



Professor Allan Snyder

Centre for the Mind

The Centre for the Mind is a joint venture of The Australian National University and the University of Sydney. The Centre is a recognised brand internationally, known by millions of people around the globe. It is mentored, through its Board and Advisory Council by Australia's most influential and creative minds, including Phillip Adams, Nobel Prize laureate Peter Doherty and film director/producer Baz Luhrmann. It has received worldwide media focus, including dedicated television and radio profiles; documentaries by the British BBC; the American ABC and NBC; the Tokyo Broadcasting System; and the Australian ABC. It has also featured in extended features in the New York Times; the Times of London; many other leading international media publications, and the esteemed scientific journals Nature and Science. The Centre's website (www.centreforthemind.com) provides a comprehensive overview of the Centre and its achievements. The Centre also completed its first five-year review in December.

The Centre's research focuses on creativity and human potential, with a view to benefiting society. The Centre's research on revealing the mind's hidden skills using transcranial magnetic stimulation was published in the Journal of Integrative Neuroscience. This work was reported in major features by the New York Times, The Times of London, Der Spiegel, The Australian Magazine, ABCTV USA, Discovery (NBC TV Documentary), and many others. A new area of research was initiated about nonconscious problem solving (the "let me sleep on it" phenomenon) with a paper in Psychological Science. In addition, the Centre formulated an information theoretic approach to evaluating a person's creativity – the Creativity Quotient, with a paper in the Creativity Journal. Finally, the Centre completed a study on the nonconscious evaluation of angry faces using transcranial magnetic stimulation. A Mind Lab has been established for brain/mind investigations jointly with the Research School of Biological Sciences.

Professor Snyder opened Sony's International Learning conference in Bologna, Italy in April and returned to Bologna in October as part of the 2004 Marconi Prize Ceremony which was awarded to the founders of Google. He also gave the opening address at the Mind States conference in Oaxaca, Mexico and spent time with Joy Hirsh and her NYC brain-scanning centre, as well as with Oliver Sacks, the Foundation Fellow of the Centre. In addition Professor Snyder gave the opening address at the NSW Tele-health Symposium in August and a dinner address at the Business and Sustainability Summit, held in Sydney in November.

The Centre again received global media attention, including worldwide and Australian television features, extended features in popular press and documentaries devoted to the Centre's research.

Examples include:

- USA's ABC 20/20 with Barbara Walters
- The Sydney Morning Herald's the sydney magazine
- CNN's Anderson Cooper 360° program

- New Scientist cover story
- Discovery Channel documentary Savants
- Channel 4 (UK) Documentary
- Japanese documentary by Tokyo TBS
- England's The Sun newspaper
- Discover Magazine

Staff (ANU and University of Sydney)

Professor and Head of Centre
Allan Snyder FRS FAA FTSE

Professor and Associate Director
(Douglas) John Mitchell

Postdoctoral Fellows
Magali Batty (from November)
Maria Hennessy (leave)

Visiting Fellow
Terry Bossomaier

Research Associate
Homi Bahramali (from July)

Research Assistants
Angela Yates
Toby Hawker

Projects
John McDougall

Web Development, Event Management
Sylvia Bembo

Departmental Administrators
Maria Gidis (until September)
Edwina Fingleton-Smith (from October)

Publications

Legend: * External to the University
Member of another area of this University other than this School
† Author having a joint appointment across departments within the School

Publications in Refereed Journals

Bossomaier, T. and Snyder, A.
Absolute Pitch Accessible to Everyone by Turning off Part of the Brain?
Organised Sound 9 (2004) 181-189

Brüne, M.
Schizophrenia – An Evolutionary Enigma?
Neuroscience and Biobehavioral Reviews 28 (2004) 41-53

Snyder, A., Bossomaier, T.* and Mitchell, D.J.
Concept Formation: 'Object' Attributes Dynamically Inhibited from Conscious Awareness
Journal of Integrative Neuroscience 3 (2004) 31-46

Snyder, A., Mitchell, D.J., Ellwood, S., Yates, A. and Pallier, G.*
Nonconscious Idea Generation
Psychological Reports 94 (2004) 1325-1330

Snyder, A., Mitchell, D.J., Bossomaier, T.* and Pallier, G.*
The Creativity Quotient: An Objective Scoring of Ideational Fluency
Creativity Research Journal 16 (2004) 415-420

The Cooperative Research Centre for Functional Communication Surfaces



Dr Mark Knackstedt

The Cooperative Research Centre for Functional Communication Surfaces (CRC SmartPrint) began operations on 1 July 2001, following funding from the Australian Government. Principal academic partners are located in Chemical Engineering, Monash University, Applied Mathematics, RSPHysSE, and the CSIRO Divisions of Forestry and Forest Products and Molecular Sciences (Clayton, Victoria). Industrial partners include AMCOR Packaging (Australia) Pty Ltd, Carter Holt Harvey Tissue Pty Ltd, Norske Skog Paper Mills (Australia) Ltd, Note Printing Australia Ltd and PaperlinX Pty Ltd (Australian Paper).

The brief of the CRC SmartPrint is to advance Australia's printing and packaging technology and expertise, with particular emphasis on advanced papers and polymeric materials (including banknotes), smart packaging indicators, improved recycling of paper and enhancement of cardboard packaging. Though these areas sound boring, they are major industries in the Western world, and even minor incremental improvements in these areas are of major benefit to consumers and producers. A number of research areas are covered by the CRC SmartPrint partners, including extensional rheology, surface chemistry and energy, polymer rheology, colloid science, three-dimensional imaging of microstructures, and print quality analyses. The ANU node is focussed on providing accurate microstructural data of relevant materials, analysing the surface physics of imbibition of, for example, inks into papers, developing accurate mechanical models and measures of mechanical properties of various printing substrates. A novel feature of our contribution is the insistence that Applied Mathematics focus on the fundamental aspects of research. This has been welcomed by our industrial partners, who recognise the need for further fundamental understanding of many processes associated with printing and paper and board production. The industry remains largely empirical, despite its enormous economic importance, and the group in Applied Mathematics are ideally equipped to investigate a number of important and interesting issues from our fundamental research perspective. While the issues are industrial in motivation, a number of fascinating problems that call on our skills are being tackled.

The work is experimental, theoretical and computational, in keeping with the philosophy of Applied Mathematics. Projects are making extensive use of the new X-ray CT machine, the Surface Forces Apparatus, Atomic Force Microscope and Ellipsometer. In the third complete year of the Centre, the ANU program continued work on four fundamentally based projects and a fifth strategic project aimed

at addressing specific industry problems. The highlights of research from the four fundamental projects that have commenced include:

- Development of three dimensional image enhancement techniques to remove blurring and distinguish material boundaries.
- Image skeletonisation and generation of network equivalents of paper and coatings have been initiated.
- Continued development of software to analyse structural, mechanical and transport properties directly from 3D digitised images of complex materials.
- Development of a new dynamic method to measure fluid penetration into paper sheets using x-ray radiography (time resolved digital radiography). Currently, software for analysing the data (e.g. saturation profiles, density correlations) is being developed.
- A compressional rheology rig suitable for use with X-Ray CT has been built. Customised software has been written to control the pressure within the rig and measure the loss of fluid from the fibre cake.
- A dynamic model for wetting fluid penetration (imbibition) has been developed based on a physically realistic and mathematically rigorous treatment of the complex dynamics of wetting front displacements.

CRC Staff

Program Manager

Dr Mark Knackstedt

Program Leaders

Dr Vince Craig

Dr Tim Senden

Researchers

Dr Armin Bauer

Dr Amit Goel

Professor Stephen Hyde

Dr Christian Kugge

Dr Ajay Limaye

Dr Arthur Sakellariou

Dr Adrian Sheppard

Dr Rob Sok

Visiting Fellow

Dr Lauri Salminen, KTH, Finland (January to May)

Students

Mr Drew Evans

Mr Ray Roberts

Technical Staff

Mr Anthony Hyde

Mr Tim Sawkins

CRC Administrator

Ms Jan James



Professor John Love

The Australian Photonics Cooperative Research Centre (Canberra Division)

The Australian Photonics Cooperative Research Centre (CRC) is now in its thirteenth year of operation. It is an unincorporated collaborative venture established in 1992 under the Commonwealth Government's Cooperative Research Centre scheme. The following organisations are partners in the CRC: The Australian National University, the Universities of Melbourne, Sydney, and New South Wales, RMIT University, TAFE NSW, ABB Transmission and Distribution Ltd, AOFR Pty Ltd, Allen and Buckeridge Pty Ltd, the Australian Electrical and Electronic Manufacturers Association, Australian Photonics Pty Ltd, BAE Systems Australia Limited, Bishop Innovation Pty Ltd, CEOS Pty Ltd, Coherent Scientific Pty Ltd, The Department of Defense (DSTO), Microo Ltd, Future Fibre Technologies Pty Ltd, Macquarie Photonics Pty Ltd, Nextrom OY, Nufern Inc, Redfern Photonics Pty Ltd, Telstra Corporation Ltd, Transgrid, Tenix Systems Pty Ltd, and VPISystems Inc.

The objectives of the CRC include:

- enhancing the Centre's status as Australia's centre of excellence in photonics with an internationally recognised, commercially relevant basic, strategic and applied research program that integrates research strengths from enabling technologies to applications;
- improving the international competitiveness of Australian industry through transfer of photonic technology through a commercialisation program that enables established firms to access technology and skills while creating new firms, through access to technology, markets, skills and finance;
- promoting photonics through education and training at the tertiary, technical and high-schools and colleges levels and through outreach to the broader community.

Following the industry downturn in 2000, the CRC moved its research focus to four key areas where it is believed that the best near-term commercial opportunities would emerge:

- Systems to monitor/manage impairments in high-capacity communication links;
- Fibre to the premises (FTTX);
- Wavelength division multiplexed transponder systems;
- Distributed sensor systems.

The Canberra division is directly involved in the first three projects. As a result, there had been some refocusing of projects within the existing research programs covering photonic integrated circuits, novel photonic components and photonic information processing to support activities required for the new projects.

In early 2004 the CRC made application to DEST for a third tranche of funding to continue its core activities beyond June 2007. Unfortunately this application was not successful and a subsequent application to DEST for support for a substantive Extension Program was also not accepted. These outcomes coupled with other financial issues resulted in the Board of Governors of the CRC introducing a budget from 1 July 2004 that led to a major reduction in non-salary support for research. Accordingly CRC projects could not be sustained at the pre-July levels and research activity was very much reduced.

Research Program

The interaction with Redfern Polymer Optics (RPO) on campus is through a collaborative project that has focussed on the design of novel photonic devices for fabrication in RPO's proprietary Inorganic Polymer Glass (IPG) material. The research included investigation of the design of multimode waveguides and devices and work on reactive ion etching of RPO's IPG materials.

ANU researchers from the Optical Sciences Group (OSG) continue to make strong contributions in modelling and theory of both linear and non-linear photonic devices. The CRC contributes to work on silicon photonics in the Department of Electronic Materials Engineering; non-linear optical materials in the Laser Physics Centre; spatial solitons and other non-linear guided waves in the Optical Sciences Group and the Laser Physics Centre.

ANU researchers have also been involved in a number of CRC-linked contracts with external organisations, including RPO and DSTO. The Canberra Division expenditure was based on \$649,401 of Commonwealth funding and \$64,940 of ANU funding for 2003/2004.

Education & Training – the Photonics Institute

The School has strong links with the Photonics Institute Pty Ltd, a subsidiary company of the Australian Photonics CRC and is managed by Dr Andrew Stevenson, a Visiting Fellow in OSG. This company is responsible for the education, training and outreach activities of the CRC. The Institute is supported by Commonwealth and ACT Government grants and by the CRC, and is located on the Bruce Campus of the Canberra Institute of Technology (CIT). The Photonics Institute continues to develop a package of undergraduate teaching modules and supporting resources for the higher-education sector. The Institute is also advising and collaborating with the CIT to develop curricula and courses for an Advanced Diploma of Photonics Technology, and for the VET sector nationally.

Activities that involve the Institute and the School in photonics include the annual Australian Conference on Optical Fibre Technology (ACOFT), the ACT Siemens Science and Engineering Experience, the Busan-Australia and the China-Australia Photonics Schools, the National Science Teachers Summer School, the ACT Science Teachers Workshop, the National Science Festival and the National Youth Science Forum.

RSPHysSE APCRC Staff

Group Head, ANU

Professor John Love (Director of Education & Training; Key Researcher)

Researchers

Dr Adrian Ankiewicz

Dr Douglas Bulla

Dr Rob Elliman

Dr Ruth Jarvis

Mr Vesselin Kolev

Dr Wieslaw Krolikowski

Dr Weitang Li

Professor Barry Luther-Davies (Key Researcher)

Dr Steve Madden

Dr Dragomir Neshev

Dr Anna Samoc

Dr Marek Samoc (Key researcher)

Professor Jim Williams

Dr Congji Zha (from September)



Professor Robert L. Dewar

Centre for Complex Systems

The Centre for Complex Systems plays a major role in drawing together the disparate complex systems science components of the National Institute of Physical Science (NIPS) at the Australian National University.

The aims of the Centre are:

- to provide a framework for bringing researchers together and stimulating interaction and synergy between them;
- to promote innovative, interdisciplinary research through seminars and topical workshops;
- to foster graduate education and research through summer schools.

The CCS was formed from the Centre for Theoretical Physics in late 2001, and continues its outreach activities while broadening its scope to the application of the powerful tools of modern theoretical physics and applied mathematics to problems ranging from the physical to the biological sciences, and even beyond to complex systems with a social dimension. A key feature in these systems is a large number of individual units interacting collectively and the emphasis is on the emergent behaviour beyond the elementary laws of interaction. The unifying theoretical and mathematical tools include statistical mechanics, many body theory and nonlinear dynamics, as well as numerical simulation.

Administrative support is provided by the Department of Theoretical Physics, Research School of Physical Sciences and Engineering.

An ARC Research Network application titled Complex Open Systems Research Network Study, submitted as an initiative of the Centre for Complex Systems, was successful in attracting \$300,000 per year for five years, commencing in 2004.

Summer Schools:

17th Canberra International Physics Summer School

Photons@Work: Australian Synchrotron Summer School,

27 January – 5 February 2004

Convenor: Dr Mark Ridgway, Department of Electronic Materials Engineering

18th Canberra International Physics Summer School

Quantum and Atom Optics Summer School, 29 November – 3 December 2004

Convenor: Professor Hans Bachor, Physics Department, Faculty of Science

CCS Seminars:

Dr Mukunda P. Das, Department of Theoretical Physics
Transport, Dissipation and Fluctuations
(Joint Seminar of the CCS & the Centre for Science and
Engineering of Materials)

Professor Sir Michael Berry, FRS, Department of
Physics, Bristol University, UK
Quantum Mechanics and the Riemann Zeros

Professor Jin-Qing Fang, Research Professor, China
Institute of Atomic Energy, Beijing, China & Fellow, City
University of Hong Kong,
*Exploring Complex Networks and Prospective
Applications*

Staff

Coordinator

Professor Robert L. Dewar, FAA

Deputy Coordinator

Professor Murray T. Batchelor

Chair of Board

Professor Denis Evans, FAA