

Materials Monthly

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July 2000

Centre for Science and Engineering of Materials

The ANU BSc in Materials



"The ANU BSc majoring in materials would have been a great way for me to combine my interests in maths, physics and biology," says Tim Sawkins, from the Applied Maths Department, Research School of Physical Sciences and Engineering.

Making Materials Scientists

Graduates from the Faculties are an important source of post-graduate students within ANU. In the past there has not been a clearly defined undergraduate stream in materials science. This has diminished the pool of students available to progress to higher degrees in the area and may help to explain why the current number of CSEM postgraduate students totals only six.

To turn this tide and make materials science a more visible option to prospective post-graduate students we have revamped the undergraduate program in materials science. By providing students with a course framework and outlining the variety of course options

and research opportunities available, we have made it much easier for them to see and understand how an undergraduate stream in materials could work for them.

The 'new' course relies on existing units from both the Faculty of Science and the Faculty of Engineering and Information Technology. The variety of possible disciplinary combinations will make this degree very attractive to prospective students.

www.anu.edu.au/CSEM

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Direct from the Director

Phil Evans, Forestry Department

Welcome to the first edition of *Materials Monthly*, a newsletter that replaces the green weekly news sheet that got us noticed, but proved less than popular in some quarters. This newsletter is designed to keep you and the broader community up-to-date with what is happening in materials research at ANU.

The major focus of CSEM's activity in the last month has been the development of an undergraduate program in materials science. This program has now been accepted by Faculty and will commence next year. The program will operate under the aegis of the Faculty of Science but it contains a large number of materials units from the Faculty of Engineering and Information Technology. There is also room in the program for students to do courses in other faculties and even other universities eg. UCAN, ADFA, CIT.

The program has been put together using existing courses but to give it balance and to introduce students to the breadth of materials studied at ANU we have created a three point (26 lecture) first year unit called *Issues in Materials Science*. This course is designed to give students an understanding of why scientists study materials and how fundamental information on the structure and properties of materials can lead to the development of new and improved materials with interesting technological applications.

We will be promoting the materials program heavily in the coming months. If successful the program will, in future years, deliver high quality honours and postgraduate students to your area. However, such an outcome will require your support in terms of willingness to give a guest lecture (for the *Issues* unit) and further down the track, supervise Honours students. I hope you will get behind this new initiative and please contact me with comments and offers of support.

Materials on Campus: *what's happening in RSBS?*



Plant Cell Biology Cell Wall and Cell Shape

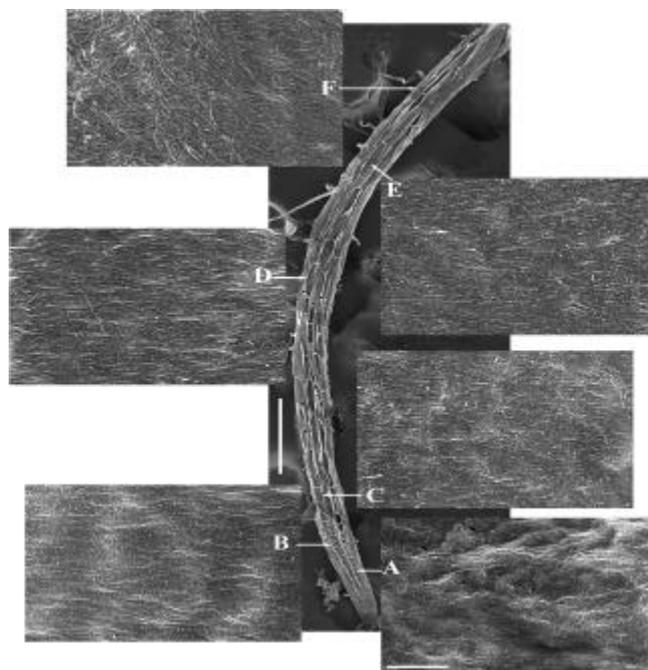
This group aims to identify the cellular machinery that makes cellulose - a key component of the plant cell wall and a key component of cotton and wood fibres. The group uses mutants of the model plant *Arabidopsis* to understand how plants make the major carbohydrates of their walls and how the properties of those walls control shape into which plant organs grow. Developing the ability to change cell wall composition is central to this work and has potential applications in producing improved cotton and wood fibres.

Cytoskeleton and Cell Shape

This group studies the cytoskeleton and components of the cell wall, and the control of plant cell shape. Cells are the building blocks of plants so cell shape is a crucial aspect of plant performance. Features like stem length and leaf shape, which depend on the cumulative shape of the cells they contain, affect the ability of plants to compete under prevailing environmental conditions.

The group is using molecular-genetic approaches to identify the genes, and the proteins they encode, that regulate the cytoskeleton and wall mechanical properties in *Arabidopsis thaliana*. They also use the latest technology in microscopy, including green fluorescent protein transgenics and field emission scanning electron microscopy, to characterize cytoskeletal, membrane and wall properties. More recently, the group has been examining the responses and adaptations of seedlings to mechanical stresses, water logging and the stress hormone ethylene.

Cell wall texture in cells at various developmental stages in a root of Arabidopsis thaliana, our model organism for understanding the molecular basis for the mechanical properties of plant cell walls. The images are produced by field emission scanning electron microscopy and show the most recently deposited cellulose microfibrils embedded in a matrix of pectic polysaccharides. Organization of cellulose microfibrils and their interaction with xyloglu-



cans appear to be critical for determining the mechanical properties of plant cell walls, which govern the rate and direction of root expansion. We are currently investigating how mutations in genes that control certain aspects of cell wall synthesis alter the texture of walls.

1999 Research Highlight

Combining field emission scanning electron microscopy and genetics, the Group demonstrated that it was time to rethink the long held belief that cortical microtubules control plant cell shape by aligning cellulose microfibrils. Isolation of microtubule and cellulose mutants by the Group over the past decade has finally allowed the testing and rejection of the accepted paradigm explaining cellular control of plant cell wall formation.

Welcome

Applied Maths welcomes **Dr. Satomi Ohnishi** from the National Institute of Materials Research, Tsukuba. Satomi will be working in the Surface Forces Group.

Applied Maths also welcomes **Dr. Fiona Meldrum**, a visitor from Queen Mary and Westfield College, University of London until mid-September. Fiona is collaborating with us on aspects of biomineralisation in sea-urchins.

Papers, papers, papers...

- J. Physics: Cond. Mat 12, 5233-5250 (2000). *High-field noise in metallic diffusive conductors*, Frederick Green (CSIRO) and Mukunda P Das (ANU)
- J. Physics: Cond. Mat 12, 5250-5274 (2000). *Coulomb screening in mesoscopic noise: a kinetic approach*, Frederick Green (CSIRO) and Mukunda P Das (ANU)
- Wood and Fibre Science, 32, 37-43 (2000). *Adverse effects of heartwood on the mechanical properties of wood-wool cement boards manufactured from radiata pine wood*. Kate Semple and Phil Evans (ANU)
- Forest Products Journal, 50, 59-64 (2000). *The effects of different kerfing and center-boring treatments on the checking of ACQ treated pine posts exposed to the weather*. Phil Evans, Robin Wingate-Hill and Simon Barry (ANU)

Jobs, jobs, jobs...

High-Pressure Structural

A 3-year postdoc position is available at the University of Edinburgh to work on "Novel high-pressure techniques applied to metals, semiconductors, thermoelectrics and new materials" under the direction of Dr Malcolm McMahon, using both laboratory-based and synchrotron x-ray facilities.

Further info: www.personnel.ed.ac.uk/FURPARTS/Acrel/306394.html

JCMS Molec Bio and Biochemistry

A postdoc position to work on the regulation of nuclear import of HIV-1 gene products, the characterisation of novel pathways, and translation of this in the long-term into possible anti-HIV-1 therapeutic approaches. The successful applicant should have a strong molecular biological background, knowledge of protein biochemistry and experience in microscopic and/or immunofluorescence techniques.

<http://jcsmr.anu.edu.au/data/jobs/jobs.html>

Forests Consultancy

Students/graduates interested in consultancy or contract work on the dendrochronology of camphor laurel for State Forests of NSW, please contact Cris Brack, Dept of Forestry, on 6249 3535

NZ Forest Research Institute Ltd

An opportunity has arisen for a Project Leader, to lead, manage and market the programme in wood composites. The position is ideally suited to an experienced research scientist seeking to expand their career into science management and business development. Forest Research is located in Rotorua in the central North Island of New Zealand. Contact Phil Evans on 6249 3628 for more info.

RSC Biological Chemistry

Four postdocs to be filled in the following research groups: Protein Synthesis and Evolution; Biochemical Reactions and Molecular Recognition; Nuclear Magnetic Resonance; Protein Crystallography and Engineering. Collaborative positions in two or more groups will be considered.

RSC web site: <http://rsc.anu.edu.au/>

Wood Structure Scientist

Forintek Canada Corp., Sainte-Foy, Quebec
Responsible for conducting research; working with primary and secondary wood industry and building industry; proposing, planning, budgeting and identifying funding sources for research projects. The position leads project teams consisting of other scientists, technologists and support staff, and serves on other teams.

Further info: deirdre.moore@qc.forintek.ca

Materials Science Missing the Forensic Frenzy

Around the globe materials science course enrolments, even at the prestigious universities are falling. Meanwhile other more fashionable courses with a significant proportion of materials units are booming. One very hot example is forensic science.

The Canberra Institute of Technology's new Bachelor of Applied Science in Forensic Investigation, developed in consultation with the Australian Federal Police and the NSW Police Department is currently full of budding young investigators. The course only began last year and already there is a lengthy waiting list.

The University of Technology, Sydney, also offers a Bachelor of Science in Applied Chemistry – Forensic Science. This BAppSci has tended to be the training ground for the AFP's new crime scene investigators. The course is undertaken in the same building as the UTS BAppSci in Materials and the course listings include many subjects which would naturally form part of a BSc majoring in materials at the ANU.

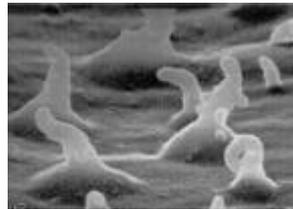
Materials science plays an important role in most forensic investigations and several materials scientists at ANU have been called upon to provide expert analysis and advice to the AFP. Closer collaboration with the AFP and the new CIT course may see the ANU BSc recognized as the training ground for crime scene investigators specializing in materials. Such exciting opportunities highlight the strength and flexibility of materials science at the ANU.

Some ANU forensic/materials scientists

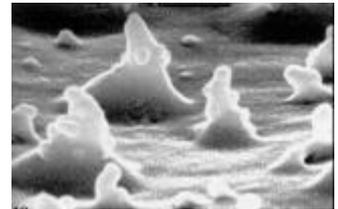
Adrian Gibb's lab in RSBS has been involved in a long term ANU project to DNA finger print cannabis varieties. Rod Peakall's lab in BoZo is continuing the research.

Phil Evans of the Forestry Department is a member of the National Institute of Forensic Science and has been involved in many cases requiring the identification of wood and fibre.

Roger Heady from the EMU is regularly called upon to assist with gun shot residue analysis.



Black cypress pine



White cypress pine

White cypress pine wood is so similar anatomically to that of black cypress pine that it is not possible to separate them using conventional wood anatomy features. However, when the warty layers lining internal walls of the woods are compared, using high resolution scanning electron microscopy, a difference can be seen. Warts in white cypress pine are typically upright and conical while those in black cypress pine are generally bent and tubular. Such differences between wood species have been used to support evidence in criminal cases.
Images by Roger Heady, EMU.

For Your Diary

- **Polymer Electrolytes**, Noosa, Australia
www.chem.monash.edu.au/electrolytes/ispe7 Aug 6-11
- CSEM seminar by Ian Jackson, RSES
High-temperature viscoelasticity of geological materials with applications in seismology
Jaeger Seminar Room, RSES, followed by refreshments Aug 9 at 4.00pm
- ANU Electron Microscopy Unit Update/Discussion
RSBS Bioinformatics Seminar Room Aug 10 at 12.30pm
- **International Symposium on Ecomaterials**
Ottawa, Canada, Mostghaci.hamid@ic.gc.ca Aug 20-23
- ANU Open Day Sept 2

Communication News

ANU Undergraduate Handbook 2001 - the Materials Science Entry has been re-vamped

Australasian Science - "The Multi-Skilled Materials Scientist" will appear in the next edition

National Schools Mailout & Canberra Careers Market - CSEM promotional material distributed

The Green Machine ANU/CSIRO Science Education Centre - discussions have begun with Green Machine staff about the possibility of developing a materials science workshop for senior high-school science students and teachers.

Any feedback and ideas would be greatly appreciated, particularly on interesting materials devices/demos/experiments that could be incorporated into a student/teacher workshop.

CSEM

Centre for Science and Engineering of Materials

Faculties

Department of Chemistry
Department of Engineering
Department of Forestry
Department of Geology
Department of Physics

Institute of Advanced Studies

Research School of Biological Sciences
Research School of Chemistry
Research School of Earth Sciences
John Curtin School of Medical Research
Research School of Physical Sciences and Engineering

Institute of the Arts

Materials Workshop

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Contacting CSEM

Phil Evans, Director

Phone: +61 2 6249 3628

Email: phil.evans@anu.edu.au

Jenny Edwards, Promotions Officer

Phone: +61 2 6249 3525

Email: jennifer.edwards@anu.edu.au

Amanda Cook, Administration Officer

Phone: +61 2 6249 3525

Email: amanda.cook@anu.edu.au

Fax: +61 2 6249 0746

Postal: Department of Forestry, Australian National University, ACT 0200

Location: Department of Forestry, Wood Sciences Building, Linnaeus Way, ANU

We welcome any feedback, enquiries or contributions.

Please let us know if you wish to be added to our electronic or postal mailing lists.

www.anu.edu.au/CSEM