MacDiarmid
Interface

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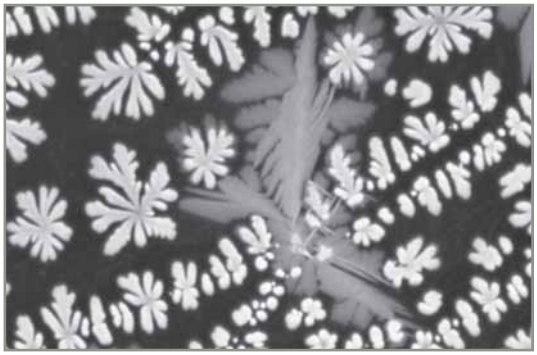
The MacDiarmid Institute
for Advanced Materials and Nanotechnology

Emulating nature by Alan Samson

The crystalline petals extend in twinkling, feathery patterns looking for all the world like snowflakes or thin pieces of delicate coral.

Looking at some of the scanning electron microscope images produced by Canterbury University doctoral student Shelley Scott and senior physics lecturer Simon Brown, one can't help but be taken by the beauty.



The petals - "nanoflowers" - are, quite simply, exquisite.

The petals - "nanoflowers" - are, quite simply, exquisite. Unlike the flakes or the coral, nanoflowers are inorganic, material clusters that are formed almost miraculously in the shapes of the very processes of nature. They are also human-built, conglomerates of atoms, remarkably "grown" in nano-scales - in dimensions in the range of billionths of a metre - by Dr Brown and Miss Scott in a university laboratory.

Once you've got your head around the wonder of laboratory creations emulating organic nature, try grappling with the reality that these things may offer the world the next great technology breakthrough - the breaking of the "size barrier" in computer chip development.

The problem with traditional electronic technology is that there is a limit to the number of components that can be built on to a semiconductor wafer or chip.

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Brilliant Colours by Veronika Meduna

Many scientific discoveries are first inspired by Nature. However, in the case of some twisted and layered nano-structures with special optical qualities, scientists learned how to make them in the laboratory first and then they discovered that Nature does the same thing - in the shiny wings of the scarab beetle including New Zealand's own manuka beetle.

Now, Professor Ian Hodgkinson and his team at the University of Otago are crunching up beetle wings to study the structure of their surface under the electron microscope to complement their groundbreaking research into birefringent and chiral coatings.

Their work feeds into research at the MacDiarmid Institute for Advanced Materials and Nanotechnology, a Centre of Excellence that encompasses partners at Victoria, Canterbury, Otago and Massey universities and Industrial Research and the Institute of Geological and Nuclear Sciences.

Birefringent materials are materials that combine two refractive indices. One example is the mineral calcite, also known

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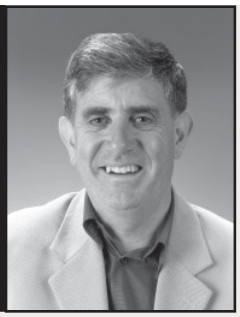
From the Director

of the MacDiarmid Institute



The MacDiarmid Institute has just completed its first year of existence. The formation of Centres of Research Excellence has resulted in three significant changes. First, and probably most important, we gained access to equipment. For years we have laboured under the extreme difficulty posed by New Zealand's policy of providing grant funding for depreciation but not for capital. This approach, unique in the world, placed an onus on employing institutions to provide capital investment in the hope of receiving depreciation on external grants and contracts. Unfortunately, for those researchers working in cash-strapped institutions, no matter how excellent their science, their chance of getting expensive equipment was practically zero. New Zealand science had become capital-starved. Suddenly, with the $10 million injection of capital funding to the MacDiarmid Institute, our laboratories have been boosted and nothing has quite lifted the morale of our researchers as much as that single change. As the electron beam lithography apparatus, the Raman spectrometer, the electron microscopes, the SQUID, and the new lasers (to name just a sample) arrive and are installed, our spirits lift and, with the supercomputer running as well, we can now carry out simulations previously only dreamed of. If, in our wildest moments, we might further dream of fresh new funding to boost our Institute, I think I could fairly represent us all by saying "give us more capital!".

So, capital injection was the first and probably most important change. Second however, came new operating funding, funding which has nearly doubled our combined research income, and which carries with it a solid term of six years with a minimum of administrative burden or anxiety for the researchers. What has that extra funding changed? It has released around 15% of researcher time for our 30 Principal Investigators and resulted in an influx of around 24 additional postdoctoral fellows and students. It has allowed us to fund overseas research visitors, some 35 during year one. It has assisted our researchers and graduate students to attend more overseas conferences and smoothed the way with consumable funding and small equipment and computer purchase. And significantly, it has made possible activities never before considered, like regular video conferencing, like easy visits to each other's laboratories, like financial support for school outreach, the building of important new links with Crown Research Institutes and highly professional communications to the New Zealand and overseas communities on whom we depend.

Third, there is the change in the way we see ourselves and the way we are seen. Travel around our four university and two CRI partners and you will see signs of people belonging to a new entity, not one competitive with their employer, but one working to assist them. You will see research laboratories carrying the Institute label, graduate students drinking coffee from MacDiarmid mugs, researchers putting the name MacDiarmid Institute on their publication bylines. You will notice undergraduates proudly announce that they are associated with the MacDiarmid Institute, and CEOs proudly point out that the MacDiarmid Institute resides within their organization. Abroad, as I found to my delight in the United States this June, people have heard of our Institute (often remarking "yes, that's right, Alan MacDiarmid is a Kiwi, isn't he"). New Zealand physical science is slightly less a quaint curiosity and slightly more a feisty bantamweight. The fact that Rutherford was one of us, just happens to resonate a little more.

It's that intangible aspect to our existence that is the most fascinating, and the least easy to fathom or predict. We don't know yet, what lies ahead. To be sure, we will find occasional frustration and irony. Will our research productivity actually rise in response to our increased funding? And if irony appeals, we might ask why it is that first year physics enrolments took a little dip at Victoria University the very year the Institute was founded, having manifested a steady rise for the four years before we came into existence? Whatever success we scientists might enjoy, we had better make sure we convey some of our excitement to the next generation.

But it's been a great year so far. The science is looking pretty exciting and the people doing it, pretty impressive. I, for one, am feeling quite optimistic and I am picking up on quite a good feeling amongst the team. Looking back on this first year, I think I can see a subtle change in the way we are all functioning as scientists. We are starting to get the feeling that we may be limited in our achievements only by our imaginations.

– Paul Callaghan

Continued from page 1

Traditionally, circuits are etched onto chips by removing material.

What Dr Brown and his team are doing is the opposite. Rather than etching something out, they are building or growing chips upwards from an atomic base, potentially creating devices much smaller.

"The fundamental goal is to develop ways of making nano-scale objects using small balls of atoms," Dr Brown explains.

"This is a bottom-up approach, with small building blocks. With [computer] chips, it's top-down - you start with a flat surface and etch features on it. We're using nano-scale lego blocks."

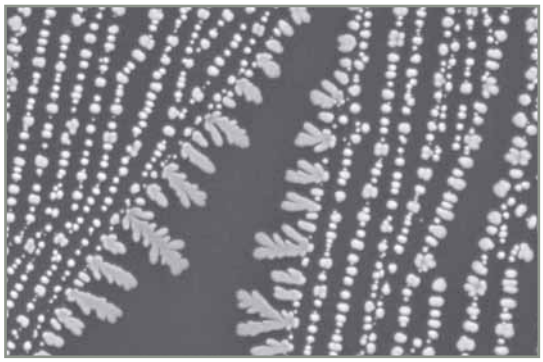
How much smaller than a computer chip could these things be? The flowers can be grown as large as 10 microns, he says - 10,000 nanometers. And to put that in context, a human hair is 100 microns in diameter. The really amazing thing is that the growth of these structures can be controlled down to sizes of a few tens of nanometres.

The potential of the new technology almost defies belief. Dr Brown casually holds out the promise of significantly more transistors to a computer, meaning potentially great leaps in power, but also of producing finely accurate sensors that could be used in anything from "read heads" (computer hard drive devices that sense data) to safety detectors in hydrogen cars to communications.

The science team has already been recognised for its building of nano-wires, linear atomic strands able to carry electricity and therefore behave as transistors. It is the nanoflowers, however, that are likely to provide the next big step in any great leap forward. This is because, though they cannot yet conduct electricity like the wires, the flowers are "self-assembling", their every particle growing to be integral and with a purpose. The flowers are the starting point in growing much more complex self-assembled structures.

Their patterns, with the ability to eventually grow other shapes, offer an extra degree of flexibility, Dr Brown says. Growing in this way, nanoflowers could one day be used to actually build the transistors and other devices, "similar to organic growth processes." "There seem to be infinite possibilities."

There remain big difficulties to surmount, notably the quandary of how to attach nanowires to the nanoflowers, to make them electronically useful. But the Canterbury breakthrough in growing the flowers in a wholly



controlled way is a sufficient advance to make people sit up and take notice.

The trick to the control lies in the speed of the deposition and the total quantity of atomic clusters deposited. "You take a very flat, smooth surface and deposit these small clusters of atoms," Dr Brown says. "You deposit them simultaneously, but controlling the flux and the number ... by varying these two parameters, you can control the number of petals or flowers or whether there are petals at all, and even whether the petals have petals!

"Ultimately we would like to be able to promote formations of flowers, connecting branches and petals in ways to build things like transistors and switches."

The machinery used in the process is itself space age - an atomic cluster deposition chamber with a crucible in which metal can be heated, engendering the release of atomic vapours.

Miss Scott describes how the machinery allows for the depositing of clusters in patterns, and their control. "We're controlling how fast we're putting clusters on a surface and how many," she says. "We can vary coverage from a single layer to a few microns.

"Our big goal is to understand how all these processes - biological, chemical and engineering - work, why all the patterns form and what similar processes control their growth. We've made a lot of progress in the last 20 years and every step is a step in the right direction."

She also expresses awe at the displays showing such remarkable similarities between their atomic growths and nature. "There are patterns," she says, "an underlying symmetry you can see not only in snowflakes but in coral reefs and in pigmentation patterns in seashells."

Dr Brown: "The big thing is controlling the shape and form. The current technology won't be used forever because it will hit the wall. Everyone agrees about that. They just don't know when the wall will appear." At the same time, nano-technology will come through - "we just don't know exactly what it will be or how long it will take to produce."

He pauses before adding: "A breakthrough with the nanowires - a commercial prototype with the university perhaps close to commercial production - could be on the cards within a couple of years."

"Making use of more complex self-assembled structures like the flowers could take a little bit longer ... maybe five years."

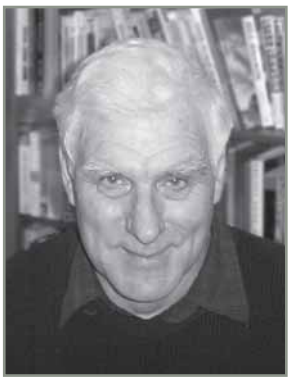
Continued from page 1

Its birefringence is so large that a calcite crystal placed over a dot on a page will reveal two distinct images of the dot. One image will remain fixed as the crystal is rotated, while the other image will rotate with the crystal, tracing out a small circle around the other dot.

Birefringent materials exhibit optical activity because light that is polarised in one direction travels through them at a different speed to light of another polarisation. Organic crystals are commonly used, but Professor Hodgkinson's pioneering achievement is to make birefringent and chiral thin-film coatings using inorganic chemicals, a range of metal oxides and silicon. And we are talking really thin films - each of the structures is only a few nanometres thick, built up from columns of deposited material that stand on the substrate either perpendicularly or at a specific angle.

"The method we use to make birefringent material involves evaporating the material, either one of the metal oxides or silicon, and depositing about two nanometres of it on to the substrate. Then you turn the substrate around by 180 degrees and deposit the next layer from the opposite side, and just keep doing that. The basic structure is a bit like plywood, which has thin layers of wood with the grain going one way and then a layer with the grain at right angle. That builds up strength in the material, because you have to break it across the grain. Nature tends to do that sort of layering for strength, and in the case of the beetles and our coatings, it's there for the optical qualities."

Once Professor Hodgkinson's team had developed the method, which is now known in nano-circles as serial bideposition, they went another step further. "We did some calculations and realised that the critical thing was to have high birefringence in each of those layers, and we thought that that should work for chiral coatings."



Prof Ian Hodgkinson, Department of Physics, University of Otago

Chirality is the technical term for handedness. An object is chiral if it exists in two distinct states that are identical upon reflection, but are not the same through any kind of rotation. Chirality is known from chemistry, and many sugar molecules come in two differently handed versions.

Chirality on a nano-scale is achieved using the same method of depositing vaporised material in layers, but in this case there's literally an added twist. As the material, say silicon, is deposited from one side and then from the opposite side, the substrate is turned around by a few degrees each cycle. The end result is a double helix, a column that looks like the miniature version of a double-start screw. And depending on the direction of the twist, the column is either right- or left-handed.

Again, such chiral structures can also be produced through liquid crystals, but Professor Hodgkinson is focusing on inorganic materials because they produce essentially permanent structures which makes them attractive in certain optical applications. One further convenience is that the direction and rotation thickness of the columns' helix can be adjusted during the deposition process simply by moving the substrate.

The main optical quality of such chiral structures is that they transmit circularly polarised light of one handedness and reflect the other. "If you use the metal oxides, it will produce chiral coatings that work in the visible part of the spectrum, and with the silicon, we are producing materials that work for the near infrared."

Interestingly, the first inorganic chiral optical coatings were produced way back in 1959 by depositing fluorites on to rotating substrates. However, Professor Hodgkinson says this research turned out to be about 40 years ahead of its time. "In the intervening period our knowledge of both the mechanics of thin film growth and the variety of nano-structures that can be achieved increased substantially," he says.

And so have the possible applications for such coatings. They range from filters and reflectors to detectors and sources of circularly polarised light. Already, a double-layer antireflection coating is used to select the polarisation direction of laser systems, birefringent materials are used in CD players and cameras, and they produce some of the most brilliant colours for displays and packaging material. "But the most profitable application," says Professor Hodgkinson, "is likely to be in telecommunications. If you put a chiral rib around an optical fibre it essentially doubles the information-carrying capacity of the optical fibre."

And as for the beetles, Professor Hodgkinson says "they are up to second-year optics at university".

"The gold beetle *P. resplendens* would top the class. It has a left-handed structure in one layer, and when the light hits that the left-handed light is reflected and the right-handed light goes through. Then it has a half-wave birefringent plate, so the light gets changed from right to left, and when it comes to the next left-handed layer it gets reflected, and so on - the result of it all is a brilliant metallic gold colour."

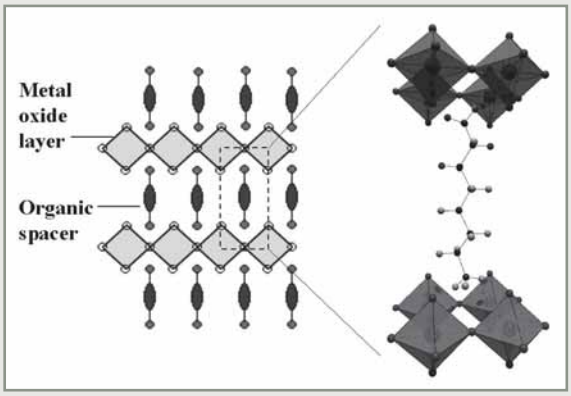
Hoiho - pushing the boundaries

by Bridget Ingham

Exploring a new class of material is rarely easy, and understanding the principles behind it is often even more difficult. In many cases the observations scientists can make about a material relate to the properties of it as a whole, but when it comes to relating this to the basic atomic structure, difficulties arise. How do small changes to the structure affect the material? Why are certain structures stable in particular regimes and not in others? How can the electrical properties be improved?

High-performance computing is one tool available to today's scientists which can aid in understanding how the basic components of a material can affect the observed properties. In the last issue of Interface (February 2003) a series of examples of current research were detailed and how the recent availability of the MacDiarmid Institute supercomputer has enormously assisted these.

The supercomputer is housed and maintained by the Applied Mathematics team at Industrial Research Limited. It has been named "Hoiho", in keeping with that team's tradition of naming computers after native New Zealand birds.



A preliminary structure of our layered material, as calculated using Hoiho; related to a schematic diagram of the system.

My involvement with Hoiho began as a student "guinea-pig" mid-way through 2002. Like learning any new skill, the task was daunting at first but well worth the effort of becoming familiar with the ins and outs of the system. As part of my PhD study, supervised by Prof. Jeff Tallon, I have used the supercomputer to calculate the structure and other properties of a new class of materials consisting of metal oxide sheets separated by organic spacer molecules. These results have proven extremely useful in confirming the properties of the materials as determined experimentally and also to predict their trends. We hope to use the supercomputer in the future to study compounds that are more complex than could be accommodated by earlier systems.

For further information please contact Shaun Hendy (s.hendy@irl.cri.nz).

MacDiarmid Institute sponsors Awhina programme

Every Wednesday five mentors of Maori or Pacific Island descent who are currently enrolled in undergraduate or graduate science programmes at Victoria University of Wellington travel to Porirua College to work with students, assisting them with their science study. Their work forms part of the Awhina Programme, a mentoring scheme aimed at getting more Maori and Pacific Island students into science careers. This year the number of students taking part in the scheme at Porirua College has doubled to 25. One of their science teachers, Lose Samasoni says that the scheme provides students with the chance to extend themselves, to ensure that they realise their potential. It has resulted in an improvement in grades and attitudes to school, not only in science, but across the board. This year the MacDiarmid Institute is supporting Awhina though major sponsorship funding, part of its "outreach" activities which are aimed at encouraging young people into science. Other MacDiarmid outreach programmes are also in place through Canterbury, Otago and Massey universities.

Porirua College year 10 student Robert Fruean and Victoria University science mentor Errol Cameron check out what flame colours are made from different elements.

Story adapted from an article by Miriam Meister, Porirua City News.
Photo: Dionne Ward

students who get out and stumble across something and hopefully there are few entrepreneurs around.

Do you get the bright ideas in the university environment because the brief is more open, the mind is allowed to wander.

No, it comes afterwards. It's the kids who afterwards have nothing to do. For example start with Australia. You have bunch of convicts and you set them loose. They've been in jail and now they get out there. And look what they did with the country. You just have to get people in a place where they have resources and they need something to do. The ones that really like technology will say, "I really hate my computer - this stupid thing - I can make this better."...

Visit the web address http://www.bell-labs.com/user/apenzias/ for more information on Arno Penzias.

Virtual meetings by video-conference

Because the MacDiarmid Institute ranges over several institutions the practice of holding seminars by videoconference has become a key activity. The seminars are held monthly and participants are Victoria, Canterbury, Otago, and Massey, and Industrial Research Ltd in Lower Hutt. Overseas video links have been made with universities in the USA and the UK. The work presented is at the forefront of international research while the visual communication provides a sense of unity to the Institute.

See Issue No 1 (February) for previous videoconference seminars.

Speaker	*Topic*
Dr Pablo Etchegoin *Blackett Laboratory* *Imperial College*	*Surface Enhanced Raman Scattering (SERS) in Single Molecules*
Dr Shaun Hendy *Industrial Research Limited* *Lower Hutt*	*Atomistic Materials Modelling*
MacDiarmid Institute staff meeting	*Chair Paul Callaghan*
Professor Jack Crow *Director of the National High Magnetic Field Laboratory, Tallahassee, Florida*	*High Magnetic Fields: an Overview of World Facilities and Science Opportunities*
Dr Richard Blaikie *Deputy Director of the MacDiarmid Institute* *University of Canterbury*	*Negative Refraction: Fact or Fiction?*

New honours for Alan MacDiarmid

Professor Alan MacDiarmid, from whom the Institute takes its name, has joined the circle of New Zealand scientists who have been made Fellows of the Royal Society of London. There are now 39 New Zealand scientists, including Ernest Lord Rutherford, to have received this title. Alan also received a Doctor of Science, honoris causa, from Cambridge University on June 23rd, 2003.

Alan MacDiarmid is the Blanchard Professor of Chemistry at the University of Pennsylvania and James Von Ehr Distinguished Chair in Science and Technology at the University of Texas in Dallas. He was jointly awarded the 2000 Nobel Prize in Chemistry with two other colleagues, Alan Heeger and Hideki Shirakawa for work on conducting polymers following the discovery that plastics could be made to conduct electricity. In 1999 Alan was given an honorary doctorate by Victoria University of Wellington. In 2000 the Royal Society of New Zealand awarded him its top honour, the Rutherford Medal. He was elected an Honorary Fellow of the Royal Society of New Zealand in 2001. In 2002 he became a Member of the Order of New Zealand, which is limited to 20 living people and is the highest honour that his home country awards.

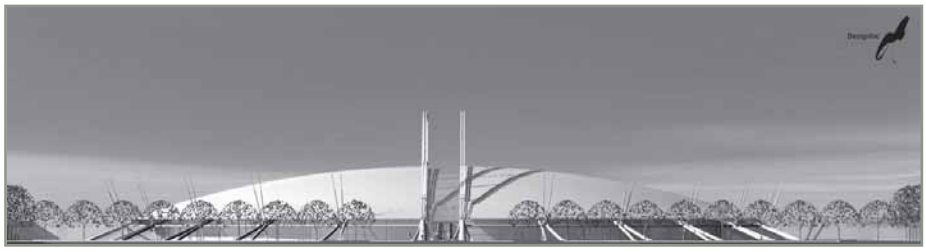
Alan MacDiarmid FRS

Professor MacDiarmid's current scientific interests are centred on the most technologically important conducting polymer, polyaniline. He is especially interested in those isomeric forms which might contribute to the greatest degree in promoting high conductivity and enhanced mechanical properties in polyaniline.

The 75th birthday of Alan MacDiarmid was celebrated on the 14th of April this year.

The coming of the synchrotron! by Graham Hawkes

The end of an era is looming for many of Australia's so-called "suitcase scientists", but their colleagues in New Zealand should prepare to pack their bags for Melbourne.



An artist's impression of the synchrotron to be based at Monash University's Clayton Campus, Melbourne

In less than four years, Australia will have its own synchrotron - a $NZ240 million science research tool that is becoming the "default" method of research for some of the hottest fields in science.

A direct result will be an end to years of globe-trotting expeditions by many scientists from this part of the world, forced to travel to the northern hemisphere to access synchrotron facilities.

To be based at the Clayton campus of Melbourne's Monash University, the new synchrotron will be made available for New Zealand scientific research, albeit on a merit-only basis.

Associate Professor James Metson, the man appointed as New Zealand's representative on Australia's National Scientific Advisory Committee (NSAC) for the synchrotron project, says our scientists too can expect to travel less than in the past as a result of this project.

However, it will be Australia's flourishing synchrotron-based research programmes that will benefit most following the synchrotron's completion in 2007. Currently, as many as 100 teams of researchers from around Australia travel to synchrotrons in other countries, at significant cost and inconvenience associated with this. Typically, they would wait months to gain a few days' use of an overseas synchrotron, and work around the clock when they finally get access.

Dr Metson is predicting strong interest in the synchrotron from New Zealand scientists, and a users meeting is planned to be held in September this year. The meeting will familiarise potential New Zealand users with the design and capabilities of the Australian ring, and discuss priorities for New Zealand's use of the facility.

"I would hope to get 50-60 people to the meeting," says Dr Metson. "But it's important to remember that we have some distance to go in developing a New Zealand user community and no guaranteed access to the synchrotron. We do have 'a seat at the table' however, and what will happen is that over the next few years, the model for New Zealand's involvement will be developed through the Ministry of Research, Science and Technology."

Dr Metson, who frequently uses overseas synchrotrons in his work with the University of Auckland's Department of Chemistry, and the MacDiarmid Institute, says there is "considerable goodwill" towards our science community from across the Tasman. He doesn't believe it will be a struggle for New Zealand scientists to get access to the synchrotron.

"I have every confidence that New Zealand science will be competitive when it comes to the allocation of beam-line time at the synchrotron. After all we are already successful in obtaining time on European and North American facilities. Provided we have a reasonable access mechanism in place, New Zealanders will get their opportunities."

"I don't think there are any quick answers in science, but what is important if you look at the Australian examples, is that critical results are being obtained from synchrotrons."

Examples of New Zealand research projects that could benefit from the Australian synchrotron include work in the area of molecular bio-discovery and bio-molecule crystallography. Given the interest here in nanotechnology, and electronic materials material science will be another likely candidate, Dr Metson says.

However, he says no one should have any expectations that New Zealand's access to the Melbourne synchrotron will bring "Eureka!" type discoveries.

"I don't think there are any quick answers in science, but what is important if you look at the Australian examples, is that critical results are being obtained from synchrotrons.

"That doesn't mean a magic answer came from a single visit. It means that the groups involved developed their science based on the results obtained from the synchrotron, and that those results were critical in, for example, analysing the structures of the molecules they were making, and the

molecules they were targeting."

A synchrotron produces fine beams of extremely bright light across a spectrum from the infra-red to the hard X-ray region. This radiation can be used to investigate the structure of molecules and matter, and is used in drug design, medical imaging, materials research, fundamental spectroscopy and more.

However, of itself, the synchrotron's intense light source is of no use, says Dr Metson.

"To use that radiation for applications such as protein crystallography, x-ray lithography, or various material science applications based on crystallography and x-ray absorption studies, you require dedicated beam lines and instrumentation to utilise that radiation.

"The Melbourne synchrotron will have the capacity to support more than 30 such beam lines, and one of the major tasks facing the NSAC will be to match these beam lines to the demand for specific applications."

While the 2007 launch of the synchrotron can't come soon enough for the scientific communities here and in Australia, that date is "frighteningly close" according to Dr Metson.

"It is actually a very tight timeline and there are many considerations," he says, "including the selection of the initial eight or ten beam lines and ensuring that they are a very good match to the user community."

Exactly how the beam line applications will be selected is among the detail yet to be worked out.

"The NSAC certainly has an oversight role in that, but it's also clear that you cannot answer to everybody's wishes in the configuration so that some tough decisions will have to be made," he says.

"On the other hand, there are perhaps 10 ports to be filled initially from a potential 30, so there's considerable opportunity for future growth. This is a very rapidly developing area of science, and we cannot tell in 2003 what new techniques will be cutting edge by the time 2007 comes round."

Dr Metson says New Zealand's exact role will evolve over time, but he is already adamant that this country should not restrict itself for example to the development of a single beam line.

"There have been suggestions that New Zealand should build a beam line by itself, but that would be the most restrictive thing we could do. This country's interests lie across at least seven of the 10 most likely beam line applications. What is more important for New Zealand is the breadth of access to the synchrotron, rather than any concept of ownership of a specific facility or instrument," he says.

However, while there is much detail yet to be worked out, Dr Metson is in no doubt about the overall value of the Melbourne synchrotron to New Zealand's scientific community.

"Science advances most easily and most rapidly when you have many minds contributing - when you have international collaboration. Synchrotrons are ideal vehicles for this.

They provide a working laboratory where scientists from many different disciplines mix. You can have protein crystallographers working directly alongside infrared spectroscopy specialists and alongside people interested in environmental science and so on.

"I've long been an advocate of New Zealand's wider involvement in these sorts of facilities because I think it's not difficult to see the potential and the power that is there, and to see the need for us to use these techniques more widely," Dr Metson says.

"Given New Zealand's geographic location it is critical that New Zealand scientists - particularly our younger scientists who don't have international collaborative networks set up, or are just developing them - should have some means of ready access. The Melbourne facility will provide a great opportunity for that."

European Research funding - the 6th Framework Programme

by Jeff Tallon

In early June I participated in a Ministerial Delegation to the European Commission for briefings on the EU 6th Framework Programme (FP6) and to explore possible R&D relationships between NZ and the EU within FP6.

FP6 is a response to the perceived need to establish EU competitiveness with the USA and Japan. Like NZ, the EU is worried about losing researchers abroad, fragmentation of R&D and the need to create wealth from research investment. To tackle these issues the EU aims by 2010 to (i) increase R&D investment from 1.9% of GDP to 3.0%, (ii) increase industry contribution from 50% to 66%, and (iii) increase involvement of SMEs to 15% of funding.

FP6 will spend EURO 17.6 billion over 4 years in 7 theme areas. These are: Life sciences, genomics and biotech, Information society technologies, Nanotechnologies, multifunctional materials, Aeronautics and space, Food quality and safety, Sustainable development, and Citizens and governance in a knowledge-based society.

Brussels Ministerial Delegation in the Board Room of the NZ Embassy in Brussels: Tom Barnes, Martin Holland, Rick Peterson, Patricia Anderson, Werner Friedrich, Christine Cheyne, Ian Whitehouse, Jeff Tallon, Diana Hill and Chris Kirk.

Proposals are reviewed by Evaluators of which there are currently some 41,000 registered. The Commission wants to raise the standard of Evaluators and is actively seeking leading researchers from non-EU countries to add to their pool. Participation by NZ researchers would be viewed as a very positive first step in developing EU/NZ links under FP6.

EU-funded programmes must be multi-national - FP5 programmes typically involved at least nine parties from five countries and the number of each will increase under FP6. Participation in any programme is on an open competitive basis and, for non-EU countries, must be essential to the programme. However, it is likely that such non-EU involvement where properly argued could actually strengthen a bid. FP6 is already underway, the first round of calls for bids in specific output areas have closed but new calls will be announced within the next 6 months, and again next year. Clearly, partnerships for bid proposals will only be developed after extensive interaction and negotiation which may take years. The success rate for proposals is 10 to 25%.

Following Helen Clarke's visit to the European Parliament and Commissioner Chris Patten's visit to NZ in April 2003 there is a clear political commitment by the EU to strengthen EU relationships with NZ. Research and the Knowledge Society have been emphasized as major common interests and it was in this context that the Delegation visited the European Commission 3-6 June. It comprised the Minister Pete Hodgson, Tom Barnes (Auckland U., DVC(Research), FRST), Martin Holland (Canterbury, European Studies), Rick Petersen (MoRST), Patricia Anderson (HRC, policy), Werner Friedrich (IRL, German/NZ science coordinator), Christine Cheyne (Auckland, social policy/ citizens and governance), Ian Whitehouse (LandCare), Jeff Tallon (IRL/VUW, nanotechnology), Diana Hill (Global Technologies Ltd., Marsden Fund, food science), Chris Kirk (Massey, ICT).

For two days we were briefed by the directorates of each EU research theme area and on the last day we had individual meetings related to our specialty areas. I met with Dr Bernd Reichert representing nanotechnology and he was keen to establish links with the MacDiarmid Institute.

There are many potential levels of engagement with EU research programmes. I list these in order of increasing formality of relationship.

(i) ad hoc collaboration with European research institutions - no funds transfer;

(ii) exchange visits for up to three years through Marie Curie Fellowships and Erasmus Mundus Scholarships - http://europa.eu.int/ mariecurie-actions;

(iii) manager-to-manager information exchange between CoRES and EC theme directorates;

(iv) registration of leading NZ researchers as EU Evaluators;

(v) formal appointment through competitive bidding of NZ research teams to EU Networks of Excellence. Only management and travel costs will be funded from EU, not research;

(vi) co-bidding of NZ research teams for IP (read RFI) or STREPS (read NERF) programmes as a fully-funded participant, including research and overhead costs. However, it was repeatedly emphasized that participation for a non-EU research team must be

Victoria University recruits Pablo Etchegoin

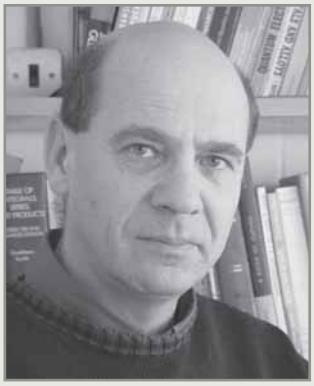
In September, our programme of research in electronic and optical properties of materials (Theme II) and in soft matter (Theme IV) will be significantly boosted by the arrival of Dr Pablo Etchegoin from London. Pablo, who comes originally from Argentina, did his PhD at the Max Planck Institut für Festkörperforschung and the University of Stuttgart under the supervision of Professor Manuel Cardona. He is currently a senior lecturer in physics at Imperial College, London, leading a research programme at the interface between physics, nanotechnology and the life sciences. His interests are broad, covering both theoretical and experimental aspects of optical spectroscopy and light scattering. Pablo's arrival will certainly enhance physics at Victoria University, says MacDiarmid Institute Director, Professor Paul Callaghan. "He will arrive just in time to help establish a new physics research laboratory at Victoria University's Kelburn campus, a laboratory which will also be home to Professor Joe Trodahl and Dr Ben Ruck, making a formidable team of researchers. I had the pleasure of visiting Pablo in his laboratory at Imperial College last month. He's a great catch, and we are delighted that he is making this move to New Zealand".

Pablo Etchegoin, on the Terrace at Imperial College, with the Albert Hall in the background.

Mark Warner wins Agilent prize

Professor Mark Warner, one of the MacDiarmid Institute's International Advisory Board members, has won the 2003 European Physical Society's premier Hewlett Packard/Agilent prize, an award of significant value that counts amongst its previous winners a galaxy of subsequent Nobel Laureates.

Mark, who is Professor of Theoretical Physics at the University of Cambridge and a Fellow of Corpus Christi College, was born and educated in New Zealand and maintains strong scientific and personal links here. He is one of the world's leading physicists working in the field of soft condensed matter and has developed the definitive theories on liquid crystalline and other ordered, non-linear elastomers. His book with Eugene Terentjev, "Nematic Elastomers" is due to be published by Oxford University Press this month. As a theorist, Mark works closely with experimentalists, for example, collaborating with Professor Heino Finkelmann of Freiburg University, to develop models which explain soft elasticity and mechanico-optical coupling in elastomers developed in Finkelmann's laboratory.



Professor Mark Warner

Mark Warner travels to New Zealand at least once a year, visiting friends and family and keeping in close touch with soft condensed matter physicists within the MacDiarmid Institute. Each January or February, research students in the Magnetic Resonance of Materials laboratory at Victoria University of Wellington can expect to have an in-depth conversation about their research project. One of Mark's former Cavendish and Corpus physics students, Daniel Corbett, is currently working towards an MSc at Victoria University.

Mark has previously been awarded the Maxwell Medal and Prize of the Institute of Physics and the Humboldt Research Prize. Last year he was elected an Honarary Fellow of the Royal Society of New Zealand. He is one of our most distinguished scientists living abroad.

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