or enzyme interactions at sub-nanomolar concentrations. The recent advances in computer emission tomography, image reconstruction and animal models of disease have led to the development of extremely sensitive and specific tools for imaging biochemical processes *in vivo* therefore representing a new means of providing information for drug development and evaluation.



Research Highlights

Environmental Science

Climate modulation of the ^{10}Be solar activity proxy

Information on past solar activity from cosmogenic beryllium-10 (^{10}Be) is contributing to our understanding of the role of the sun in climate changes on Earth. ^{10}Be is produced in the Earth's atmosphere and at the surface by cosmic rays at a rate which is modulated by the activity of the sun. For example, over the 11-year solar cycle ^{10}Be production in the atmosphere varies by up to 50%. Some ^{10}Be is deposited to the polar ice caps and is archived within the annual snow layers, variations in ^{10}Be concentration in samples may be used to reconstruct the history of solar activity. However, interpretation of ^{10}Be records has been limited by a poor understanding of the processes which deliver ^{10}Be to the polar ice core archives.

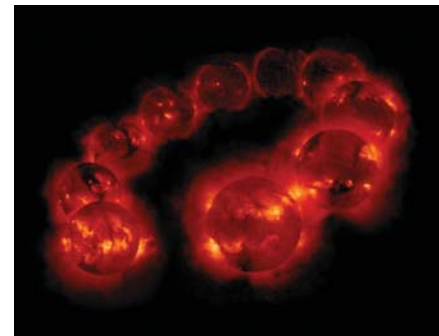
AINSE post-graduate scholar Joel Pedro (supervised by Dr William Howard) and Dr Thomas Trull of the University of Tasmania, are investigating ^{10}Be concentrations in Antarctic ice using the ANTARES accelerator mass spectrometer at ANSTO. Results from detailed snow pit records at Law Dome, East Antarctica have provided new insight into the way ^{10}Be is transported in the atmosphere and deposited to the ice sheet. It has been found that meteorological effects may influence the ^{10}Be record in a way that compromises the standard techniques for reconstructing solar activity. Continuing analysis of ^{10}Be concentrations in detailed snow and ice core records from Law Dome, Antarctica will provide information to improve understanding of solar activity and climate in the past.



Snow pit sampling for ^{10}Be at Law Dome, East Antarctica (Photo: A. Smith)

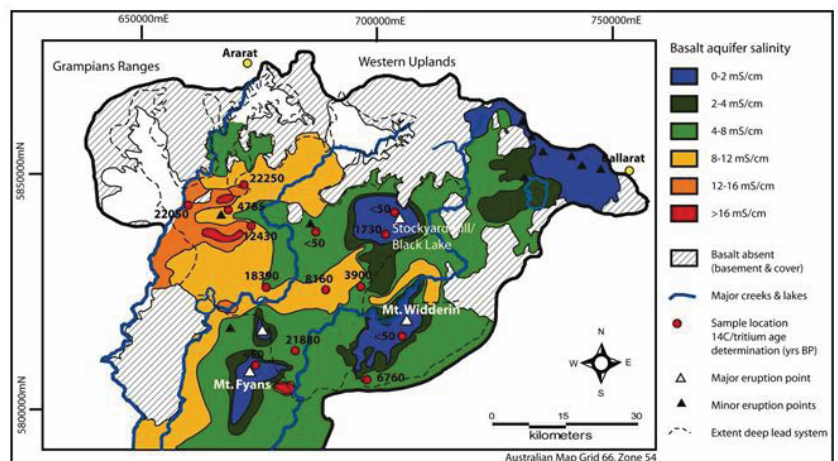
Groundwater as a non-renewable resource

Groundwater dating using the radiocarbon and tritium dating facilities at ANSTO was integrated with other environmental tracers and geological information by AINSE post graduate scholar Mattias Raiber and Dr John Webb of La Trobe University. Investigating the geological controls on the spatial distribution of groundwater quality, and in particular the impact of aquifer lithology and cross-formational flow between a regional-scale basalt aquifer and an underlying palaeoriver system in the basalt plains of western Victoria, tritium analysis showed that the freshest groundwater in the vicinity of the youngest volcanoes in both aquifers commonly contains substantial amounts of tritium, indicating modern recharge through the rocky outcrops. By contrast, tritium activities of groundwater in the remainder of the basalt plain, composed of old basalt phases and thick, clay-rich soils, are below the detection limit, showing that recharge rates in these areas are very slow.



The 11-year solar cycle captured in x-ray (Image: http://solar.physics.montana.edu/sxt/Images/The_Solar_Cycle_XRay_med.jpg)

Radiocarbon ages display a very similar pattern to groundwaters with maximum ages of more than 21000 years BP in the basalt aquifer and 37000 years BP in the deepest section of the deep lead system. These trends show that the rocky outcrops of the major volcanoes form preferential recharge areas for both aquifers, resulting in good water quality in both aquifers in these areas, whereas groundwater recharge throughout the remainder of the basalt plains is very slow and the groundwater quality is generally poor. The old groundwater ages observed in downgradient sections of the aquifers clearly emphasise that these precious groundwater resources are essentially non-renewable on human time-scales, and that a sustainable management is required to preserve these groundwaters for future generations.



Groundwater salinity and age distribution within the basalt aquifer.

Wild harvests and enrichment planting

The northern sandalwood (*Santalum lanceolatum*) is widespread through northern and inland Australia. Although less favoured than Asian or Western Australian species, it forms the basis of a wild harvest industry providing raw material for the manufacture of incense and extraction of medicinal oil. The high value of raw sandalwood and its capacity to occupy a diversity of sites provides opportunities for indigenous communities to develop enrichment plantings on traditional country as a relatively low input, high yield cash crop. As part of a larger project investigating prospects for developing improved varieties of northern sandalwood for this purpose, this AINSE supported project by Dr Jonathan Luly of James Cook University, carried out high precision accelerator mass spectrometry dating of heartwood and sapwood from trees growing on Delta Downs Station on the Gulf coast of southwestern Cape York Peninsula, on Billy's Lagoon Station near Weipa, and on Wongalee Station north of Hughenden in semi-arid western Queensland.

All trees appear to have begun life in the late 1950s or very early 1960s. Age estimates based on unpublished growth increment measurements collected by the Queensland Department of Primary Industry suggest trees of legally harvestable size are approximately 40 years old and AMS dating suggests these estimates are broadly accurate. Trees from Billy's Lagoon, which lack heartwood entirely, are also approximately 40 calendar years of age but are commercially useless. This is a clear indication that heartwood formation in *S. lanceolatum* is a complex phenomenon and is the focus of ecophysiological work in other parts of the project. Calendar ages for samples at the heartwood – sapwood boundary are from the early 1980s. On face value, it appears that merchantable heartwood in northern sandalwood takes at least 30 years to develop. This is a relatively short latency period for an agroforestry tree and, coupled with the high value of sandalwood logs, suggests that plans for enrichment plantings of northern sandalwood on Aboriginal land may well be viable.

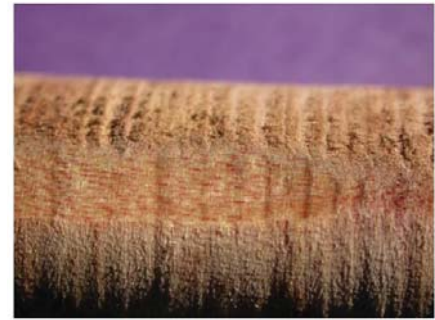
Peat: problems and pollen

Over the last 30 years, many studies have focused on peatlands and peat deposits in order to assess palaeoenvironmental changes or anthropogenic impact during the Holocene. Peat deposits are sensitive archives of environmental changes in particular if they have a convex topography and therefore receive influx from the atmosphere only. The age of these organic deposits is commonly determined using ¹⁴C radiocarbon methods. Tropical peat deposits often host rainforest vegetation and the roots of the trees can penetrate several metres into the peat, commonly accounting for a large subsurface input of young carbon. In order to assess the effect of young carbon input and the complex mixing of carbon with various ages, Dr Raphael Wust of James Cook University, has investigated different organic fractions from a peat profile from Central Kalimantan, Indonesia. The findings show that the extracted pollen fraction always yielded the oldest radiocarbon AMS age while the bulk material was often several hundred years younger. The age difference between the bulk and the pollen fraction is highest in the section where highest peat accumulation rates occurred in the past. The study suggests that in tropical peatlands, pollen fractions should exclusively be used to determine the age structure and model.

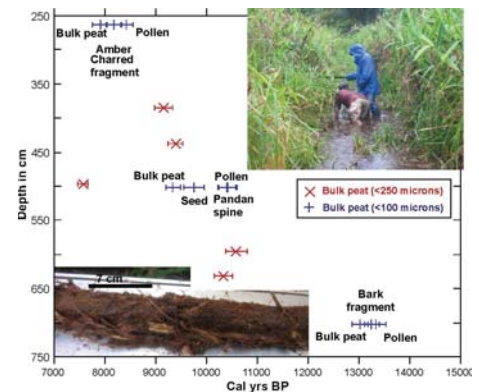
Concentrating on selenium

This research is part of a larger project investigating selenium dynamics in marine sediments. Selenium is toxic at high concentrations and accumulates in sediments particularly adjacent to industries such as smelters and coal-fired power stations. Thus far the research has investigated a polluted area in Port Kembla Harbour, physically and chemically characterised these sediments, and quantified the selenium-sediment binding phases at various depths. Dating of sediment cores from Port Kembla Harbour will provide an understanding of sediment disturbance and diagenetic behaviours of selenium at these highly contaminated sites.

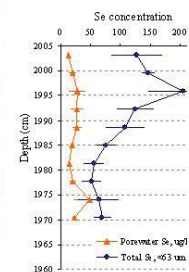
Dr Dianne Jolley and Pattanan Tarin from the University of Wollongong collected sediment cores which were dated by alpha spectrometry at the Radiochemical Laboratory ANSTO in collaboration with Atun Zawadzki and Jennifer Harrison. Results confirmed that sediments were not disturbed, that large amounts of selenium were deposited at the same time as production peaked at an adjacent copper smelter, that soluble selenium concentrations are higher in deeper sediments (most likely due to the loss of dissolved selenium in porewater to the overlying water) and that the area's sedimentation rate is 0.55 ± 0.03 cm/year.



Northern sandalwood does not produce annual rings and radiometric dating provides a means of verifying growth rates estimated from stand histories



Calibrated ¹⁴C data of various organic fractions at different depth throughout a tropical peat profile. Long roots from the rainforest vegetation contribute younger carbon into the subsurface which results in younger ages of bulk material compared to pollen extracts



The collection and careful sectioning of aquatic sediments allows us to obtain sediment depth profiles. Profile information includes sediment dates, and concentrations of selenium in the sediments and surrounding porewaters.

Research Highlights

Materials – Properties and Engineering

Forensic analysis procedures for radiologically contaminated biological evidence: a counter terrorism initiative

The malevolent use of radioactive materials by terrorist organisations has become of serious concern to law enforcement institutions. Of particular importance is how the use of these materials can impact on forensic investigations, from limiting access to the crime scene to contaminating and destroying critical forensic evidence. Investigations involving radioactive materials may include the terrorist use of a dirty bomb, where radioactive materials are dispersed with the aid of explosives, or possibly intelligence gathering at clandestine laboratories where manufacture of these devices take place. Such circumstances pose unique challenges to forensic agencies as there is limited information on analytical methods or handling procedures for forensic samples that are contaminated with radioactive materials.

Through collaboration with the University of Canberra, Australian Federal Police Forensic Services, and ANSTO, AINSE post-graduate scholar Serena Abbondante, with her supervisor Professor Jennelle Kyd, has investigated the potential impact of radioactive contaminants on the analysis and interpretation of forensic biological evidence. Biological materials, such as blood, saliva and bone, were exposed to gamma radiation from the cobalt-60 source at the GATRI facility and alpha radiation produced from the STAR particle accelerator. These examinations have identified threshold doses for DNA profiling when exposed to gamma and alpha radiation. In addition, methods for isolating biological material from a contaminating ^{137}Cs radioactive source were successfully established. This outcome reflects the potential for successful forensic investigations following a radiological incident.



A caesium-filled package discovered in Ismailovsky Park Russia, 1995

Reducing fuel consumption with carbon fibre nanocomposites

The auto and aerospace industries are under significant pressure to reduce structural weight in order to achieve greater fuel efficiency without sacrificing overall performance. One method used to accomplish this is to replace metal (steel, magnesium, aluminium) body panels with composite materials. Although carbon fibre composites are known for their high strength to weight ratios, they commonly sacrifice toughness due to the brittleness of the matrix as well as the inefficient load transfer between the fibre and matrix. Small amounts of toughening agents such as nanoparticles can be embedded within the matrix to offer mechanical properties similar to those of fibre reinforced composites that require 60% volume, but only when the structure of the nanocomposite is well dispersed. Uniform dispersion throughout a thermosetting polymer is difficult to achieve, due to the inability of the nanoparticles to individually separate from one another prior to polymer solidification.

AINSE post-graduate Scholar Betime Nuhiji and Dr Bronwyn Fox of Deakin University are currently working in collaboration with a team of ANSTO researchers to investigate the structure - property relationships of carbon fibre nanocomposites using a novel curing technology, Quickstep™. This fluid filled bladder system lowers a resin's viscosity via a rapid temperature heating rate, which potentially assists in dispersing nanoclay platelets to create a uniformly distributed material. In addition, this feature also assists in better wetting of fibres, leading to an increase in interfacial adhesion. This technique will facilitate the manufacturing of low-weight, high-performance nanocomposite materials at an affordable cost.

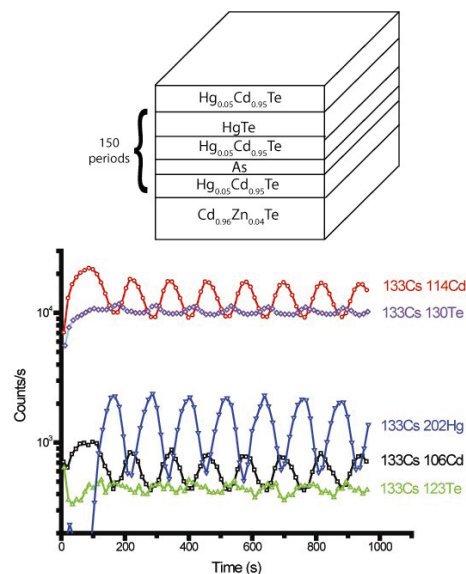


Quickstep™ clamp shell

Controlling low-level doping for infrared detector applications

One of the main foci of research by the Microelectronics Research Group (MRG) of the University of Western Australia (UWA) is in the area of infrared optoelectronic sensors. Infrared systems are used extensively in a diverse range of applications including surveying, sensing and imaging, geological surveying, bushfire detection, weather forecasting, minerals exploration, as well as surveillance activities including law enforcement and defence. Current state-of-the-art infrared systems utilise infrared focal-plane array detectors (IRFPA) based on the ternary semiconductor HgCdTe. To realize more complex novel detector structures, precise n and p-type doping of HgCdTe is necessary. While n-type doping of HgCdTe has been successfully implemented during molecular beam epitaxial (MBE) growth, the inability to controllably dope HgCdTe *in-situ* at low levels has meant a wide range of advanced device structures capable of significantly improving performance of HgCdTe based detectors has not been possible. Various strategies have been implemented in this work by AINSE post graduate scholar Mr Gordon Tsen and Dr Charles Musca of the University of Western Australia, to incorporate arsenic into HgCdTe as a p-type dopant during MBE growth.

A large number of HgCdTe samples doped with arsenic were grown via the MBE facility at UWA. The samples were characterized to ascertain their optical, physical and structural properties via a number of different techniques including scanning electron microscopy (SEM), high-resolution x-ray diffraction (HRXRD), magneto-transport Hall measurements, Fourier transform infrared radiation (FTIR) and secondary ion mass spectrometry (SIMS). In particular, SIMS was performed at ANSTO's dynamic SIMS facility under the supervision of Dr Kathryn Prince and Mr Armand Atanacio, both from ANSTO's Institute for Environmental Research. The SIMS facility was primarily used to quantify the amount of arsenic incorporated during growth and to correlate the results to Hall measurements which determine the level of electrical activation. Preliminary results indicate that arsenic is electrically active when incorporated in a superlattice structure using a delta-doping approach. These findings indicate that the technique used is promising and presents an alternative approach to obtaining p-type material compared to the conventional method of alloy direct doping.

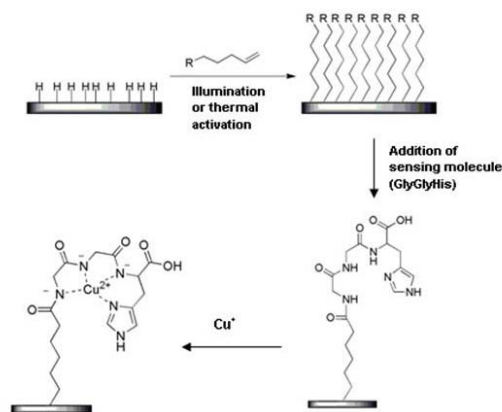


Building better carbon-based chemical sensors

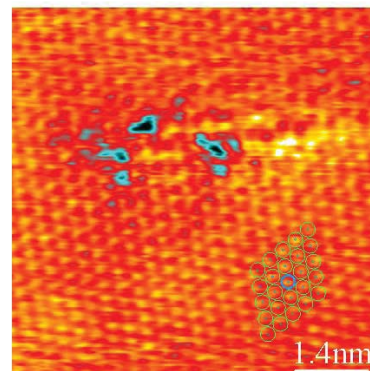
A collaborative effort between Dr Jamie Quinton and PhD student Alec Deslandes of the Smart Surface Structures Group at Flinders University and the Biosensors & Biodevices Group at University of New South Wales is focused on developing superior, carbon-based electrochemical sensors. However, to construct the required chemical-sensing architecture on the carbon surface, a step-wise approach is required. The first and most critical of these involves termination of the surface with hydrogen with exposure to hydrogen and methane plasma.

Working with the assistance of Dr Mihail Ionescu from ANSTO's Institute for Environmental Research, the team accessed the ion beam analysis facilities at ANSTO, in particular using the STAR Accelerator to perform elastic recoil detection analysis (ERDA) and Rutherford back-scattering (RBS) measurements. These measurements have been used to quantify the presence of surface hydrogen which is otherwise difficult to measure directly. The ERDA results now provide a standard for secondary ion mass spectrometry (SIMS) experiments, which when used in conjunction with multi-variate analysis, provide information on surface hydrogen and morphology.

Very recent experiments at ANSTO using RBS measured simultaneously with ERDA, have provided a quantitative measure of the successful bonding of subsequent intermediate species to hydrogen-terminated surfaces.



Schematic showing how a hydrogen terminated carbon surface can be used to anchor a terminating sensing molecule. This sensing molecule can then interact with desired species (Cu^{2+} ions in this example).



An atomic resolution STM current-mode image of graphite that has been subject to a low exposure CH_3 plasma. The image has been processed using WSxM software.

Research Highlights

Materials – Structures and Dynamics

Alane (AlH₃) nanoparticles: hydrogen storage for vehicles

The need for a replacement fuel for motor vehicles is becoming ever more apparent as oil reserves begin to be depleted. Hydrogen is a leading contender to replace petrol as a fuel for motor vehicles but there are a couple of factors which are preventing it from being immediately implemented. One of the problems is being able to safely store adequate quantities of hydrogen on board. AINSE postgraduate scholar Mark Paskevicius and Professor Craig Buckley of Curtin University are investigating nanoparticulate alane (AlH₃) as a hydrogen storage medium because it has a high weight percent hydrogen storage (10.1 weight %) and a high volumetric storage density which makes it appealing for vehicular use. The research goal is to determine the difference in the material properties between alane nanoparticles and alane bulk to reduce the high hydrogen pressure (>2.5 GPa) required for hydrogen absorption into aluminium.

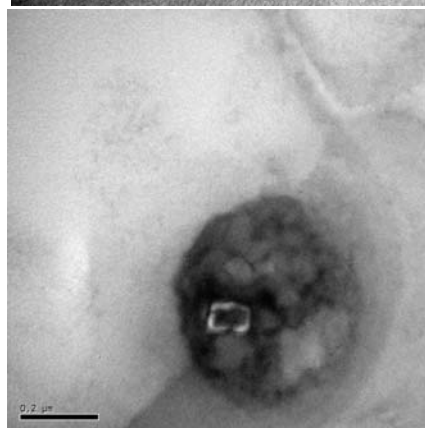
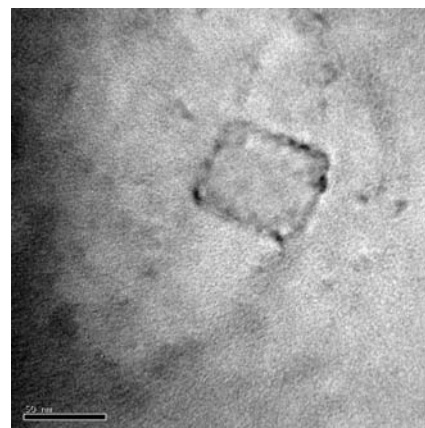
Alane nanoparticles have been synthesised via a mechanochemical reaction (see figure) in order to determine the sorption conditions for hydrogen in the aluminium-alane nanoparticle system. A range of techniques including x-ray diffraction, transmission electron microscopy, small angle x-ray scattering and hydrogen sorption measurements have been undertaken to characterise the alane nanoparticles. *In-situ* neutron diffraction and small angle neutron scattering experiments are planned in order to analyse the hydrogen desorption characteristics in more detail.

Production and storage of renewable fuel

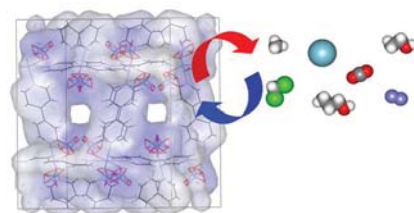
Increased public and political awareness of the environmental issues associated with the use of fossil fuels in transport, coupled with concerns regarding the continuing supply of fossil fuels is driving the search for alternative fuels such as H₂ and CH₄, their synthesis, safe transport and storage. Understanding the guest-exchange properties of materials such as CB-A that exhibit ambient pressure storage of H₂ is critical for commercially viable methods of production and storage of alternative, renewable fuels

During his PhD research, AINSE postgraduate scholar Joseph Bevitt of the University of Sydney, under the supervision of Dr Cameron Kepert, has developed variable temperature *in situ* single crystal x-ray diffraction methods to demonstrate the reversible adsorption of small gaseous molecules into dynamic nanoporous coordination polymer materials such as Co(bpy)_{1.5}(NO₃)₂, CB-A, where bpy = 4,4' bipyridine. These methods yielded the first structural evidence for the adsorption and storage of light molecules such as argon, methane and nitrogen within such materials and enabled the prediction, later confirmed, that selective absorption and storage of H₂ would be observed at 78 K and 100 kPa.

With the support of AINSE and Dr Ross Piltz at ANSTO's Bragg Institute, a hardware system was developed, and a viable *in situ* single crystal neutron diffraction technique was demonstrated to safely examine H₂ uptake by CB-A at low temperatures. This preliminary investigation has determined the full capability of the instrumentation in demonstrating the plausible detection of intracrystalline adsorbed hydrogen gas.



TEM micrographs of an alane nanoparticle ~ 50 nm in size (top) and alane nanoparticles embedded in a larger LiCl by-product particle ~400 nm (bottom)

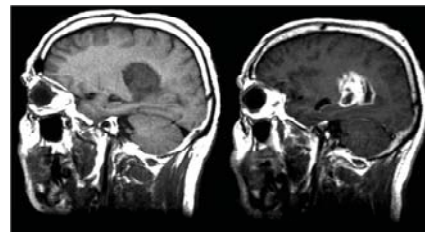


Nanoporous coordination polymers show great promise as gas storage and purification media.

Increasing contrast with superparamagnetic nanoparticles

Magnetic resonance imaging (MRI) is a widely used, powerful technique for imaging soft tissue within the body. It has given medical practitioners an indispensable tool in the diagnosis of neurological, musculoskeletal, cardiovascular and oncological diseases, yet the question remains, can the contrast in these images be sufficiently increased to enhance the ability of the medical practitioners to make a more accurate or earlier diagnosis? The answer to this question lies in the emerging field of nanotechnology with research into superparamagnetic nanoparticles.

AINSE postgraduate scholar Matthew Carroll and Dr Robert Woodward, working within a team at the University of Western Australia, have been studying a novel system of polymer coated magnetite superparamagnetic nanoparticles. These particles are about 10nm in diameter and are highly magnetic when subjected to a magnetic field. When injected into the body these particles will significantly affect the local magnetic fields, ultimately leading to a substantial increase in the contrast of the final MRI image. By using a variety of techniques such as transmission electron microscopy, SQUID magnetometry and proton relaxometry, combined with small angle neutron and x-ray scattering (at ANSTO and NIST), the project has revealed that this increase in contrast is heavily dependent upon a number of parameters including the size and structure of the polymer coating. This has led to significant progress in the development of tailored superparamagnetic nanoparticles for MRI contrast enhancement.



MRI images of a brain tumour before (left) and after (right) an injection of magnetic nanoparticle contrast agents

From protein structure to disease

Parkinson's disease is a prevalent neurological disorder that is usually not inherited, but which does exist in a number of rare heritable forms. Recent investigation revealed heritable parkinsonism can be caused by mutations in the gene encoding LRRK2 (Leucine-Rich Repeat Kinase), affecting most of its six predicted functional domains. Two of these domains have enzymatic functions that are implicated in the disease process, and this enzymatic activity is governed by interaction between the domains. Full understanding of these inter-domain interactions will require study of their arrangement in three dimensions. This is the objective of an AINSE funded collaborative project undertaken by PhD student Ryan Mills of the Department of Pathology, and the Department of Biochemistry & Molecular Biology at the University of Melbourne, under the supervision of Dr Tracey Hanley of the Bragg Institute at ANSTO.

High-yield systems for the expression and purification of segments of LRRK2 have been developed through this project in both naturally occurring and parkinsonism-associated mutant forms. These preparations are suitable for determining the low-resolution protein structure by small-angle x-ray scattering (SAXS). To further describe the orientations of the LRRK2 domains within the protein segments visualized by SAXS, individual domains from LRRK2 can be expressed and purified independently, reconstituted and resolved in contrast-matched experiments using small-angle neutron scattering (SANS). This information will be correlated with enzymological data obtained at the University of Melbourne to help reveal the links between LRRK2 structure and function, how this is perturbed in familial parkinsonism, and may also suggest potential strategies to control LRRK2 function in the treatment of Parkinson's disease.

Predicted structures of four of the six functional domains of LRRK2. Probable locations of mutations causing hereditary parkinsonism are shown as red circles



AINSE Winter School 2007

Saturday 31 June to Wednesday 4 July 2007

The Winter School continues to be an effective AINSE activity for the promotion of research opportunities at ANSTO to prospective research students. Four students from previous Winter Schools were successful in gaining AINSE PGRA top-up scholarships in 2007.

One student is selected by the AINSE councillor at each of the 39 member universities.

Despite the dominance of students with physics and chemistry majors there was a variety of disciplines represented, see the table on page 17. The experiments and lectures cover a wide range of disciplines and scientific techniques and are designed to broaden the scientific outlook of the students. Working and socialising with students is another important part of the Winter School experience.

We were pleased that Dr Henk Hejnis and his colleagues from ANSTO's Institute of Environmental Science were able to present the very successful experiment on natural radioactivity in the environment, after a recess of several years.

The untimely death of Dr Ken Doolan just before the Winter School opened deeply affected all of us involved with the School. Dr Doolan's work in bringing undergraduates to experience the range of facilities available at ANSTO was the seed from which the Winter School grew and he was a valuable member of the Advisory Committee. He was directly involved with several of the experimental sessions and the Winter School committee is grateful to Mark Callaghan, one of the AINSE Postgraduate student demonstrators, for making sure the radiation science experiment continued satisfactorily after Dr Doolan's death.

The postgraduate student demonstrators continue to make a very important contribution to the School in the laboratory sessions, as role models and through the presentations on their research. They are always warmly welcomed by the students. The Winter School and AINSE are very grateful for the commitment to the 2007 School by the AINSE Postgraduate Scholars, Mark Callaghan from the University of Technology, Sydney, Paul Saines from The University of Sydney, Betime Nuhiji from Deakin University, and Susan Pearce from the University of Adelaide.



*Winter School 2007,
the entire group*

The number of students studying nanotechnology has increased steadily since it first appeared as a major in 2004 and now has similar numbers to those in the environmental, biological and engineering sciences. The gender ratio was 20 females to 19 males. This year the following students attended the Winter School.

Students

Name	Uni	Name	Uni	Name	Uni
Amie Anastasi	CQU	Veronica Gray	NCT	Rhiannon Mulherin	QLD
Simon Arneaud	TAS	Kym Haskins	SCU	Kathryn Napier	MUR
Simon Blee	CUR	Emma Hooley	MEL	Alsio Parisi	USQ
Jessica Chadbourne	SYD	Danielle Kim Hudson	ECU	Matthew Pinson	ANU
Kim Cheng	CDU	Grace Jefferson	DEA	Blake Jordan Plowman	RMI
Jamie Clifford	UNE	Emma Laird	JAM	Lawren Sullivan	GRI
Leon Cooper	MON	Mary-Rose Larosa	VIC	Ashwath Sundaresan	CAN
Nicole Cordina	MAC	Karen Lavin	OTA	Ba Phuoc Tran	NSW
Melantha De Soysa	AKL	Emma Lawrance	FLI	Lewis Tunstall	ADE
Jaclyn Dedini	CSU	Ashley Locke	QUT	Ken van't Schip	UTS
Kristina Eriksson-Scott	UWS	David Marusic	WOL	Akshat Vij	UWA
Christopher Felstead	USA	Vincent Marziale	SWI	Joanna Waugh	LAT
Leroy Gonsalves	ACU	Logan McLintock	USQ	Stephanie Anne White	BAL



Michael Prior from ANSTO describing PIXE analysis on the STAR accelerator to a group of students

Discipline	No
Chemistry	15
Physics	10
Biological sciences	6
Engineering	4
Environment	4
Mathematics	4
Nanotechnology	4
Agriculture	1
Sum	48

The total number of students shown in the sum of disciplines exceeds 39 because 9 students were doing a double discipline major and each of these has been tallied.

Special Speakers

Two outstanding evening speakers engaged the students: Professor Peter Johnston, from RMIT University, spoke on 'Australia's uranium – greenhouse friendly fuel for an energy hungry world'; and Dr Joel Gilmore, from The University of Queensland, gave a lively presentation on 'How a Nuclear Reactor Works'.

Thanks

Dr Gerald Laurence is retiring as convenor of the Winter School and this position will be filled by Dr Danielle Meyrick from the University of Western Australia. Dr Meyrick brings enthusiasm and new ideas to the running of the Winter School which will continue to flourish under her guidance. Dr Laurence will continue to work for the Winter School by supervising the Radiation Science experiments in 2008. The Convenor, the Executive Secretary of AINSE, the Board, the Executive Director and the staff of ANSTO for their generous contribution to the School. They thank all the ANSTO staff who gave so much of their time and talents in making the School a success.

2007 Conferences & Workshops

AINSE conferences play a major part in the information exchange process for scientific and technological information, providing a forum for debate and an opportunity for young researchers to present their work to the research community. Participants from member organisations are assisted with travel and accommodation support and receive a discount on registration fees.

AINSE organised three national conferences/workshops in 2007: the 15th AINSE Conference on Nuclear and Complementary Techniques of Analysis (NCTA) held at the University of Melbourne 21 - 23 November 2007; the 6th AINSE/ANBUG Neutron Scattering Symposium (AANSS) 2007 held at AINSE, Lucas Heights 4 – 6 December 2007; and the Chemical Deuteration Workshop, held on 27 September 2007 at Lucas Heights.

AINSE supported participants in other conferences and workshops which are described on page 19 as well as providing travel and accommodation support for participants from member universities who presented papers at the Goldschmidt Geochemistry, and the International Union for Quaternary Research (INQUA) Conferences.

15th AINSE Nuclear & Complementary Techniques of Analysis Conference (NCTA 2007)

21 – 23 November, the University of Melbourne

103 participants attended the 15th AINSE Nuclear & Complementary Techniques of Analysis Conference. Another 16 participants attended an intensive one day course on Vacuum Technology held in conjunction with NCTA 2007 on 20 November. Of the 103 NCTA participants, 7 attended from ANSTO, 7 from overseas and 49 were students. There were 35 oral presentations and 70 poster presentations. The conference highlighted key areas such as environment, bioscience, advanced materials and analysis, nanotechnology, and ion beam science. Invited speakers included David Paterson and Julian Adams from the Australian Synchrotron, and James Robertson from the Australian Federal Police.

AINSE is grateful for the financial support from the ARC Nanotechnology Network and the ARC Australian Research Network for Advanced Materials, and for organisational support AINSE acknowledges the contributions from the University of Melbourne and the University of Newcastle. The participation of a number of sponsors was an integral part of the conference and is acknowledged with thanks.



NCTA 2007 Participants

Chemical Deuteration Workshop

27 September, AINSE, Lucas Heights

AINSE hosted this consultative workshop which was held to determine mainstream neutron scattering user needs for chemical deuteration. The workshop welcomed two Malaysian scientists and AINSE supported the attendance of 11 participants from AINSE member institutions. The funding for the proposed chemical deuteration facility to be commissioned at ANSTO is provided through the NCRIS process.

Pushing Small Angle Neutron Scattering at OPAL to a Smaller Q

15 – 16 November, Bragg Institute, Lucas Heights

Travel and accommodation support was provided for eight participants from AINSE member universities who took part in this workshop which was organised by ANSTO's Bragg Institute to discuss current Australian neutron scattering research on large-scale structures having real space sizes ranging from 0.1 to 50 nm, low-Q neutron scattering techniques and applications, and to help make a start on defining specifications for a low-Q neutron scattering instrument to be commissioned at the OPAL Research Reactor.

Polarized Neutron Scattering Workshop

28 – 29 November, Bragg Institute, Lucas Heights

This workshop was attended by sixteen delegates from AINSE member universities, fourteen from ANSTO, and 6 from international neutron scattering research organisations. The purpose of the workshop was to discuss the scientific opportunities of polarized neutron scattering to Australian industry, government and universities, and to define specifications for polarized neutron capabilities at the OPAL beam instruments.

ANSTO-AINSE Neutron School on Diffraction

29 November – 3 December, AINSE, Lucas Heights

This School was attended by 30 PhD students and post doctoral researchers. It provided training for newcomers to neutron scattering with a focus on diffraction, its use and its applications. AINSE provided travel support for 27 of the attendees from member universities.

6th AINSE/ANBUG Neutron Scattering Symposium (AANSS 2007)

4 – 6 December, AINSE, Lucas Heights

The AINSE/ANBUG (Australian Neutron Beam User Group) Neutron Scattering Symposium attracted 65 participants this year including 33 from universities, 28 from ANSTO, and 4 from overseas. There were 19 students, and 38 oral and 17 posters were presented. AINSE is grateful for the financial support from the ARC Molecular and Materials Structure Network (MMSN).

International Conference Travel Scholarships

These scholarships are available to students and post doctoral fellows from AINSE member universities who wish to present their AINSE supported research at an international meeting which is being conducted outside Australia.

Five international travel scholarships were awarded during the year to the following students.

Student	University	Conference	Amount
Amy Wyatt	WOL	17th International Symposium on Radiopharmaceutical Sciences	\$900
Matthais Raiber	LAT	Twelfth International Symposium on Water-Rock Interactions	\$900
Soodkhet Imlao	UNSW	ICMAT2007	\$900
Madhu Bhaskaran	RMIT	European Materials Research Society (E-MRS) 2007 Fall	\$900
Sharath Sriram	RMIT	European Materials Research Society (E-MRS) 2007 Fall	\$900

In addition \$31,000 was provided in travel support for ten Australian people from AINSE member universities who presented papers at the 13th International Congress of Radiation Research held in San Francisco, California, July 8-12, 2007 (ICRR2007). It was the surplus from ICRR2003, which AINSE underwrote, that was used to create the international travel scholarship fund.

For more information about International Travel Scholarships see our web site www.ainse.edu.au