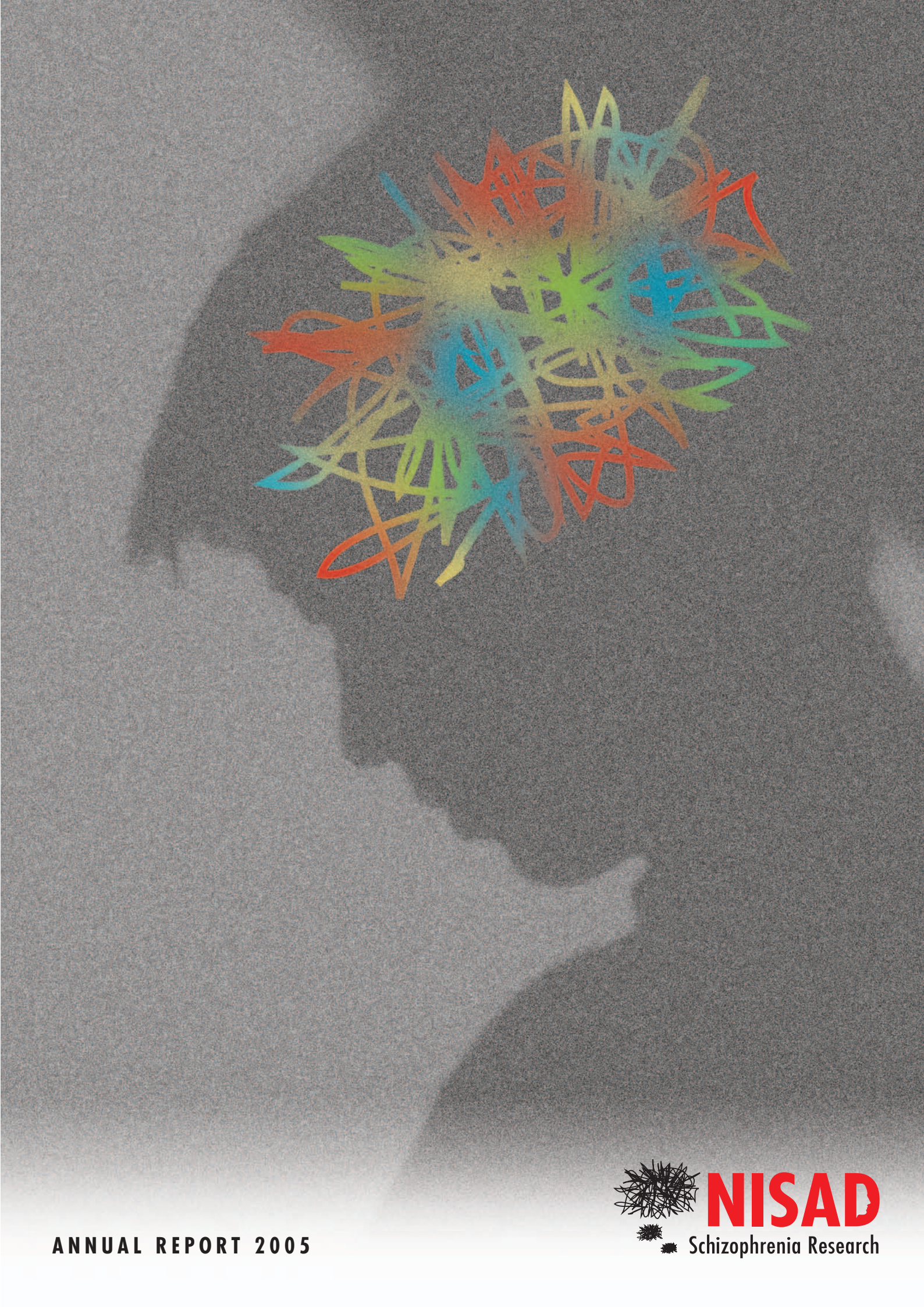
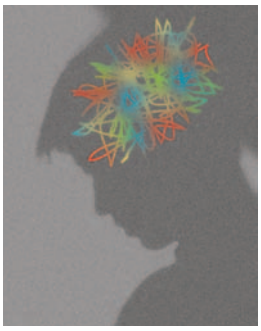


ANNUAL REPORT 2005

NISAD
Schizophrenia Research

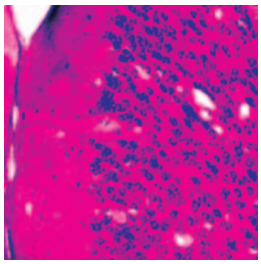


Schizophrenia is a biological brain disease that permanently disables more young people than any other illness. 1 in every 100 people will develop schizophrenia in their lifetimes, most between the ages of 15 and 25.

Schizophrenia can affect any family and in most cases arises where there is no previous history of the illness. It often leads to long-term disability, unemployment, drug and alcohol abuse, family trauma, homelessness, crime and imprisonment. It costs the Australian community around $2 billion each year.

Since inception in 1996, NISAD has developed a powerful research network integrating clinical research, neurobiology, neuroimaging and genetics in the quest to find a cure.

Some Research Highlights 2004-2005

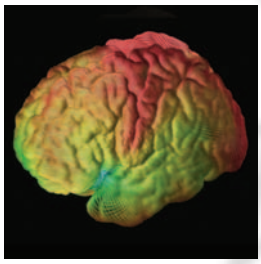


■ Discovery of how the human brain may develop the cellular and anatomical abnormalities characteristic of schizophrenia from prenatal or neonatal deficits in the somatosensory neuronal system which transmits sensory information to the brain.

◀ *Abnormally condensed neuronal groupings produced in the brains of rats after induced neonatal damage to their somatosensory systems. Over 40 days of development from infancy, the rats developed many of the characteristic brain abnormalities found in schizophrenia, suggesting that the cascade of symptoms in humans may stem from this single source.*

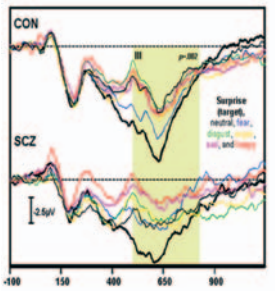
■ NISAD's ongoing research into scanpath abnormalities in schizophrenia has already investigated how characteristic restrictions in scanning human faces may contribute to deficits in interpersonal behaviour associated with the illness. Current research is now exploring whether these disturbances in visual attention can be remediated to improve emotion recognition in schizophrenia.

◀ *A NISAD-supported study at the Macquarie Centre for Cognitive Science is training patients to normalise their scanning of human faces. If successful, the results could form the basis for a new treatment intervention to improve emotion recognition and social communication skills.*



■ The NISAD Virtual Brain Bank is a growing database of three-dimensional digital images of brains, currently of 250 schizophrenia patients and normal control subjects. It was always intended that the Virtual Brain Bank would link to the Schizophrenia Research Register and to the DNA Bank to offer an unrivalled source of data to worldwide researchers. A major grant from the Australian Research Council will enable NISAD to fast track this plan, creating an online global centre of integrated mental health research collaborations.

◀ *NISAD introduced to Australia the LONI processing technique of MRI brain images in order to identify abnormalities in brain structure and function caused by schizophrenia.*



■ NISAD's team at the University of Newcastle completed an innovative study combining fMRI and ERP to investigate emotion processing in schizophrenia. The results indicate that schizophrenia disrupts the brain's facial perception processes at the very earliest 'encoding' stage, *before* the more elaborate emotion recognition mechanisms of the limbic system are activated.

◀ *Composite ERP brainwave activity recordings of normal controls (CON) and schizophrenia subjects (SCZ) while performing a facial emotion recognition task. Of particular significance is that schizophrenia subjects less accurately discriminate between emotion expressions at a very early stage of information processing.*

CONTENTS

BACKGROUND

NISAD Schizophrenia Research is an innovative independent Australian medical research organisation undertaking world class studies to find the means to prevent and cure schizophrenia.

Formed in 1996 and funded by State Government, corporate and private donations, NISAD Schizophrenia Research is an "institute without walls" which utilises research and infrastructure facilities located in teaching hospitals, universities and research institutes throughout New South Wales, as well as domestic and international collaborations, in driving its proactive research agenda.

This means that rather than investing valuable funds in bricks and mortar, efforts are directed into research initiatives aimed at improving the lives of those affected by the disease, and at discovering the means of preventing its onset in others.

From its central management office in Sydney, NISAD Schizophrenia Research manages and coordinates a multi-disciplinary research program led by scientists of world standing in their fields, harnessing cutting-edge technology and state-of-the-art techniques.

Activities include investigating the functional disorders causing the symptoms of schizophrenia, the effects of the disease on brain cells, the genes expressed when it develops, and how schizophrenia affects the brain's processing of thoughts and feelings.

NISAD Schizophrenia Research also plays a key public awareness role in promoting an environment where families living with the disease do not have to suffer in silence but instead receive the acceptance and help they need. It also fuels support for more intensive research as the only long-term solution.

NISAD's ambitious research agenda can only progress with the support of Government, the private sector, and generous individuals. To enable this, the Institute undertakes fund-raising and public education activities to increase awareness of the impact of schizophrenia on families and on the community. In particular, these educational programs aim at increasing awareness of schizophrenia as a major cause of permanent disability and suicide in young people.

SCIENTIFIC HIGHLIGHTS

RESEARCH FINDINGS

■ Discovery that genes involved in functions such as presynaptic function, myelination and cellular signalling are dysregulated in the amygdala and superior temporal gyrus brain regions in schizophrenia. This may provide new information about the genes that predispose a person to developing schizophrenia.

■ Development of an animal model to test the hypothesis that deficits in the somatosensory system affect the brain's development and results in schizophrenia. Such deficits chemically induced in neo-natal rats produced brain changes resembling those found in human subjects with schizophrenia, including reduced cortical thickness, larger ventricles and increased neuronal density in several cortical areas.

■ Discovery that treatment with three different anti-psychotic drugs produces changes in a number of common genes. This may provide information on potential molecular and cellular pathways responsible for schizophrenia as well as the identification of novel targets for the development of new treatments.

■ Demonstration that the absence of one copy of the neuregulin Nrg1 gene in mice has an impact on a range of schizophrenia-related behaviours. Neuregulin is a candidate gene for the development of schizophrenia. Resultant information from this research could provide benefits through better understanding of how developmental changes lead to symptoms, how environmental factors influence these symptoms and how they may be better treated.

■ Demonstration of changes in behaviour and brain protein expression in rats following treatment with anti-psychotic drugs. This research may shed light on the molecular mechanisms of the side effects of these drugs, such as extrapyramidal symptoms, and also provide clues to the causes of schizophrenia.

■ Discovery of correlated alterations to muscarinic, GABA, glutamate, serotonin and cannabinoid receptors in posterior and anterior cingulate cortex as well as muscarinic, GABA and glutamate receptors in the superior temporal gyrus in schizophrenia. These brain areas have been suggested as sites of primary pathological change in schizophrenia and the relationship and interaction between these multiple receptor systems is under further investigation.

■ Discovery that a particular brain wave-form, which measures attention, is altered in schizophrenia patients. This research may assist in understanding the problems patients with schizophrenia experience in focusing attention on everyday events and, potentially, the development of a biological test.

■ Discovery of a disruption of both direct and indirect fear processing pathways in both subliminal and conscious

conditions in schizophrenia. Such breakdowns in fear processing across levels of awareness might account for the intrusive nature of fear-related symptoms such as paranoia, and the inability to consciously control these experiences in schizophrenia.

■ Research that suggests that certain fatty acids may aid cannabis-using individuals with schizophrenia to cope with stress. These results are promising from the point of view of developing pharmacological and/or dietary interventions which may help protect stabilised patients from relapse.

■ Evidence that people with schizophrenia show short-term improvement in their ability to recognise emotions from facial expressions after training with a computerised remediation tool. This suggests that brief remediation targeting facial emotion perception may be a valuable adjunct to existing cognitive remediation programs, and in the long-term may improve social skills for people with schizophrenia.

RESEARCH OUTPUTS

■ 50 publications reporting NISAD-supported schizophrenia research accepted/published in peer-reviewed scientific journals (increase of 65% compared to 2003-2004). The average impact factor for published manuscripts was 3.777 (increase of 12% compared to 2003-2004). A further 8 manuscripts are in revision and 19 under editorial review.

■ 99 presentations (including 4 invited) of NISAD-supported schizophrenia research accepted/presented at scientific conferences held in Australia, New Zealand, Canada, Cuba, Ireland, Hungary, Spain, Finland, China, Taiwan, Greece, UK and USA.

■ 32 grants, with a total value of approximately $3.7M, were awarded to NISAD and/or NISAD-affiliated scientists to support schizophrenia research initiatives, equipment or travel costs. Grants administered by NISAD doubled in value compared to 2003-2004.

■ Award of 8 research higher degrees to NISAD-supported students. This represents a 50% increase from 2003-2004.

RESEARCH INFRASTRUCTURE

■ The NISAD Schizophrenia Research Register has recruited over 1,150 volunteers and in 2004-2005 supported 17 schizophrenia research studies in NSW and for the first time interstate in Queensland and Victoria. In the past year 10 manuscripts were accepted/published from research that utilised the Register.

■ The Hunter DNA Bank for Schizophrenia and Allied Disorders has grown to list over 130 members from the Hunter region. In the coming year the DNA Bank will be expanded to include recruitment of volunteers from the Sydney region.

■ The NSW Tissue Resource Centre (TRC) supported 13 neuropsychiatric research studies in Australia (New South Wales, Queensland, South Australia) and Japan. In the past year 10 manuscripts were accepted/published on schizophrenia-related research that utilised the NSW TRC.

■ The 'Gift of Hope' and 'Using our Brains', NISAD-supported brain donor programs, have now recruited over 1,850 volunteers Australia-wide. A further 6 collections have occurred in 2004-2005.

■ The NISAD Virtual Brain Bank (VBB) now contains approximately 120 high-resolution MR brain scans from people suffering from schizophrenia at various stages of their disease, first-degree biological relatives, cannabis users (with and without schizophrenia) and healthy controls.

RESEARCH PERSONNEL

■ NISAD employee numbers grew to 27 permanent positions and 3 casual positions, 80% of which are research focused.

■ Further increased investment in training with the support of 50 students undertaking schizophrenia research. This is a 21% increase compared to 2003-2004 and recognises the need to develop young schizophrenia researchers, as they are the scientists who will provide the discoveries of the future.

■ Further growth in scientific participation on NISAD research panels with affiliation of 6 new scientists.

RESEARCH SITES AND COLLABORATIONS

■ Significantly increased schizophrenia research collaborations with scientists and institutions from Australia and worldwide. NISAD-supported research has occurred in collaboration with 68 other institutions located throughout Australia and internationally. This is an 100% increase compared to 2003-2004.

■ NISAD-supported collaborative research has taken place in Australia (NSW, QLD, SA, WA, VIC, ACT), Japan, Germany, New Zealand, Austria, Russia, Finland, UK and USA.

CHAIR OF SCHIZOPHRENIA RESEARCH

■ Broad consultation within NISAD determined that the Chair should be in the field of the developmental neurobiology of behaviour and cognition in relation to schizophrenia.

■ 6 submissions from potential host institutions for the Chair were received and reviewed by an independent group of national and international researchers, the NISAD Scientific Advisory Committee and the Board.

■ Selection of University of NSW/Prince of Wales Medical Research Institute as host institution partner for establishment of the NISAD Chair. In the coming year NISAD and the University of NSW/POWMRI will conduct a search process with the aim of the Chair position commencing early in 2006.

OTHER RESEARCH HIGHLIGHTS

■ Review and restructure of NISAD's current research program endorsed by all NISAD scientists and Board.

■ Convening of two NISAD Scientific Summits with the aim of development of multidisciplinary, cross-panel schizophrenia research initiatives.

■ Finalisation of formal research agreements between NISAD and the Universities of Wollongong, NSW, Macquarie, the Garvan Institute and the Prince of Wales Medical Research Institute.

■ NISAD accredited by the NHMRC as an Independent Research Institute.

FUNDRAISING/AWARENESS HIGHLIGHTS

■ Australia's first early intervention schizophrenia awareness poster created by NISAD was launched by Her Excellency, Professor Marie Bashir AC, Governor of New South Wales at the South Sydney Police Community Youth Club on 20 May 2005. Over 5,000 posters have been distributed nationwide.

■ Made possible by the Construction Forestry Mining Energy Union (CFMEU) and the loyalty of the building industry as a whole, 10 metre wide schizophrenia awareness banners were hung on 20 key building sites throughout Sydney during Mental Health week.

■ Supported by Macquarie Bank, 50 NISAD banners lined Pitt and Phillip streets during Schizophrenia Awareness Week.

■ As part of Schizophrenia Awareness Week, Telstra hosted NISAD exhibits providing information on schizophrenia and NISAD's research activity. Over 1,000 staff received information across both the Sydney and Melbourne offices.

■ NISAD brought together scientists, sponsors, supporters, and people directly affected by schizophrenia to create a new corporate and community DVD - under the generously provided direction of Doug Hawkins of TVU. The video was launched at the Annual Sponsors & Supporters Lunch.

■ The annual public health seminar jointly hosted by The Garvan Institute and NISAD was this year titled 'Understanding Mental Illness'. Over 300 people attended the Garvan Auditorium.

■ NISAD participated in the Sydney 2005 Seniors Expo held at Darling Harbour. In addition NISAD featured in the national Probus magazine, and followed up with presentations to Probus groups.

■ Three editions of HeadLines were produced and distributed to a growing readership of over 15,000.

■ 'Cocktails and Consciousness' was launched in October. The inaugural annual event provided a platform for the launch of the NISAD Society, a new membership-based form of donating to the Institute.

■ The NISAD Annual Sponsors and Supporters Lunch was generously hosted by NISAD Board Director and AMP CEO Andrew Mohl and attended by 100 guests at the AMP Board room in August. NSW Minister for Health Morris Iemma attended as guest speaker.

■ Continued sponsorship commitment from Mrs Margarete Ainsworth, Janssen-Cilag, Macquarie Bank Foundation, St.George Foundation, Westfield Design and Construction, Australand Holdings, Baulderstone Hornibrook, Ron & Peggy Bell Foundation, Abigroup, Leighton Holdings Limited, Lundbeck Australia, Paynter Dixon Constructions. These sponsorships have produced $170,000 during the financial year.

■ Deutsche Bank has joined ABN AMRO and Insurance Group Australia in supporting NISAD through their workplace giving program. The initiative is beginning to build, producing $39,000 during the financial year.

■ NISAD's End of Financial Year Appeal attracted $34,000 in donations - a 90 percent increase on last year's appeal. The money was specifically donated to fund the first year of a 3-year PhD scholarship in schizophrenia research.

■ NISAD was selected as one of 20 charities to benefit from the ASX Reuters Charity Golf Day and Art Union raffle, and received $20,000 and a commitment for the following year.

■ $33,000 was raised from the Baulderstone Hornibrook NISAD Charity Golf Day.

■ NISAD reached a new audience in The Hunter as the benefit charity for Hungerford Hill's inaugural 'VineFire' Event, which raised $19,000.

■ Continued the Bovis Lend Lease / Construction Forestry Mining Energy Union car parking initiative. After the completion of the Jackson's Landing project, a Macarthur Square initiative has begun. The initiative has raised $32,000 this financial year.

CHAIRMAN'S REPORT

As the preceding scientific and fundraising 'highlights' show, 2004-2005 was another year of expansion and innovation for NISAD, with a 65 percent increase in scientific publications, a 100 percent increase in value of awarded grants, and a doubling of research collaborations at home and internationally.

The last item of expansion particularly signposts the way to the future of mental illness research. Such collaborations have increased exponentially over the last few years in response to the new understanding that the complexities of mental illness will only be unravelled by team efforts involving multiple research techniques.

Neuroimaging, neurobiology, cognitive neuroscience, clinical studies, animal studies and genetics have now developed into highly specialised areas, so the need now is for large-scale collaborative programs spanning multiple laboratories and mobilising many types of expertise.

The original concept of NISAD as a 'virtual' institute encompassed and predicted this development, and the launch last year of our new Virtual Brain Bank heralds the way such team efforts can occur. With recent funding support from the Australian Research Council, the Virtual Brain Bank is set to become a model for the future of cross-discipline, multi-centre brain research.

A further notable innovation has been the development of Australia's first Professorial Chair of Schizophrenia Research, and I congratulate the University of NSW and the Prince of Wales Medical Research Institute on their successful joint bid to partner NISAD in this initiative. With their involvement in the recruitment process, NISAD looks forward to commencing the position in early 2006.

Another Australian 'first' was the national launch in May of the schizophrenia 'Early Intervention Poster' by NISAD Patron and Governor of NSW, Prof. Marie Bashir AC. The culmination of a tenacious effort by NISAD Communications Director Alan Tunbridge, the poster is the first such campaign to feature the medical facts about the illness. With the help of the Mental Illness Fellowship of Australia it has now been distributed to a wide variety of public venues across all States and Territories.

Executive Director Debbie Willcox and Corporate & Community Partnerships Manager Lee Drury have done a great job in developing the NISAD Society membership to the level where membership donations now annually exceed that of a Silver Sponsorship. The members and their guests enjoyed their annual event 'Cocktails and Consciousness' in October. The event proved to be an excellent example of how Debbie and Lee are attacking the outmoded public perceptions of mental illness issues in entertaining and enlightening ways. As this is only the second Annual Report to include Debbie Willcox, I should certainly mention that her presence as Executive Director has brought a new vivacity and team spirit to NISAD's central office, and throughout the Institute.

I must also thank NISAD Board member and CEO of AMP Andrew Mohl for generously hosting the Sponsors and Supporters Lunch held in August 2004. The NSW Minister for Health Morris Iemma was guest speaker, and I thank him for his strong support of NISAD.

Since July 2004, a number of Directors have stepped down from the Board, and others have generously accepted invitations to join. I thank Graham Shaw, and welcome Janet McDonald and Irene Moss.

Another Director who has stepped down from the Board during the year has been Don McDonald. Together with Founding Chairman Stan Catts, Don was the driving force behind the early creation and development of the Institute, and I formally thank him for his vision and determination in establishing Australia's only Institute solely dedicated to schizophrenia research.

Peter Dempsey
Chairman

SCIENTIFIC DIRECTOR'S REPORT

A major development of the past year has been the attempt to sharpen NISAD's research focus through a consultative process among NISAD's scientific community. This has proceeded in parallel and close relationship with consultations to define the role of the Professorial Chair in Schizophrenia Research. The outcome has been general acceptance of an organising theme that provides the scientific framework within which schizophrenia-related research is to be undertaken. This is that schizophrenia entails a developmental abnormality of connectivity in the nervous system. In accord with this framework it has been decided that the Chair in Schizophrenia Research will be in the field of the developmental neurobiology of behaviour and cognition pertaining to schizophrenia.

On this basis all NSW universities and research institutions were invited to submit written applications to host the Chair. These were reviewed and rated by independent scientists whose reports were evaluated by NISAD's Scientific Advisory Committee, which then made recommendations to the Board of Directors. Final negotiations between the Board and a short list of applicants resulted in the Prince of Wales Medical Research Institute & University of New South Wales being identified as the preferred host institution. We are now all looking forward to the appointment of this Chair, the first of its kind in the world.

Meanwhile, the productivity of NISAD-supported schizophrenia research has continued to grow with a 65% increase in research papers published or accepted for publication in scientific journals, and the value of grants directly administered by NISAD has doubled. We have also seen growth in all of NISAD's research infrastructure facilities, the crucial underpinnings of the Institute's research activities.

Scientific highlights of the year can be found on page 4 and include dysregulation of genes concerned with neural connectivity in schizophrenia, genetic changes and alterations in brain protein expression caused by antipsychotic medication, experimental studies of the neuregulin gene, receptor alterations in key parts of the brain involved in schizophrenia, an innovative experimental model of schizophrenia involving intrinsic sensory deprivation, electrophysiological studies of attention, fear processing pathways in schizophrenia, facial emotion recognition and retraining, and the use of fatty acids as an adjunct to treatment.

One of the most pleasing aspects of the past year has been an increase in the numbers of research higher degrees awarded to graduate students supported by NISAD and the rise in numbers of NISAD-supported graduate students, including 25 PhD candidates. They represent the future of schizophrenia research and it is crucial that NISAD continues to nurture this very important investment in achieving the Institute's aims of finding the means to prevent and cure schizophrenia.

None of the growth in research activity achieved by NISAD would be possible without growth in funding. Accordingly, I must mention the outstanding work of Ms Deborah Willcox, Executive Director, and Ms Lee Drury, Manager of Corporate and Community Partnerships, whose enthusiastic leadership and innovation in fund-raising and community awareness contribute so much to the successes of NISAD.

Professor Vaughan Carr
Scientific Director

Research Council

Professor Vaughan Carr
Convenor, Psychopharmacology and Therapeutics Research Panel (until April 2005); Scientific Director (Chair)

Dr Martin Cohen
Convenor, Psychopharmacology and Therapeutics Research Panel (from April 2005)

Mr Daren Draganic
NISAD Research Manager

Professor Clive Harper
Co-Convenor, Schizophrenia Research Infrastructure Panel

Professor Graham Johnston
Co-Convenor, Neurobiology Research Panel

Dr Carmel Loughland
Co-Convenor, Schizophrenia Research Infrastructure Panel; NISAD Scientific Employee Representative (from July 2004)

Professor Pat Michie
Board Representative

Associate Professor Ulrich Schall
Convenor, Cognitive Neuroscience Research Panel

Professor Peter Schofield
Co-Convenor, Neurobiology Research Panel

Dr Paul Tooney
NISAD Scientific Employee Representative (until July 2004)

EXECUTIVE DIRECTOR'S REPORT

2004 was a year of strengthening and strategic growth for NISAD. While staffing numbers have increased modestly, productivity from the research team has been impressive, with a 65 percent increase in publications, compared to the previous year. Building an ongoing community of schizophrenia researchers has always been a key part of the NISAD philosophy - investing in students has also been a hallmark of 2004-2005 with 53 students now undertaking schizophrenia research. These students are a valuable resource for the future of NISAD and schizophrenia research more broadly.

A large amount of work has been undertaken this year to identify the host for Australia's first Chair of Schizophrenia Research - it has been a rigorous process focused completely on delivering the best home for this very important appointment. To that end the NISAD Board determined that the University of NSW and the Prince of Wales Medical Research Institute will jointly host Australia's first Chair of Schizophrenia Research with NISAD. We look forward to working in partnership with these two prestigious organisations to identify the best candidate and together build a strong and competitive centre at the POWMRI.

Another important milestone for NISAD this year has been its accreditation as an Independent Research Institute by the National Health and Medical Research Council. NISAD now joins a group of just 35 institutes nationally, and 12 in New South Wales, to receive such accreditation.

Organisationally, NISAD has been strengthened, in particular with the appointment of two new Board members, Ms Irene Moss and Ms Janet McDonald. Both Janet and Irene bring a wealth of skills to the Board as well as high levels of integrity and commitment. I want to thank them both for joining us. In addition, Dr Marion Kellenbach has joined the head office team in the role of Research Coordinator. Marion has an impressive academic background and is a very welcome member to the team.

As NISAD looks to grow and raise the profile of schizophrenia research, we welcome the opportunity to work with the Australian Psychosis Research Network (APRN), a national initiative led by Professor Stan Catts. The Myer Foundation has funded the network to build a constituency of support with which NISAD is assisting. Plans are underway to commence discussions with State and Federal Government leaders. The APRN has the capacity to industrialise the level of research into psychotic disorders across the country and to accelerate the timeline to discovery.

Public awareness remains a key plank of NISAD's role. This year NISAD launched Australia's first schizophrenia awareness poster. Her Excellency, Professor Marie Bashir AC, Governor of New South Wales gave the keynote address and as a child and adolescent psychiatrist was highly supportive of this initiative. With the support of the Schizophrenia Fellowship NSW and their national body, the Mental Illness Fellowship of Australia, more than 5,000 posters have been distributed nationally.

Last October, NISAD launched 'Cocktails and Consciousness' an annual event aimed to entertain and inform our supporters. It also provided the platform to launch a new form of regular giving to NISAD called 'The NISAD Society'. Peter FitzSimons entertained and enthused an audience of around 80 guests. The membership of the Society has steadily increased over the remaining part of the year, and shows every sign of becoming a solid new source of support.

The organisation has been striving to build on our current relationships with our generous sponsors and working hard to establish additional corporate partners to allow us to sensibly grow and generate a sustainable funding base. In an effort to spread our message, a new digital video disc has been created - with the help of many NISADstaff and supporters. The DVD was launched at NISAD's Annual Sponsors and Supporters Lunch, once again kindly hosted by Andrew Mohl (NISAD Director, CEO, AMP) and AMP.

I would like to acknowledge the generosity and support NISAD has received from its current sponsors - without their support our role would be greatly diminished. I also want to acknowledge the Construction, Forestry Mining Energy Union. The construction sector and the union have on a number of occasions joined together to support us in often very innovative ways, and we deeply appreciate these relationships.

Workplace giving programs have also provided a steady source of revenue, and we thank the staff at Deutsche Bank, Insurance Australia Group and ABN AMRO for seeing the importance of mental health research and giving so generously.

I would also like to take the opportunity to acknowledge the NISAD Board who have been a source of great support in my first year, and who have enabled me to look forward to the year ahead with optimism and enthusiasm.

And finally, I would like to thank the NISAD team - both at our Central Office and at our many research centres. All have worked enthusiastically in many ways to further NISAD's mission. In particular, I want to acknowledge Lee Drury, Manager Corporate and Community Partnerships. Much of what NISAD does would not be possible if we re not for Lee's energy, innovation and drive.

Deborah Willcox
Executive Director

NEUROBIOLOGY RESEARCH PANEL REPORT

Panel Members

Dr Jonathon Arnold
University of Sydney (from April 2005)
Dr Murray Cairns
NISAD Senior Research Officer (from November 2004)
Professor Vaughan Carr
NISAD Scientific Director
Associate Professor Loris Chahl
University of Newcastle
Dr Albert Chetcuti
NISAD Research Officer
Dr Mary Collins
University of Sydney
Dr Irina Dedova
NISAD Research Officer
Dr Chao Deng
University of Wollongong
Dr Gavin Dixon
NISAD Research Officer (until October 2004)
Mr Daren Draganic
NISAD Research Manager
Ms Liesl Duffy
NISAD Research Assistant (from February 2005)
Prof Peter Dunkley
University of Newcastle (until February 2005)
Prof Clive Harper
University of Sydney
Dr Jasmine Henderson
University of Sydney
Dr Tina Hinton
University of Sydney
Associate Professor Xu-Feng Huang
University of Wollongong
Prof Graham Johnston
University of Sydney (Co-Convenor)
Dr Tim Karl
The Garvan Institute of Medical Research
Dr Marion Kellenbach
NISAD Research Coordinator (from March 2005)
Assoc Prof Izuru Matsumoto
University of Sydney
Prof George Paxinos
Prince of Wales Medical Research Institute (until February 2005)
Prof David Pow
University of Newcastle (from April 2005)
Dr Fraser Ross
University of Newcastle
Prof Peter Schofield
Prince of Wales Medical Research Institute (Co-Convenor)
Prof Rodney Scott
Hunter Area Pathology Service
Dr Sinthuja Sivagnanasundaram
NISAD Senior Research Officer (from December 2004)
Dr Yean Yeow Tan
NISAD Research Officer (from November 2004)
Dr Paul Tooney
University of Newcastle
Dr Bryce Vissel
The Garvan Institute of Medical Research
Dr Katerina Zavitsanou
Australia Nuclear Science and Technology Organisation

The Neurobiology Research Panel targets specific human and animal brain systems to identify the abnormally functioning neurons and neurotransmitters that could be responsible for the hallucinations, delusions, thought disorders and other symptoms of schizophrenia, as well as isolating the defects in gene action which may be the cause of the disease. The Panel also develops and undertakes behavioural studies of animal models of schizophrenia.

School of Biomedical Sciences, University of Newcastle

GENETIC STUDIES OF SCHIZOPHRENIA

Since the introduction of microarrays many disorders have been further characterised by the generation of gene expression profiles that identify subtypes of disease. Schizophrenia is a heterogenous disorder that is characterised by a combination of symptoms with variable expression in the course of illness. To address the heterogeneity of this disorder, NISAD-supported PhD student Ms Nikola Bowden, Dr Paul Tooney and colleagues investigated differential gene expression from blood samples in relation to symptom expression, age, and mismatch negativity (MMN), an event-related potential measure of auditory sensory memory function and putative phenotypic marker of schizophrenia. A number of genes showed significantly different expression between groups based on median split of age, positive and negative symptoms, and MMN. These findings suggest distinct gene expression profiles in peripheral blood lymphocytes dependent on schizophrenia phenotypes may provide a first step towards a biological basis for the classification of schizophrenia.

Researchers at the centre also examined two brain regions that have been implicated in schizophrenia using post-mortem human tissue. NISAD-supported PhD scholars Ms Judith Weidenhofer and Ms Nikola Bowden and colleagues have been using microarray techniques to investigate gene expression in the amygdala and superior temporal gyrus, regions that have not been analysed in this way previously. Genes involved in presynaptic function, myelination, cellular signalling and metabolism were identified as being consistently dysregulated in these regions in schizophrenia, and the protein products of some of the dysregulated genes are now being examined for expression changes related to schizophrenia. These studies may provide

new information about the genes that predispose a person to developing schizophrenia.

In November 2004, NISAD appointed Dr Murray Cairns as Senior Research Officer at the Newcastle centre and he has initiated two new lines of research focusing on gene expression in schizophrenia. The first of these is investigating the differentially expressed genes which have been identified in the above post-mortem brain tissue studies. Some of these genes are potentially involved in the pathophysiology of schizophrenia and may even be drug targets. It is planned to establish cell culture based assays in order to determine the functional significance of candidate genes. This would also enable intervention at the molecular level, with the aim of understanding the significance of their aberrant expression at the cellular level. With some basic cell biology of genes associated with schizophrenia, we may then be in a better position to determine their involvement in the disorder and their potential as drug targets.

Further novel research by this group at the centre is examining the role of micro RNA expression in schizophrenia. Micro RNAs have been shown to play a significant role in the regulation of gene expression and have been shown to be important for regulating development and neuronal differentiation. It is conceivable that neurological disorders, such as schizophrenia, may stem from some disturbance to the normal pattern of micro RNA expression. As these changes would not be detected by conventional microarray studies it is intended to take a different approach to identifying and quantifying schizophrenia related alterations in micro RNA expression. This involves cloning the small RNA fraction of the total RNA from post mortem brain tissue of individuals with schizophrenia and normal controls for sequencing. After identifying the micro RNA profile, relative expression levels can then be determined.

SCHIZOPHRENIA AND SENSORY DEPRIVATION

Schizophrenia is considered to be a neurodevelopmental disorder with origins in the prenatal or neonatal period. Brains from subjects with schizophrenia have enlarged ventricles, reduced cortical thickness and increased neuronal density in the prefrontal cortex compared with those from normal subjects. It has been suggested that these abnormalities occur due to problems with sensory input pathways, which would affect processing of all input information in the brain. This could explain the wide range of symptoms and the varying severity of the disorder experienced by those with schizophrenia. NISAD-supported PhD scholar Ms Penny Newson, under the supervision of A/Prof. Loris Chahl, has completed a study using an animal model to test the hypothesis that sensory deprivation during development and continuing into adult life results in schizophrenia. The study tested the hypothesis that intrinsic somatosensory deprivation, induced by neonatal capsaicin treatment, causes changes in the brains of rats similar to those found in schizophrenia. Compared to control rats, neonatal capsaicin treatment of rats produced brain changes resembling those found in brains of subjects with schizophrenia, including reduced cortical thickness, larger ventricles and increased neuronal density in several cortical areas.

Neurobiology Program, Garvan Institute of Medical Research

GENETIC RESEARCH IN SCHIZOPHRENIA AND BIPOLAR DISORDER

Although previous research has demonstrated a genetic component in the development of schizophrenia and bipolar disorder, the nature of these genetic changes remains unknown. NISAD scientists Dr Albert Chetcuti, Ms Carlotta Duncan, Prof. Peter Schofield and colleagues have continued a research program that aims to provide more information about the genetic changes that occur with these disorders.

Studies conducted at the Garvan over the last year have aimed to identify genetic changes produced via the treatment of normal mice with anti-manic and anti-psychotic drugs. Lithium and valproate are two chemically distinct drugs that display similar anti-manic effects in bipolar patients. In a series of studies, microarray analysis was used to identify genes and cellular pathways that are altered in the mouse brain after treatment with these drugs to determine whether these drugs act via overlapping biochemical pathways. The results have identified a range of genes to be significantly altered by each of the drug treatments. Many of the genes identified as altered by valproate are involved in the development and function of the brain, while the genes identified as altered by lithium are involved in molecular pathways that regulate the transcription of multiple genes. These results indicate that valproate and lithium regulate a large number of different functional pathways in the brain. Understanding the molecular and cellular mechanisms by which these anti-manic drugs achieve their therapeutic action represents a valuable step in clarifying the pathophysiology of bipolar disorder. A further study was conducted to investigate molecular changes produced via the treatment of normal mice with three anti-psychotic drugs (clozapine, olanzapine and haloperidol). Altered gene expression was observed in a number of genes, and at least three of these genes were co-dysregulated by different antipsychotics and may have applications for schizophrenia treatment.

Using a different approach, a susceptibility locus for bipolar disorder was previously localised to chromosome 4q35 by genetic linkage analysis. The Garvan team has applied a positional cloning strategy, combined with association analysis, and provided evidence that a cadherin gene, FAT, confers susceptibility to bipolar disorder. This study further localised the bipolar associated region of the FAT gene to a specific interval. NISAD-supported research at the Garvan showed that FAT was significantly altered in response to therapeutic doses of the anti-manic drug, lithium, while eight interacting molecules

showed significantly altered expression in response to therapeutic doses of lithium. Together, these observations implicate FAT and its protein partners in a molecular pathway involved in the pathogenesis of bipolar disorder.

It is hoped that genes identified in these studies may lead to the identification of potential molecular and cellular pathways responsible for schizophrenia and bipolar disorder as well as the identification of novel targets for the development of new treatments.

ANIMAL MODELS OF SCHIZOPHRENIA

The risk of developing schizophrenia is associated with both genetic and environmental factors. However, neither of these factors is sufficient to cause the disorder in isolation. The genetic component is likely due to the combined effects of multiple genes. Neuregulin 1 (Nrg1) is a candidate gene for schizophrenia, which plays a central role in neural development and in regulating synaptic plasticity. The aim of this study, undertaken by NISAD researchers Dr Tim Karl, Ms Liesl Duffy and Prof. Peter Schofield was to investigate the behavioural effects of genetic and environmental risk factors in a mouse model of schizophrenia.

Using a multi-tiered behavioural approach, Nrg1 knockout mice were studied for general health, neurological reflexes, sensory abilities, and motor coordination followed by a variety of tests for motor activity, exploration, anxiety, and prepulse inhibition. Effects of age (<3 months vs. >3 months) and housing conditions (standard laboratory housing vs. environmental enrichment) were taken into consideration. Results demonstrated a potent effect of the absence of one copy of the Nrg1 gene on motor activity and exploration, which was age- and housing condition-dependent. Nrg1 heterozygous mice were hyperactive in tasks for motor activity and exploration (evident in animals >3 months). No abnormalities were detected in anxiety-related parameters or baseline and drug-induced prepulse inhibition. Importantly, housing conditions seemed to modify onset and intensity of the behavioural phenotype. This study demonstrates that Nrg1 has an impact on some but not all schizophrenia-related behavioural domains. However, this influence is highly dependent on other factors such as age and housing conditions, confirming the importance of multi-tiered strategies in this field.

Dr Karl has also collaborated with other researchers at the Garvan Institute in a study investigating the role of the Y1 receptor system in the regulation of aggression, food intake, anxiety and exploration-related behaviours in mice, with the longer-term goal of determining whether Y1 knockout mice could provide an appropriate animal model for schizophrenia. Results to date have provided evidence for a mechanism involving the Y1 receptor system through which physiological survival mechanisms such as food intake are coordinately linked with enabling aggressive behaviour. Furthermore, Y1 deficient mice were shown to exhibit a strongly task-dependent anxiety-related phenotype and a high level of explorative-like behaviours. Further examination of potential schizophrenia-like behavioural characteristics such as prepulse inhibition has commenced.

Departments of Pathology and Pharmacology, University of Sydney

PROTEIN PROFILING IN SCHIZOPHRENIA

Protein profiling is a technique that enables the identification of proteins that may be present in increased or decreased amounts in the abnormal brain structures of individuals with schizophrenia, compared to individuals without the disorder. Determining these key proteins enables the identification of underlying sources of the observed structural abnormalities and forms the basis for further investigations into the brain pathways and associated functional abnormalities implicated in schizophrenia.

In December 2004 NISAD appointed Dr Sinthuja Sivagnanasundaram as Senior Research Officer at the Sydney centre. Dr Sivagnanasundaram has collaborated with Dr Irina Dedova and A/Prof. Izuru Matsumoto on a number of studies focusing on human brain regions where disruption or abnormalities are thought to underlie some symptoms of schizophrenia, including the prefrontal cortex, the corpus callosum and anterior cingulate cortex. A proteomics approach is being used to identify alterations in the protein expression profile in these areas in schizophrenia compared to the healthy controls. Preliminary results have already identified differentially expressed proteins in the anterior cingulate cortex associated with schizophrenia, providing support for a role of this brain region in the origin or development of the disease.

PROTEOMIC AND BEHAVIOURAL INVESTIGATION OF SCHIZOPHRENIA AND ANTI-PSYCHOTIC DRUG TREATMENT

The understanding of changes in protein expression due to anti-psychotic drugs may shed light on the molecular mechanisms of their side effects, such as extrapyramidal symptoms, and provide clues to the pathogenesis of schizophrenia.

A collaborative team of NISAD scientists including Dr Irina Dedova, A/Prof. Izuru Matsumoto, Ms Sonja Schleimer, Dr Jasmine Henderson and Prof. Graham Johnston have conducted a study that aimed to single out specific effects of a typical anti-psychotic, haloperidol, on protein expression in the rat brain (striatum) and to correlate the changes with behavioural effects. Results of the behavioural testing revealed significant orofacial dyskinesia, with decreased total movement and grooming onset in the haloperidol treated rats. Expression of several proteins was changed in the haloperidol-treated brains, including glial fibrillary acidic protein. Chronic haloperidol treatment resulted

in extrapyramidal side effects in rats implying that this animal model is suitable for studying molecular mechanisms of this anti-psychotic on the brain. Changes in glial fibrillary acidic protein expression suggests a possible role of glia in mediation of haloperidol effects on brain function.

Studies are being undertaken concurrently in collaboration with NISAD scientists Dr Tim Karl and Ms Liesl Duffy at the Garvan Institute, to correlate changes in rat brain protein expression profiles with changes in rat behaviour and side effects of haloperidol (typical) and risperidone (atypical) anti-psychotic drugs (APDs). Previous research suggests that the atypical anti-psychotics are less likely to cause side effects such as extrapyramidal symptoms (EPS) than the typical anti-psychotics. Results from the behavioural studies demonstrated that anti-psychotic drug treatment in general had a significant sedative-like effect on motor activity. Furthermore, drug-treated animals exhibit an anxious-like phenotype and a loss of fine motor movements. The first detected increase in EPS in APD-treated animals disappeared over time. Risperidone had a more stimulating effect on grooming behaviour whereas haloperidol had a stronger sedative-like effect. In conclusion, this study has shown that the effects of APDs are not limited to EPS. Domains such as anxiety and motor activity are affected as well. Differences in the behavioural profile of typical and atypical APDs are not restricted to EPS.

THE ROLE OF THE GABA NEUROTRANSMITTER/RECEPTOR SYSTEM IN SCHIZOPHRENIA

Abnormal GABA neurotransmission in schizophrenia may lead to a deficit in inhibitory processes. This deficit has been suggested to account for some of the symptoms of schizophrenia. NISAD-supported researchers Dr Tina Hinton, Prof. Graham Johnston and colleagues have previously shown that GABA-A receptor subunits are differentially altered in post-mortem schizophrenia brains, but it is not certain whether these changes are due to the disease or antipsychotic drug administration. Furthermore, this group has also shown that some antipsychotic drugs alter GABA activity at GABA-A receptors, predominantly through inhibition of GABA activity. NISAD-supported Honours students Ms Kelly Skilbeck and Ms Jenn O'Reilly have investigated the effects of antipsychotic drugs at GABA-A receptor subtypes, chronically administering antipsychotic drugs to rats to determine whether differential changes in GABA-A receptor subtype expression are due to drug administration in schizophrenia. NISAD-supported PhD student Ms Kelly Skilbeck is now investigating mechanisms by which the brain adapts to stress and the endogenous mediators involved that act on the GABA-A receptors, which has implications for the pathophysiology of schizophrenia.

THE EFFECTS OF DRUGS OF ABUSE IN AN ANIMAL MODEL OF SCHIZOPHRENIA

NISAD-supported PhD student Ms Aurelie Boucher, Dr Jonathon Arnold, Dr Tina Hinton, Prof. Graham Johnston and Dr Tim Karl are extending the study of the Neuregulin 1 (Nrg1) knockout mouse model of schizophrenia (see Garvan report above) by examining the effects of acute and chronic illicit drug treatment on a wide variety of schizophrenia-related behavioural domains. Such a "multi-tiered" strategy for the behavioural phenotyping of a drug-affected animal model of schizophrenia is a unique approach in schizophrenia research. To explore the neurobiological mechanisms associated with recreational drug use in schizophrenia, different brain areas of interest will also be analysed in Nrg1 knockout animals. As evidence shows that the risk of developing schizophrenia is also associated with environmental risk factors, further research will examine the effects of standardised laboratory housing conditions versus conditions of "environmental enrichment".

Department of Biomedical Science, University of Wollongong & Australian Nuclear Science and Technology Organisation

THE ROLE OF THE CINGULATE CORTEX AND SUPERIOR TEMPORAL GYRUS IN SCHIZOPHRENIA

The superior temporal gyrus (STG) and cingulate cortex, including anterior (ACC) and posterior (PCC) divisions, are brain areas that have been suggested as sites of primary pathological change in schizophrenia. Using human post-mortem brain tissue, NISAD researchers Dr Katerina Zavitsanou, Ms Kelly Newell, Dr Chao Deng and A/Prof. Xu-Feng Huang have continued to investigate alterations in a range of neurotransmitter/receptor systems in these areas in schizophrenia.

Previous research by this group has shown a significant decrease in muscarinic (M1/M4) receptors in the ACC in schizophrenia. In the past year a subsequent study has suggested this effect was highly specific, as no evidence was found for a similar decrease in M2/M4 muscarinic receptors in schizophrenia. Given the growing evidence of the possible role of the muscarinic system in schizophrenia, this research suggests the potential for the development of new pharmacological treatments for schizophrenia, possibly through the development of muscarinic agonists. Future research will examine the effects of anti-psychotic medications on muscarinic receptors in the rat brain to help determine whether the changes observed in the human brain were a result of schizophrenia or anti-psychotic medication.

The Wollongong group has also focused on examining alterations in various receptors in the PCC. Evidence was found for a decrease in M1/M4 muscarinic receptors, no change in M2/M4 muscarinic receptors and an increase in GABAA receptors in schizophrenia. Further studies have shown that ionotropic

glutamatergic, serotonin 5-HT2 and cannabinoid CB1 receptor densities were also altered in the PCC in schizophrenia. These were the first studies to examine neurotransmitter receptor binding in the PCC in schizophrenia and the findings were all consistent with earlier ACC studies from this group.

The STG is strongly implicated in the pathophysiology of schizophrenia, particular with regards to auditory hallucinations. Research by the Wollongong group has found significantly decreased densities of muscarinic M1/M4 receptors and increased GABAA receptor densities in this region in schizophrenia. These results again correlate with the findings in the ACC and PCC.

ADRENOCEPTORS IN THE PREFRONTAL CORTEX - POSSIBLE MECHANISM FOR COGNITIVE DYSFUNCTION IN SCHIZOPHRENIA

Cognitive dysfunction and difficulties in learning and adapting to new environmental challenges are routinely observed in schizophrenia patients. The prefrontal cortex (PFC) is known to play an important role in cognition and memory and previous studies have shown that noradrenaline, the neurotransmitter in the adrenergic system, acts on post-synaptic α2-adrenoceptors to strengthen working memory. Thus selective α2-adrenoceptor agonist treatment has been shown to improve PFC function in both animals and humans. Stimulation of α1-adrenoceptors, however, impairs PFC function and this can be reversed with selective α1-adrenoceptor antagonists. Dr Yean Yeow Tan, appointed as NISAD Research Officer at the Wollongong Centre in November 2004, has commenced a study examining the PFC of the human brain to test whether the population and function of these receptors involved in memory formation are altered in schizophrenia.

BRAIN GENE AND PROTEIN EXPRESSION INDUCED BY DRUGS USED TO TREAT SCHIZOPHRENIA

In general, treatment for schizophrenia involves chronic therapy with atypical anti-psychotics. Whilst these drugs are effective in treating the symptoms of the disorder, they can produce severe side effects. Olanzapine, an atypical anti-psychotic with high affinity for serotonin receptors, can alter energy balance regulation leading to obesity. A/Prof. Xu-Feng Huang, Dr Katerina Zavitsanou and Dr Chao Deng conducted a study that examined changes in the mRNA levels encoding serotonin 5-HT2A and 5-HT2C receptors in various regions of the rat brain, and their relationship to energy balance/energy efficiency following chronic olanzapine administration. It was found that olanzapine had significant effects in stimulating food intake and increasing body weight gain, particularly in the first 12 days of treatment. These rats were able to maintain the body weight gained subsequently with a slight increase in food intake. The study also demonstrated that in some areas of the brain, 5-HT2A and 5-HT2C receptor mRNA expressions were altered after chronic olanzapine treatment. It is suggested that the maintenance of the body weight gained by olanzapine treatment may be due, not only to high energy intake, but also energy conversion efficiency. Future research will investigate whether a range of anti-psychotics can change/remodel neurotransmitter systems progressively in those areas associated with the neuropathology of schizophrenia.

THE ROLE OF MEMBRANE PHOSPHOLIPID COMPOSITION IN SCHIZOPHRENIA

Whilst the aetiology of schizophrenia remains unknown there is an emerging body of evidence that suggests membrane phospholipid composition (MPC) is altered in schizophrenia. Slight changes in fatty acid composition of the membrane has significant effects on ion channels, membrane bound proteins, receptors and neurotransmitters. Previous research has also shown that fatty acid supplementation can significantly improve symptoms experienced by schizophrenia patients. NISAD scientists Ms Teresa du Bois, A/Prof. Xu-Feng Huang and colleagues conducted a study examining how membrane composition affects muscarinic receptors, which have been implicated in schizophrenia, in several brain regions in animals who have been fed high/low fat diets. The main findings from the study were that compared to a low fat diet control group, M2/M4 receptor density was significantly reduced in the caudate putamen, anterior cingulate cortex, dentate gyrus and regions of the hippocampus and amygdala of rats on a high n-6 polyunsaturated fatty acid (PUFA) diet, but no differences were found for rats on high n-3 PUFA or saturated fat diets. No differences in M1/M4 receptor binding densities were observed for any of the fat diet groups. These results suggest that a diet high in n-6 PUFA may selectively alter M2/M4 receptor-mediated signal transduction in the rat brain.

COGNITIVE NEUROSCIENCE RESEARCH PANEL REPORT

Panel Members

Dr Johanna Badcock
University of Western Australia (from May 2005)
Dr Michael Breakspear
Prince of Wales Medical Research Institute
Dr Bill Budd
University of Newcastle
Professor Vaughan Carr
NISAD Scientific Director
Dr Martin Cohen
University of Newcastle
Professor Max Coltheart
Macquarie University
Mr Gavin Cooper
NISAD System Administrator
Dr Pritha Das
NISAD Senior Research Officer

Mr Daren Draganic
NISAD Research Manager
Dr Allison Fox
University of Western Australia
Dr Ross Fulham
University of Newcastle
Dr Melissa Green
Macquarie University
Dr Anthony Harris
Westmead Hospital
Dr Pat Johnston
University of Newcastle
Dr Frini Karayanidis
University of Newcastle
Dr Marion Kellenbach
NISAD Research Coordinator (from March 2005)
Dr Robyn Langdon
Macquarie University
Dr Carmel Loughland
NISAD Senior Research Officer
Dr Gin Malhi
Prince of Wales Medical Research Institute
Ms Kathryn McCabe
NISAD Research Assistant
Professor Patricia Michie
University of Newcastle
Mr Paul Rasser
NISAD Research Officer
Dr Tamara Russell
Macquarie University
Associate Professor Ulrich Schall
University of Newcastle (Convenor)
Dr Nadia Solowij
University of Wollongong
Dr Tirupati Srinivasan
University of Newcastle (from February 2005)
Assistant Professor Paul Thompson
University of California Los Angeles
Dr Juanita Todd
University of Newcastle
Associate Professor Philip Ward
University of NSW (until June 2005)
Mr Thomas Whitford
Westmead Hospital (from February 2005)
Associate Professor Lea Williams
Westmead Hospital

The Cognitive Neuroscience Research Panel focuses on research in cognition, computational modelling, and cognitive neuroscience as it applies to understanding the neural systems implicated in schizophrenia and associated disorders (covering the full range of methodologies, including radionuclide, MR-based, electrophysiological, and additional techniques not currently available or widely used e.g. transcranial magnetic stimulation, magnetoencephalography, optical imaging).

NISAD Virtual Brain Bank

The NISAD Virtual Brain Bank (VBB) is a schizophrenia-focused MRI brain data collection based on imaging technology developed by the Laboratory of Neuro Imaging (LONI) of UCLA, and extended in Australia by NISAD. The VBB has grown substantially over the past year and now contains approximately 120 high-resolution MR brain scans from people suffering from schizophrenia at various stages of their disease, first-degree biological relatives, cannabis users (with and without schizophrenia) and healthy controls. This VBB will provide the basis to investigate important research questions such as the effect of gender, age of onset, duration of illness, and cannabis use on cortex integrity in schizophrenia.

Schizophrenia Research Unit, Liverpool Hospital

EVENT-RELATED POTENTIAL STUDIES OF AUDITORY PROCESSING DYSFUNCTIONS IN SCHIZOPHRENIA AND BIPOLAR DISORDER

Converging evidence from event-related potential (ERP) and behavioural studies demonstrates that patients with schizophrenia display deficits in early stages of auditory information processing, which may reflect altered inhibitory processing. A study conducted by NISAD supported researchers Mr Nathan Clunas and A/Prof. Philip Ward at the Schizophrenia Research Unit used ERP techniques to investigate a particular brain waveform which measures attention and attention deficits that can be found in patients. A series of studies measured the recovery cycle of the auditory N100 ERP component in patients with schizophrenia, patients with bipolar disorder and healthy volunteers. That is, the research group examined the subjects' brain waves approximately 100 milliseconds after sounds were presented. Results showed that the distinctive pattern observed in healthy volunteers was disrupted in patients with schizophrenia. Future research will examine patients with bipolar disorder, to see whether different patterns of response to sounds are seen in these patients. Ultimately, this research may assist in understanding the problems patients with schizophrenia and bipolar disorder experience in focussing attention on everyday events and depending on the final results in the bipolar group, the development of a biological test.

Centre for Mental Health Studies, University of Newcastle

FACIAL EMOTION RECOGNITION DEFICITS IN SCHIZOPHRENIA

Patients with schizophrenia have been shown to have problems in recognising displays of facial emotion. Previous research has suggested that this deficit is restricted to the recognition of negative emotions (e.g. fear, anger, disgust, sadness) implying that schizophrenia may be associated with a "negative emotion

specific deficit", putatively associated with a dysfunction in the limbic system, particularly the amygdala. The alternate view is that, given that patients with schizophrenia show an overall decline in facial expression recognition, the greater difficulty in recognising negative emotions may reflect *a priori* differences in discrimination difficulty for negative ratehr than positive facial expressions of emotion. NISAD scientists Dr Pat Johnston and Dr Frini Karayanidis from the University of Newcastle therefore conducted a study that examined facial emotion recognition accuracy for seven emotion categories. Schizophrenia subjects and one group of controls viewed identical sets of facial stimuli. A second group of controls viewed the same stimuli degraded so as to equate overall level of accuracy to the schizophrenia subjects. Both the schizophrenia and degraded-image control groups showed reduced overall recognition accuracy and reduced recognition accuracy for fearful and sad facial stimuli compared to the intact-image control group. There were no differences in recognition accuracy for any emotion category between the schizophrenia group and the degraded-image control group. These findings argue against a negative emotion specific deficit in schizophrenia.

VISUAL SCANPATH STUDIES OF FACES AND FACIAL EXPRESSIONS IN SCHIZOPHRENIA

Dr Carmel Loughland has continued with her program of research examining visual scanpaths as, previously, people with schizophrenia have been shown to exhibit abnormally restricted visual scanpaths to faces/facial expressions of emotion and to avoid salient facial features (e.g. eyes and mouth). It is thought that these visual scanpath deficits may contribute to problems with interpersonal communication and social interaction in schizophrenia. Evidence also exists that attenuated but similar scanpath deficits are evident in first-degree relatives of schizophrenia patients, and may represent a trait vulnerability marker for schizophrenia. Dr Loughland's latest study investigated whether the observed scanpath deficits to faces in schizophrenia were associated with dysfunction in information sequencing or information retention/integration of facial information, and whether a familial transmission component was involved. Results showed that schizophrenia subjects had restricted visual scanpaths to faces, and impaired performance compared to relatives and controls on tasks used to differentially tap information sequencing or information retention/integration processes. However, first-degree relatives' performance fell equidistant between the schizophrenia and control subjects and they produced an attenuated scanpath pattern, suggesting familial transmission involvement. Facial emotion accuracy was impaired only for the schizophrenia subjects. The findings from this line of research may be used to develop treatment and rehabilitation strategies to assist people with schizophrenia to optimise their social communication with others and to reduce their social disability.

Schizophrenia Research Unit, Liverpool Hospital; Centre for Mental Health Studies, University of Newcastle

STRUCTURAL AND FUNCTIONAL DEFICITS IN FIRST-EPISODE SCHIZOPHRENIA PATIENTS

A collaborative group of NISAD scientists including Mr Paul Rasser, Dr Pat Johnston, A/Prof. Ulrich Schall and A/Prof. Philip Ward have continued their research investigating the potential relationships between structural and functional brain anomalies and schizophrenia using the latest analysis techniques developed by LONI, UCLA. Previously their research found novel evidence for a significant association between the widespread cortical grey matter reductions in schizophrenia and fMRI activation in a task requiring executive attention and working memory. These findings suggested a subtle reduction of regional grey matter in first-episode schizophrenia patients was associated with impaired brain function. In the past year this research has been extended to examine the cerebellar cortex in first-episode schizophrenia patients using similar techniques. While the cerebellar cortex has traditionally been associated with gait and fine motor control, it has been suggested that this structure is part of a neuronal loop that serves to integrate motor and cognitive functioning. Preliminary results have shown cerebellar involvement in the higher level cognitive processing required for the planning task in control subjects, who displayed a pattern of right frontal cortical and contralateral cerebellar activation. First-episode schizophrenia patients, however, exhibited a reversed pattern of fMRI activation suggesting they may rely on alternative strategies to perform the planning task.

Schizophrenia Research Unit, Liverpool Hospital; Centre for Mental Health Studies & Functional Neuroimaging Laboratory, University of Newcastle

BRAIN IMAGING STUDIES OF AUDITORY PROCESSING DYSFUNCTIONS IN SCHIZOPHRENIA

Abnormalities in the auditory system have long been suspected to be present among people who suffer from schizophrenia, due in part to the high prevalence of auditory hallucinations amongst these patients. Over the last decade a core group of NISAD scientists including A/Prof. Philip Ward, A/Prof. Ulrich Schall and Prof. Pat Michie have identified an index of auditory information processing called mismatch negativity (MMN), that is elicited by a sound that violates an established pattern stored in memory, and is abnormal in patients with schizophrenia. In the past year these research groups have collaborated on a range of studies investigating this phenomenon.

An NHMRC-funded study utilising fMRI to identify the specific brain regions that are active during auditory information processing, and linking these to the sources of the scalp recorded measures in schizophrenia patients was conducted in

2004-2005. This functional measure was examined in relation to the volume of brain tissue, measured from MRI scans using the LONI analysis technique, which enables the identification of subtle changes in brain anatomy. Patients who had recently developed schizophrenia, those who were chronic patients, and their close relatives were examined, providing the opportunity to identify biological markers of increased vulnerability for the development of schizophrenia. Preliminary fMRI results confirmed patients showed reduced activity in a fronto-temporal network in line with electrophysiological MMN data.

Dr Juanita Todd and colleagues at the University of Newcastle have been extending previous MMN research to examine candidate mechanisms for MMN reduction and the impact of duration of illness (in schizophrenia). The aim of this study was to determine the effect of duration of illness, deviant type and probability on the MMN in patients and first-degree relatives. Whilst MMN was reduced in schizophrenia to duration and intensity deviants early in the illness, the reduction in MMN to frequency deviants did not appear until later in the illness. MMN was not reduced in first-degree relatives. The results support a weaker memory trace of the repeated sequence rather than poor precision in feature encoding and invite speculation on a pattern of premature aging in the auditory system.

Brain Dynamics Centre, Westmead Hospital

PATHWAYS FOR FEAR PERCEPTION IN SCHIZOPHRENIA

When humans express fear, anger or disgust, they show different patterns of autonomic response, yet it is not known how autonomic and other neural systems interact during perception of danger signals. This is especially relevant to schizophrenia patients, as it is known that these individuals process emotional stimuli differently to unaffected individuals. NISAD scientists Dr Pritha Das, A/Prof. Lea Williams and colleagues have previously utilised fMRI in healthy control subjects during a fear perception task to show that the thalamus, amygdala, sensory (inferior occipital, fusiform) cortices and the anterior cingulate cortex are part of a distributed neural system for fear perception. It is thought that breakdowns in these interactions may give rise to emotion-related symptoms seen in a range of neuropsychiatric disorders.

During 2004-2005, this group have extended their research to examine fear perception in schizophrenia patients using fMRI. A new study examined whether fear-related deficits in schizophrenia are also apparent for subliminal processing, and whether more specific breakdowns in the pathways for fear perception could be identified. Schizophrenia and control subjects viewed fear and neutral face stimuli presented either subliminally or supraliminally. In the subliminal condition, the control group showed greater activation in the bilateral amygdalae and ventral MPFC, whereas the schizophrenia group showed more activation in the thalamus, midbrain, fusiform and dorsal MPFC. In the control group the amygdalae activation correlated positively with the pulvinar and brainstem, and negatively with the sensory cortex. These relationships were reversed in the schizophrenia group in both the subliminal and conscious fear conditions, suggesting a disruption of both direct and indirect fear processing pathways. Such a breakdown in fear processing across levels of awareness might account for the intrusive nature of fear-related symptoms such as paranoia, and the inability to consciously control these experiences.

THE CLINICAL PROFILE OF FIRST EPISODE PSYCHOSIS IN WESTERN SYDNEY

NISAD provided support for Dr Anthony Harris and colleagues to conduct a study to examine the clinical profile, treatment and social functioning of a community based sample of young people presenting with their first episode of psychosis. Over a two year period, young people with their first episode of psychosis referred to early intervention services in two area mental health services in Western Sydney were assessed with a battery of clinical, neuropsychological, psychophysiological and neuroanatomical measures. Of the 224 referrals to the project, 94 subjects met inclusion criteria and agreed to take part. Subjects were divided into three diagnostic groups - "Schizophrenia", "Mood Disorders" and "Mixed Psychosis", the latter principally comprised of substance induced psychotic disorders. Subjects from the "Schizophrenia" group differed significantly from the other two groups in that they had higher levels of negative symptoms and general psychopathology, and were less likely to be employed or engaged in study. They had poorer overall social functioning. Subjects with "Mixed Psychosis" were similar to those from the "Schizophrenia" group in that they were older and male, but they did not have the same burden of negative symptoms as the "Schizophrenia" group. The "Mood Disorders" group was younger, female and had overall a higher level of psychosocial functioning than the other two groups. Subjects from the "Mood Disorders" group were more likely to be managed with mood stabilisers and multiple drug therapies. The use of atypical antipsychotic medication was almost universal. Even shortly after the time of presentation to mental health services young people with a schizophrenia spectrum diagnosis have a heavier burden of symptoms and are significantly more impaired by them than young people with other psychotic illnesses. This and their symptom profile differentiated them from young people with other psychotic disorders.

GREY MATTER DEFICITS IN FIRST-EPISODE SCHIZOPHRENIA

Building upon the Western Sydney First Episode Psychosis Project (see above), NISAD supported a study conducted by PhD student Mr Thomas Whitford, Dr Anthony Harris, A/Prof. Lea Williams and colleagues that used MRI scanning techniques to investigate the relationship between grey matter reductions and

clinical profile in first-episode schizophrenia patients (FES). In an initial study FES subjects and controls underwent an MRI brain scan. Four regions of grey matter reduction were identified in the FES subjects, which were correlated with their composite scores on the following three symptom dimensions: Psychomotor Poverty, Disorganization and Reality Distortion. The volumes of 3 of the 4 target cortical regions were positively correlated with Reality Distortion syndrome score, indicating that distinct, widespread grey matter reductions are present very early in the course of schizophrenia. The results also suggest a possible structural underpinning for the abnormal brain activity typically associated with symptoms of Reality Distortion.

Macquarie Centre for Cognitive Science, Macquarie University

SOCIAL CONTEXT PROCESSING IN SCHIZOPHRENIA

Deficits in the processing of contextual information have been related to multiple cognitive dysfunctions in schizophrenia and may constitute a core deficit of the disorder. However, the relevance of poor context processing for the understanding of social cognition in schizophrenia has been relatively overlooked.

This study, led by Dr Melissa Green, tested the hypothesis that schizophrenia patients may fail to use social contextual information effectively when making mental state attributions on the basis of information contained in facial expressions. Using visual scanpath recordings as an overt index of directed attention to contextual information contained in pictures of social scenes, the study examined the pattern of short-duration saccadic eye movements (saccades < 50 ms) thought to reflect an integrative perceptual grouping process. Subjects viewed a series of picture pairs that depicted target facial expressions of characters presented in isolation or embedded in a realistic social context. Participants were asked to judge the mental state of each character while eye movements were recorded. Results demonstrated that schizophrenia patients showed abnormal attention to contextual information when judging the meaning of ambiguous and fearful expressions. Specifically, schizophrenia patients spent more time viewing faces (versus context) when the face depicted an ambiguous expression, but spent more time viewing contextual information when the face expressed fear. Schizophrenia patients also demonstrated a lack of the normal increase in short-duration fixations when viewing complex social scenes versus faces alone. These results do not support a simple deficit account of social context processing in schizophrenia. Eye-movements to social scenes suggests that ambiguous facial expressions capture the attention of schizophrenia patients, while those displaying overt threat elicit excessive context processing. The reduced number of short-duration fixations in schizophrenia reflects a lack of rapid scanning of visual stimuli that may facilitate effective social context processing in real world environments.

THEORY OF MIND AND SCHIZOPHRENIA

Many prominent schizophrenia symptoms (e.g. social dysfunction/persecutory delusions) have been attributed to an impaired ability to infer, monitor, and take appropriate account of other people's mental states (e.g. thoughts, interests, intentions and feelings). This capacity has come to be termed theory-of-mind (ToM). Recent findings suggest that these impairments in schizophrenia may be secondary to more fundamental disruptions of social attention coupled with abnormal reasoning and/or attributional biases. Led by Dr Robyn Langdon, a team of NISAD-supported scientists examined whether the ToM deficits associated with schizophrenia resemble those observed in autism. Autistic individuals fail to appreciate false beliefs, yet understand the causal connections between behavioural events and simple emotions, leading to the hypothesis that their difficulty is specific to appreciating the representational nature of beliefs. To assess whether this domain-specificity is also seen in schizophrenia, cartoon-strips of events likely to elicit strong emotional reactions in story characters were used to assess emotion attribution. Characters' faces were blanked out and participants thought about how the characters would be feeling in order to select cards depicting the appropriate facial affect. Participants later named emotions depicted in facial-affect cards. Results demonstrated that patients were as capable as controls of identifying cartoon facial expressions, yet had greater difficulties with (a) attributing emotions based on circumstances and (b) inferring false beliefs. Schizophrenia patients, unlike autistic individuals, suffer a domain-general difficulty with empathetic perspective-taking that affects equally their appreciation of other people's beliefs, percepts and emotions.

PERSECUTORY DELUSIONS IN SCHIZOPHRENIA

During 2004-2005 NISAD-supported student Ryan McKay completed a range of studies investigating persecutory delusions in schizophrenia and was awarded his PhD. An influential model of persecutory delusions claims that they are characterised by a particular attributional bias (a tendency to make externalising, personalising attributions for negative events), driven by a defensive need to maintain self-esteem by avoiding the activation of covert negative self-concepts. This model predicts that persecutory delusions should be associated with discrepancies between relatively high measures of overt self-esteem and relatively low measures of covert self-esteem. In this study, patients with persecutory delusions, recruited from the NISAD Schizophrenia Register, were found to have lower covert self-esteem (as assessed by the Implicit Association Test) relative to controls and patients with remitted persecutory delusions, while scoring no differently on two measures of overt self-esteem. These results are thus consistent with a model of persecutory delusions as serving a defensive function to avoid activation of covert negative self-concepts.

Centre for Clinical Research in Neuropsychiatry, University of Western Australia

THE RELATIONSHIP BETWEEN EMOTION AND HALLUCINATIONS IN SCHIZOPHRENIA

The majority of patients with schizophrenia will experience auditory hallucinations (AH) during their illness. Hallucinated voices are predominantly negative and critical in tone and content. Negative emotions (e.g. depression, anxiety, stress etc) are strongly linked with AH, often accompanied by lower personal well-being, such as hopelessness and suicidality and predict poor long term outcomes. Current pharmacological and psychological treatments for schizophrenia and, in particular, for AH, are not consistently successful.

Over 2004-2005 NISAD-supported PhD student Georgina Paulik and Dr Johanna Badcock have continued to explore the relationship between emotion and hallucinations in schizophrenia. The aim of their first study was to explore the relationship between negative mood and the risk of experiencing AH in the general population. Approximately 700 first year university students completed several questionnaires including the Launay-Slade Hallucination Scale (LSHS) - which provides an index of individual predisposition to hallucinatory experiences - together with the Depression, Anxiety and Stress Scales. The results from this research have revealed that individuals predisposed to hallucinations (identified using the LSHS) have significantly higher levels of all three negative emotions, but especially anxiety, than individuals who are at lower risk of experiencing hallucinations. These findings are important as they contribute to the development of a profile of hallucination-prone individuals, which may help to increase the reliability of early identification of individuals during the prodromal phase of psychosis, and guide preventative and early interventions. For example, the results point to the particular importance of treating anxiety (in addition to psychotic symptoms) in the earliest phases of psychosis.

PSYCHOPHARMACOLOGY AND THERAPEUTICS RESEARCH PANEL REPORT

Panel Members

Dr Amanda Baker
University of Newcastle
Professor Vaughan Carr
NISAD Scientific Director (Convenor, until April 2005)
Associate Professor Scott Clark
University of New South Wales (until June 2005)
Dr Martin Cohen
University of Newcastle (Convenor, from April 2005)
Mr Daren Draganic
NISAD Research Manager
Ms Jo Gorrell
NISAD Research Officer
Dr Melissa Green
Macquarie University
Dr Anthony Harris
Westmead Hospital
Dr Marion Kellenbach
NISAD Research Coordinator (from March 2005)
Dr Carmel Loughland
NISAD Senior Research Officer
Ms Kathryn McCabe
NISAD Research Assistant
Ms Bev Moss
NISAD Research Officer
Dr Louise Nash
Royal North Shore Hospital
Dr Tamara Russell
Macquarie University (from March 2005)
Dr Nadia Solowij
University of Wollongong
Dr Helen Stain
Centre for Rural and Remote Mental Health

The Psychopharmacology and Therapeutics Research Panel focuses on research investigating the effects of medication and/or pharmacological probes in patients, 'at-risk' populations and healthy volunteers. It also provides a platform for initiating trials of new interventions, both pharmacological and non-pharmacological.

Department of Psychology, University of Wollongong

INVESTIGATION OF RELATIONSHIPS BETWEEN CANNABIS USE AND SCHIZOPHRENIA

A range of NISAD-supported studies, examining the relationship between cannabis use and schizophrenia, have continued at the University of Wollongong in 2004-2005. This is an area of particular interest to NISAD as such a high percentage of people with schizophrenia also use cannabis.

Dr Nadia Solowij, Ms Colleen Respondek and colleagues have continued with their study that is using functional MRI and tests of neuropsychological functioning to investigate the neurocognitive correlates of memory, apathy and executive functioning associated with long-term heavy cannabis use and schizophrenia. The research aims to determine if co-morbidity of schizophrenia and long-term cannabis use has a greater effect on these functions than schizophrenia alone. Preliminary results in the cannabis group have shown differences in neuropsychological test performance and alterations in brain activation including lower activation in regions relevant to memory function. Data collection from people with schizophrenia who do and do not also use cannabis is continuing.

Dr Solowij, Ms Sharon Monterrubio and colleagues have also conducted a study that investigated the relationship between fatty acids, cannabis use and stress in schizophrenia. This line of research was inspired by evidence that cerebrospinal fluid levels of anandamide (a neurotransmitter formed from an omega-6 fatty acid) were abnormally high in patients with schizophrenia. Anandamide is known to affect the stress-regulating cannabinoid system, and higher levels are associated with reduced symptoms. Fatty acid levels were measured in red blood cell membranes of medicated patients. Half these patients had never used cannabis, and half had stopped using cannabis more than six months prior to the study. Stress levels were also measured using standardised questionnaires. Results showed that high levels of arachidonic acid and other fatty acids that enhance anandamide function were associated with lower levels of nervous tension-stress, but only in the former cannabis users. At the same time, high levels of linoleic acid, a fatty acid that is abundant in diet, were strongly associated with higher levels of nervous tension-stress - again, only in former cannabis users. These results suggest that certain fatty acids may aid cannabis-using individuals with schizophrenia to cope with stress and are promising from the point of view of developing pharmacological and/or dietary interventions which may help protect stabilised patients from relapse.

THE EXPERIENCE OF RECOVERY FROM SCHIZOPHRENIA

In order to realise the vision of recovery-oriented mental health services, there is a need for a model and a method of measuring recovery as it is described by consumers. NISAD-supported PhD student Ms Retta Andresen and colleagues previously developed a consumer-oriented five-stage model of recovery, Focusing on reports made by people with schizophrenia, the first stage of the study identified four key factors in psychological recovery: (i) finding hope; (ii) re-establishment of identity; (iii) finding meaning in life; (iv) taking responsibility for recovery. Five stages were identified in the process of psychological recovery: (i) moratorium; (ii) awareness; (iii) preparation; (iv) rebuilding; (v) growth. A measure based on this model, the Stages of Recovery Instrument (STORI), was subsequently developed. Using volunteers from the NISAD Schizophrenia Research Register, results provide preliminary support for a stage model of recovery, and validation of the STORI as a measure of the consumer definition of recovery. Further development of the measure will improve its capacity to discriminate between stages of recovery. This will enable further empirical testing of the stage model of recovery.

Centre for Mental Health Studies, University of Newcastle

BRAIN IMAGING IN CHRONIC CANNABIS USERS AND CANNABIS USING FIRST EPISODE SCHIZOPHRENIA PATIENTS

This study, being undertaken by Dr Martin Cohen and colleagues, is investigating whether schizophrenia pathology shares a common neural substrate with the pathological brain changes associated with cannabis use. Chronic use of cannabis can impair frontal brain functioning, affecting the capacities for attention, working memory and concentration. These cognitive deficits bear striking similarities to those associated with the negative symptom cluster of schizophrenia, which are also thought to be related to frontal brain dysfunction. The NHMRC supported study has used the LONI analysis technique, via NISAD's collaboration with UCLA, to apply both structural and fMRI techniques to investigate how chronic cannabis use affects the structure and function of the brain and make comparative analyses with the brain changes associated with schizophrenia. Preliminary results have shown that both chronic cannabis users and first episode schizophrenia patients showed a similar reduced pattern of activation (compared to healthy controls), suggesting the possibility of a shared pathological mechanism in these conditions.

COGNITIVE REMEDIATION OF FACIAL EMOTION DECODING AND VISUAL SCANPATH DEFICITS IN SCHIZOPHRENIA

Patients with schizophrenia demonstrate deficits in their ability to identify facial displays of emotion, which may contribute to the observed problems with interpersonal communication and social interaction seen in schizophrenia. Recording eye movements (i.e. visual scanpaths) while people view face stimuli provides a window into the neurocognitive strategies that underlie face processing. NISAD-supported PhD scholar Ms Kathryn McCabe has initiated a study that aims to investigate cognitive remediation of scanpath deficits in schizophrenia. This is an area of research not previously investigated in schizophrenia. The first stage of this research has commenced, with the establishment of the eye movement paradigm and stimuli development. The results of this research in people with schizophrenia and first-degree relatives will allow the identification of people with specific eye movement deficits associated with information sequencing or information integration/retrieval for the targeting of remediation programs. This research will draw together two previously unrelated fields of research into one program.

COGNITIVE BEHAVIOUR THERAPY FOR SUBSTANCE USE DISORDERS AMONG PEOPLE WITH A PSYCHOTIC ILLNESS

Few randomised controlled trials have been aimed specifically at substance use reduction among people with psychotic disorders. The aim of this NHMRC and NISAD-supported study, led by Dr Amanda Baker, was to investigate whether an intervention comprised of motivational interviewing (MI) and cognitive behaviour therapy (CBT) was more efficacious than routine treatment in reducing substance use and improving symptomatology and general functioning. A sample of people with psychotic disorder and reporting hazardous alcohol, cannabis and/or amphetamine use during the last month was recruited and randomly allocated to MI/CBT or treatment as usual. The

study found that MI/CBT intervention was associated with modest improvements. Further research is needed to evaluate the specific impacts on regular amphetamine use and to develop more efficacious interventions among regular cannabis users. A stepped care approach to interventions for excessive alcohol consumption among people with a psychotic disorder was recommended.

SMOKING CESSATION INTERVENTION AMONG PEOPLE WITH A PSYCHOTIC DISORDER

Despite extremely high smoking rates among people with a psychotic disorder, and associated financial and health costs, few studies have investigated the efficacy of smoking cessation interventions among this group. Led by Dr Amanda Baker, and utilising the NISAD Register, this NHMRC-funded study compared an integrated psychological and nicotine replacement therapy (NRT) intervention for people with a psychotic disorder with routine care alone. Smokers with a psychotic disorder received either routine care, or an eight session, individually administered smoking cessation intervention consisting of NRT, motivational interviewing (MI) and cognitive-behaviour therapy (CBT). While there were no overall differences between the treatment and control groups in abstinence rates, a significantly higher proportion of smokers who completed all treatment sessions had quit smoking at each of the follow-up occasions (3, 6 and 12 months). Smokers who completed all treatment sessions were also more likely to have achieved continuous abstinence at 3 months. There was a strong dose-response relationship between treatment session attendance and smoking reduction status, with half of those who completed the intervention program achieving a 50% or greater reduction in daily cigarette consumption across the follow-ups, compared with less than one-fifth of those in the control condition. There was no evidence of any associated deterioration in symptoms or functioning. These findings demonstrate the utility of an NRT plus MI/CBT smoking cessation intervention among people with a psychotic disorder. Further development of more efficacious interventions is required for those who do not respond to existing interventions.

Macquarie Centre for Cognitive Science, Macquarie University

REMEDIATION OF POOR EMOTION PROCESSING IN SCHIZOPHRENIA

Deficits in social functioning are a hallmark of schizophrenia. One aspect that has received much attention is emotion processing; specifically facial emotion processing. Difficulties with this social skill are of particular importance as they impact on both the day-to-day functioning of the patient and their quality of life. Dr Tamara Russell, a NISAD co-funded Research Officer, conducted two studies to determine the feasibility of an intensive, computer-based intervention for emotion recognition in schizophrenia, which has not been attempted previously.

The first project examined the performance of stable, medicated, out-patients with schizophrenia compared to healthy control participants on two tasks assessing emotion recognition (emotion labelling and emotion matching), before and after a visual/attention remediation package was administered. Accuracy on the two tasks was determined at baseline followed immediately by the computer intervention (Ekman's Micro Expression Training Tool - METT) and a post-test assessment. The METT trains subjects on the recognition of seven universally recognised facial expressions. Patients with schizophrenia improved with training on both tasks, and their performance was no longer significantly different from pre-trained healthy controls following training. The use of brief remediation therapy to improve emotion perception may therefore be a valuable adjunct to existing cognitive remediation programs.

In a further study being conducted in collaboration with Dr Melissa Green and Prof. Max Coltheart, visual scan path technology is used to quantify changes in visual attention to facial emotional stimuli occurring after training with the METT. Eye movement recordings represent a direct means of examining attentional strategies used to process facial expressions. This project is ongoing, and is aiming to show that remediation with the METT can "normalise" information gathering processes in schizophrenia, during the perception of emotions from faces. This project has future implications for clinical treatment of social cognitive deficits in schizophrenia.

SCHIZOPHRENIA RESEARCH INFRASTRUCTURE PANEL REPORT

Panel Members

Ms Lisa Azizi
NISAD Research Assistant
Ms Angela Bates
NISAD Clinical Assessment Officer (April - June 2005)
Ms Margaret Boyes
NISAD Research Officer
Dr Bill Budd
University of Newcastle (from February 2005)
Professor Vaughan Carr
NISAD Scientific Director
Associate Professor Scott Clark
University of New South Wales (until June 2005)
Dr Irina Dedova
NISAD TRC Coordinator
Dr Gavin Dixon
NISAD Research Officer (until October 2004)
Mr Daren Draganic
NISAD Research Manager
Associate Professor Jo Duflou
Department of Forensic Medicine (from February 2005)
Ms Therese Garrick
University of Sydney

Ms Alisa Green
University of Sydney
Professor Clive Harper
University of Sydney (Co-Convenor)
Dr Anthony Harris
Westmead Hospital
Professor Graham Johnston
University of Sydney (until April 2005)
Dr Marion Kellenbach
NISAD Research Coordinator (from March 2005)
Ms Gali Lawrence
NISAD Clinical Assessment Officer (from April 2005)
Mr Terry Lewin
University of Newcastle
Dr Carmel Loughland
NISAD Senior Research Officer (Co-Convenor)
Associate Professor Izuru Matsumoto
University of Sydney
Dr Louise Nash
Royal North Shore Hospital (until February 2005)
Ms Amanda North
NISAD Research Assistant (from September 2004)
Dr Sarah Russell
NISAD Clinical Assessment Officer (from April 2005)
Professor Rodney Scott
Hunter Area Pathology Service
Ms Donna Sheedy
University of Sydney
Dr Paul Tooney
University of Newcastle

The Schizophrenia Research Infrastructure Panel oversees the operation of NISAD's key schizophrenia research infrastructure facilities. These include the NISAD Schizophrenia Research Register, the Hunter DNA Bank for Schizophrenia and Allied Disorders, the NSW Tissue Resource Centre and the NISAD 'Gift of Hope' Tissue Donor Program.

NISAD Schizophrenia Research Register

The NISAD Schizophrenia Research Register is a volunteer database of people with schizophrenia and their first-degree family members who are willing to be involved in schizophrenia research. In 2004-2005 the Register has continued to develop, now listing 1,150 members. This continuing growth led to NISAD appointing Ms Gali Lawrence as a Clinical Assessment Officer for the Register in April, 2005.

In the past year the Register has provided participants for 17 schizophrenia research studies conducted at Liverpool Hospital, Macquarie University and the Universities of Newcastle and Wollongong. Additionally, for the first time, the Register has supported research conducted interstate at the University of Queensland and the Mental Health Research Institute of Victoria. These studies have included clinical, neuroimaging and genetic research investigating many facets of schizophrenia including delusions, cognition, emotions, the effects of cannabis, social skills, auditory processing and remediation/recovery. Since its launch there have been over 500 'participations' in schizophrenia research projects by Register members.

In 2004-2005 there were 10 manuscripts accepted/published on research that utilised the Register.

Hunter DNA Bank for Schizophrenia and Allied Disorders

The Hunter DNA Bank for Schizophrenia and Allied Disorders collects and stores DNA from blood samples of people with schizophrenia, their close relatives and healthy controls, to be used in projects investigating the genetics of schizophrenia. In 2004-2005 the DNA Bank has grown to list over 130 members from the Hunter region. In the coming year the DNA Bank will be expanded to include recruitment of volunteers from the Sydney region.

As with the Register, all volunteers also undergo an interview to confirm diagnosis and to collect clinical and neuropsychological information, and family history of psychiatric illness. This will ultimately provide researchers with a large sample of genetic (DNA) samples that are cross-referenced with comprehensive clinical and neuropsychological information, to support research into the genetics of schizophrenia. In the coming year it is hoped that the DNA Bank will be able to commence supporting such research.

NISAD was successful in obtaining grant funding from the Australian Rotary Health Research Fund to appoint Dr Sarah Russell to the position of Clinical Assessment Officer with the DNA Bank in April, 2005.

The DNA Bank is supported by NISAD, the Hunter Medical Research Institute, University of Newcastle and Hunter Area Pathology Service.

NSW Tissue Resource Centre

The NSW TRC is a facility for the collection, storage and distribution of well characterised fixed and frozen human brain tissue for neuropsychiatric research (with a focus on schizophrenia). A further 20 cases were collected during 2004-2005, taking the total number of cases held by the TRC to over 400.

In the past year tissue has been requested and supplied for 13 neuropsychiatric research studies nationally (New South Wales, Queensland, South Australia) and internationally (Japan). These studies have used a variety of neurobiological techniques, including genetics, proteomics and autoradiography to investigate the causes of schizophrenia. In 2004-2005 there were 10 manuscripts accepted/published on schizophrenia-related research that utilised the NSW TRC.

NISAD was successful in obtaining three-year grant funding from

the Macquarie Bank Foundation to support the NSW TRC and 'Gift of Hope' Program (see below). Ms Amanda North was appointed to the position of Research Assistant with the NSW TRC in September, 2004.

The NSW TRC is jointly supported by NISAD, the University of Sydney, Sydney South West Area Health Service, Australasian Brewers' Foundation and the National Institute of Alcohol Abuse and Alcoholism.

Brain Donor Programs - The NISAD 'Gift of Hope' & 'Using our Brains' Brain Donor Programs

The NISAD 'Gift of Hope' (GoH) is a volunteer program which enables people with schizophrenia and those without a mental illness to donate their brain for schizophrenia and related research after death. The benefit of this program (and the UoB program - see below) is that donors are assessed on a range of clinical, neuropsychological and neuroimaging investigations, the results of which are available for later correlation with post-mortem findings. In the past year an additional 30 volunteers from NSW have indicated their interest in joining the GoH program, taking the total number of donors to over 260.

The 'Using our Brains' (UoB) program focuses on inviting people without a mental illness to donate their brain for research after death. Having access to 'normal control' tissue for comparison is essential for studies into such disorders as schizophrenia. Over 1,600 people have joined the UoB program nationwide, and a further six collections have occurred in 2004-2005.

PUBLICATIONS

Journal Articles

NISAD support played a vital role in the development of the schizophrenia-related research initiatives that led to the submission and publication of the following manuscripts in peer-reviewed journals.

PUBLISHED

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Das P, Kemp A, Liddell B, Brown K, Olivieri G, Peduto T, Gordon E, **Williams L**. Pathways to fear perception: modulation of amygdala activity by thalamo-cortical systems. *Neuroimage* 2005; 26: 141-148.

Dixon G, **Garrick T**, Whiteman I, **Sarris M**, **Sithamparanathan S**, **Harper C**. Characterisation of GABAergic neurons within the human medial mamillary nucleus. *Neuroscience* 2004; 127: 365-372.

Dixon G, **Harper C**. No evidence for selective GABAergic interneuron deficits in the anterior thalamic complex of patients with schizophrenia. *Progress in Neuropsychopharmacology and Biological Psychiatry* 2004; 28: 1045-1051.

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Harper C, **Matsumoto I**. Ethanol and brain damage. *Current Opinion in Pharmacology* 2005; 5: 73-78.

Harris A, Brennan J, Anderson J, Taylor A, Sanbrook M, Fitzgerald D, Lucas S, Redoblado-Hodge A, Gomes L, Gordon E. The clinical profile of first episode psychosis in Western Sydney - Scope and general findings of the Western Sydney First Episode Psychosis Project. *Australian and New Zealand Journal of Psychiatry* 2005; 39: 36-43.

Karl T, Lin S, Schwarzer C, Sainsbury A, Couzens M, Wittman W, Boey D, von Horsten S, Herzog H. Y1 receptors regulate aggressive behaviour via modulating serotonin pathways. *Proceedings of the National Academy of Sciences* 2004; 101: 12742-12747.

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Rasser P, **Johnston P**, **Lagopoulos J**, **Ward P**, **Schall U**, Thienel R, Bender S, Toga A, **Thompson P**. Functional MRI BOLD response to Tower of London performance of first-episode schizophrenia patients using cortical pattern matching. *Neuroimage* 2005; 26: 941-951.

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Wright M, Harmon K, Bowman J, **Lewin T**, **Carr V**. Caring for depressed patients in rural communities: general practitioners' attitudes, needs and relationships with mental health services. *Australian Journal of Rural Health* 2005; 13: 21-27.

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Zavitsanou K. M1 receptor agonism, a possible treatment for cognitive deficits in schizophrenia (letter). *Neuropsychopharmacology* 2004; 29: 1585-1586.

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Eyles D, Smith S, Kinobe R, Hewison M, McGrath J. Distribution of the vitamin D receptor and the 1a-hydroxylase in human brain. *Journal of Chemical Neuroanatomy* 2005; 29: 21-30.

Ito M, Depaz I, Wilce P, Suzuki T, Niwa S, **Matsumoto I**. Expression of human neuronal protein 22, a novel cytoskeleton-associated protein in the prefrontal cortex, anterior cingulate cortex and hippocampus of schizophrenic brain: an immunohistochemical study. *Neuroscience Letters* 2005; 378: 125-130.

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Badcock J, Maybery M. Common or distinct deficits for auditory and visual hallucinations? - Commentary. *Behavioural and Brain Sciences* (in press).

Baker A, Bucci S, **Lewin T**, Kay-Lambkin F, Constable P, **Carr V**. Randomised control trial of cognitive behaviour therapy for substance use disorders among people with a psychotic disorder. *British Journal of Psychiatry* (in press).

Blair I, **Chetcuti A**, Badenhop R, Scimone A, Moses M, Adams L, Craddock N, Green E, Kirov G, Owen M, Kwok J, Donald JK, Mitchell P, **Schofield P**. Positional cloning, association analysis, and expression studies provide convergent evidence that the cadherin gene FAT contains a bipolar disorder susceptibility allele. *Molecular Psychiatry* (in press).

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Deng C, **Huang XF**. Decreased density of muscarinic receptors in the superior temporal gyrus in schizophrenia. *Journal of Neuroscience Research* (in press).

Du Bois T, **Deng C**, **Huang X**. Membrane phospholipid composition, alterations in neurotransmitter systems and schizophrenia. *Progress in Neuropsychopharmacology and Biological Psychiatry* (in press, subsequently published 2005; 29: 879-889).

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Johnston P, Stojanov W, **Devir H**, **Schall U**. Functional MRI of facial emotion recognition deficits in schizophrenia and their electrophysiological correlates. *European Journal of Neuroscience* (in press).

Karl T, Burne T, Herzog H. Effect of a Y1 receptor deficiency on anxiety- and exploration-related behaviours in mice. *Behavioural Brain Research* (in press).

Lagopoulos J, **Malhi G**, Shnier R. A fibre-optic system for recording skin conductance in the scanner. *Behaviour Research Methods Instruments and Computers* (in press).

Langdon R, Coltheart M, Ward P. Empathetic perspective-taking is impaired in schizophrenia: evidence from a study of emotion attribution and theory of mind. *Cognitive Neuropsychiatry* (in press).

Langdon R, Corner T, McLaren J, **Coltheart M**, **Ward P**. Attentional orienting triggered by gaze in schizophrenia. *Neuropsychologia* (in press).

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Newell K, Zavitsanou K, Huang XF. Differential alterations in iontropic glutamatergic receptors in the posterior cingulate cortex in schizophrenia. *Neuroreport* (in press).

Newson P, Lynch-Frame A, Roach R, Bennett S, **Carr V, Chahl L**. Intrinsic sensory deprivation induced by neonatal capsaicin treatment induces changes in rat brain and behaviour of possible relevance to schizophrenia. *British Journal of Pharmacology* (in press).

Nicholson R, Karayanidis F, Poboka D, Heathcote A, **Michie P**. Electrophysiological components associated with anticipatory task-switching processes. *Psychophysiology* (in press).

Schleimer S, Johnston G, Henderson J. Novel oral drug administration in an animal medial of chronic neuroleptic therapy. *Journal of Neuroscience Methods* (in press, subsequently published 2005; 146: 159-164).

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Teubner M, Nixon J, **Rasser P**, Bottema M, Clark R. Source localisation in a real human head. *Brain Topography* (in press).

Tooney P, Anderson W, Lynch-Frame A, **Chahl L**. The effects of haloperidol treatment on the distribution of NK1 receptor immunoreactive neurons in the guinea pig brain. *Neuroscience Letters* (in press, subsequently published 2005; 383: 155-159).

Whitford T, Farrow T, Gomes L, Brennan J, **Harris A**, **Williams L**. Grey matter deficits and symptom profile in first-episode schizophrenia. *Psychiatry Research: Neuroimaging* (in press).

BOOKS

Senior C, **Russell T**, Gazzaniga M (eds). Methods in Mind. MIT Press 2005 (in press).

RESEARCH GRANTS

NISAD GRANTS

NISAD scientists were successful in obtaining the following grants administered by the Institute in the 2004-2005 period.

Badcock J, Draganic D, Michie P, Ward P. Well-being in schizophrenia: the role of emotion in auditory hallucinations: a collaborative NISAD/CCRN study. Ron and Peggy Bell Foundation, 2004-2006 ($30,675).

Carr V, Draganic D, Harper C. The NSW Tissue Resource Centre and 'Gift of Hope' Tissue Donor Program. The Macquarie Bank Foundation, 2004-2007 ($75,000).

Carr V, Scott R, Tooney P, Loughland C, Draganic D. Schizophrenia DNA Bank. Australian Rotary Health Research Fund Project Grant, 2005 ($59,750).

Dedova I. Effects of chronic haloperidol treatment on proteomic profiles in the rat striatum. Australian Neuroscience Society Travel Award, 2005 ($500).

Draganic D, Carr V. The neural pathophysiology of the posterior cingulate cortex in schizophrenia: The St George Foundation Scholarship for Schizophrenia Research. The St George Foundation, 2005 ($10,000).

Draganic D, Tooney P, Ward P. Analysis of gene expression in schizophrenia using genetic technology: NISAD PhD Scholarship for Schizophrenia Research. J S Love Trust, 2004-2005 ($20,000).

Schofield P, Draganic D, Carr V. Linking basic and clinical research to understand the causes of schizophrenia (PPI equipment). The Alma Hazel Eddy Trust & Baxter Charitable Foundation, 2005 ($19,000).

NISAD-SUPPORTED GRANTS

NISAD infrastructure support played a vital role in the success of the following grant applications from NISAD scientists and affiliates in 2004-2005.

Aitken R, McLaughlin E, Lewis P, Griffith R, Rose R, Patrick J, McCurdy D, McCluskey A, Von Nagy-Felsobuki E, Dunkley P, Dickson P, Rostas J, Ashman L, Burns G, Foster P, Gibson P, Smith R, Sim A, **Tooney P**, **Ross F**. The University of Newcastle Advanced Proteomics Facility. ARC Linkage Infrastructure Equipment & Facilities Grant, 2005 ($207,189).

Bowden N. Altered expression of brain related genes in lymphocytes in schizophrenia. World Congress on Psychiatric Genetics Travel Grant, 2004 ($2,000).

Budd B. An integrated psychoacoustic and high-field fMRI study of auditory temporal processing dysfunction in schizophrenia. NHMRC New Investigator Grant, 2005-2007 ($302,250).

Catts S, **Willcox D**. A constituency building project in support of an Australian Psychosis Research Network. The Myer Foundation, 2005-2006 ($80,000).

Cohen M, Johnston P, Schall U, Carr V. A comparative structural and functional cerebral MRI study of first episode schizophrenia and long-term cannabis use. University of Newcastle Project Grant, 2005 ($14,500).

Deng C. Muscarinic M1 and M2 receptors in the superior temporal gyrus of normal and schizophrenia subjects. University of Wollongong Early Career Grant, 2004-2005 ($2,000).

Deng C. Pathological alterations in glutamate receptors in the superior temporal gyrus in schizophrenia. University of Wollongong Health and Behavioural Sciences Faculty Small Grant, 2005-2006 ($5,000).

Harper C, Green A, Garrick T. Using our Brains TDP, analysis of cognitive effects in drinkers and non drinkers - Australian normative data. Australian Brewer's Foundation, 2005 ($32,500).

Karl T, Herzog H. Environmental and genetic background effects on the behavioural phenotype of a schizophrenia-related Nrg1 knockout model. The Rebecca Cooper Medical Research Foundation, 2005 ($16,000).

Loughland C, Cohen M, Johnston P, Carr V. Remediation of facial affect decoding and visual scanpath deficits in schizophrenia. University of Newcastle Project Grant, 2005 ($8,000).

Matsumoto I, Dedova I. Effects of chronic risperidone treatment on rat brain proteomics. Janssen-Cilag Japan, 2005 ($63,050).

Matsumoto I. Brain bank and donor program for biomedical research into schizophrenia and alcohol-related disorders. NSW Ministry for Science and Medical Research Biofirst Award Extension, 2006 ($110,000).

McClean C, **Harper C**. National network of brain banks. NHMRC Enabling Grants, 2004-2009 ($2,000,000).

Meyer B, **Solowij N**, **Monterrubio S**. A study of stress, cannabis use and fatty acids in schizophrenia. University of Wollongong Faculty of Health and Behavioural Sciences Small Research Grant, 2005-2006 ($5,000).

Michie P, Hunter M, **Karayanidis F, Todd J, Budd B, Fulham R**. Upgrade of ERP facilities in the Functional Neuroimaging Laboratory. Brain and Mental Health Research Program Grant, Hunter Medical Research Institute, 2004-2005 ($8,000).

Newell K. Increased NMDA receptor density in the posterior cingulate cortex in schizophrenia: selective alterations in ionotropic glutamate receptors in the posterior cingulate cortex in schizophrenia. University of Wollongong Travel Grant, 2005 ($1,000).

Richards A. The contribution of contextual processing problems to reduced mismatch negativity in schizophrenia. EEG and Clinical Neuroscience Society Meeting Travel Award, 2004 ($1,500).

Schall U, Karayanidis F, Budd B, Johnston P. Functional neuroimaging of prepulse inhibition in schizophrenia and Parkinson's disease. NHMRC Project Grant, 2005-2007 ($440,625).

Schall U, Karayanidis F, Johnston P. Functional neuroimaging and inhibitory brain processes in schizophrenia. University of Newcastle Project Grant, 2005 ($14,000).

Schall U, Michie P, Carr V, Johnston P, Karayanidis F, Todd J, Budd B, Cohen M. Research assistant for EEG recordings and neuropsychiatric assessments at the Psychological Assistance Service. Brain and Mental Health Research Program Grant, Hunter Medical Research Institute, 2004-2005 ($17,500).

Tan YY. Adrenoceptors regulation in human prefrontal cortex - possible mechanism for cognitive dysfunction in schizophrenia. University of Wollongong Early Career Researcher Grant, 2005 ($2,000).

Tan YY. Effects of acute and chronic antipsychotic treatment on brain adrenoceptors and intracellular signalling proteins. University of Wollongong Health and Behavioural Sciences Faculty Small Research Grant, 2005-2006 ($5,000).

Tooney P, Loughland C, Scott R, Carr V. Technical support for the Hunter DNA Bank for Schizophrenia and Allied Disorders. Brain and Mental Health Research Program, Hunter Medical Research Institute, 2004-2006 ($75,116).

Ward P. SynAmps2 EEG/ERP amplifier (64 channel). NHMRC Equipment Grant, 2004 ($30,000).

Weidenhofer J. Gene profiling in the amygdala in schizophrenia. World Congress on Psychiatric Genetics Travel Grant, 2004 ($2,000).

CONFERENCE PRESENTATIONS

INVITED PRESENTATIONS

NISAD scientists were invited to give presentations on NISAD-supported research outcomes at the following conferences/meetings.

Karayanidis F. ERP measures of attentional control. Invited presentation at the International Conference on Attentional Control, Chai-Yi, Taiwan, January, 2005.

Solowij N. Cannabis and neurocognitive functioning. Invited presentation at the Institute of Psychiatry Symposium on Cannabis and Psychosis, London, December, 2004.

Solowij N. Cannabis and cognitive function: relevance to psychotic disorders. Invited presentation at the Cannabis and Mental Illness Conference, Melbourne, August, 2004.

Ward P. Models of cognitive dysfunction in schizophrenia and first episode psychosis - evidence from ERPs and fMRI. Invited presentation at the Australasian Society for Biological Psychiatry meeting, Perth, December, 2004.

CONFERENCE PRESENTATIONS

NISAD support played a vital role in the development of the schizophrenia-related research initiatives that led to the following conference presentations/submissions.

PRESENTED

Alexander K, Dedova I, James G, **Sheedy D, Matsumoto I**. Proteomics of the alcoholic BA9 white matter. Presented at the Australian Neuroscience Society Conference, Perth, January, 2005.

Anderson W, Tooney P, Ross F. Complexation of cannabinoidergic and serotonergic G protein-coupled receptors in schizophrenia. Presented at the Australian Neuroscience Society Conference, Perth, January, 2005.

Andresen R, Oades L, Caputi P. Psychometric Testing of a Measure of Stages of Recovery. Presented at The Mental Health Services Conference of Australia and New Zealand, Gold Coast, September, 2004.

Baker A, Carr V, Richmond R, Haile M, **Lewin T**, Taylor R, Wilhelm K. Intervention for tobacco dependence among people with a psychotic illness - results from a randomised controlled trial. Presented at the International Congress on Schizophrenia Research, Savannah, USA, April, 2005.

Baker A, Richmond R, Haile M, **Lewin T, Carr V**, Wilhelm K, Moeller-Saxone K, Taylor R, Jansons S, Kay-Lamkin F, Constable P. A randomized control trial of an intervention for tobacco dependence among people with a psychotic illness. Presented at the Australasian Society for Psychiatric Research Conference, Perth, December, 2004.

Barrett J, Glahn D, Velligan D, **Green M**. Emotion intensity judgments are not influenced by context in schizophrenia. Presented at the International Congress on Schizophrenia Research, Savannah, USA, April, 2005.

Bowden N, Weidenhofer J, Scott R, Todd J, Case V, **Schall U**, **Tooney P**. Altered expression of brain related genes in lymphocytes in schizophrenia. Presented at the World Congress on Psychiatric Genetics, Dublin, Ireland, October, 2004.

Boyes M, Garrick T. Schizophrenia, neuroscience and the 'Gift of Hope' Tissue Donor Program. Presented at the Central Sydney Area Health Service Winter Symposium, Sydney, July, 2004.

Budd B. A psychoacoustic and fMRI investigation of auditory temporal processing in schizophrenia. Presented at the Australasian Society for Psychiatric Research Conference, Perth, December, 2004.

Budd B. A psychoacoustic and fMRI investigation of auditory temporal processing. Presented at the Australasian Society for Psychophysiology Meeting, Melbourne, December, 2004.

Chahl L, Newson P, Roach R, Bennett S, Lynch-Frame A, **Carr V**. Intrinsic sensory deprivation induced by neonatal capsaicin treatment induces changes in adult rat brain and behaviour relevant to schizophrenia. Presented at the International Congress on Schizophrenia Research, Savannah, USA, April, 2005.

Chetcuti A, Adams L, **Schofield P**. Microarray analysis of altered gene expression in the mouse brain after treatment with lithium chloride or sodium valproate. Presented at the Australian Schizophrenia Conference, Brisbane, September, 2004.

Clark D, **Dedova I, Matsumoto I**. Changes in the grey matter proteomic profile of the anterior cingulate cortex in schizophrenia. Presented at the Australian and New Zealand Society for Neuropathology Conference, Sydney, May, 2005.

Clunas N, Ward P. Altered auditory recovery cycle function in schizophrenia and bipolar disorder: an ERP study. Presented at the Australasian Society for Psychiatric Research Conference, Perth, December, 2004.

Clunas N, Ward P. Altered auditory recovery cycle function in schizophrenia and bipolar disorder: an ERP study. Presented at the International Congress on Schizophrenia Research, Savannah, USA, April, 2005.

Cohen M, Carr V, Schall U, Johnston P, Ward P, Rasser P. fMRI investigation of executive function in first episode schizophrenia and chronic cannabis users. Presented at the Australian Schizophrenia Conference, Brisbane, September, 2004.

Cohen M, Johnston P, Schall U, Ward P, Carr V. Discussion of the rationale and methodology for conducting a structural and functional brain imaging study assessing the potential neurodevelopmental sequelae of adolescent cannabis use. Presented at the Australasian Society for Psychiatric Research Conference, Perth, December, 2004.

Cohen M, Johnston P, Schall U, Ward P, Carr V. A comparative fMRI investigation of the effects of chronic cannabis use and first episode schizophrenia on cerebral activation requisite for executive function. Presented at the International Congress on Schizophrenia Research, Savannah, USA, April, 2005.

Dedova I, Garrick T, Sheedy D, Fortis A, **Harper C**. Brain Banking for neuroscience. Presented at Science Week, University of NSW, Sydney, August, 2004.

Dedova I, Garrick T, Sheedy D, Fortis A, **Harper C**. Brain Banking for neuroscience. Presented at the University of Sydney College of Health Sciences 'Cell to Society' Conference, Sydney, November, 2004.

Deng C, Huang XF. Decreased density of muscarinic M1/M4 and M2 receptors in superior temporal gyrus in schizophrenia. Presented at the Australian Neuroscience Society Conference, Perth, January, 2005.

Duncan C, Chetcuti A, Schofield P. Identification of genes associated with schizophrenia using an animal model of antipsychotic drug action. Presented at the Australian Society for Medical Research Conference, June, 2005.

Duncan C, Chetcuti A, Schofield P. Identification of genes associated with schizophrenia using an animal model of anti-psychotic drug action. Presented at the St Vincents Hospital Research Symposium, Sydney, September, 2004.

Garrick T, Azizi L, Harper C. Brain donation for research - what do families say? Presented at the Australasian Health and Medical Research Congress, Sydney, November, 2004.

Garrick T, Azizi L, Harper C. Brain donation for research - what do families say? Presented at the University of Sydney College of Health Sciences 'Cell to Society' Conference, Sydney, November, 2004.

Garrick T, Howell S, Terwee P, Redenbach J, Blake H, **Harper C**. Brain donation for research - who donates and why? Presented at the Australian and New Zealand Society for Neuropathology Scientific Meeting, Sydney, June, 2005.

Garrick T, Sheedy D, Fortis A, Cutler N, Hodda A, **Harper C.** Neurotoxicology and Coroner's cases in New South Wales, Australia. Presented at the International Toxicology Conference, Finland, June, 2005.

Gorrell J, Moss B, Ward P, Nash L, Tennant C. Pathways to care in early psychosis: understanding treatment delay. Presented at the Australasian Society for Psychiatric Research Conference, Perth, December, 2004.

Gorrell J, Moss B, Ward P, Nash L, Tennant C. Pathways to care in early psychosis: understanding treatment delay. Presented at the Australian Schizophrenia Conference, Brisbane, September, 2004.

Gorrell J, Moss B, Ward P, Nash L, Tennant C, **Draganic D**, Rosen A. Pathways to care in early psychosis: understanding treatment delay. Presented at the International Early Psychosis Conference, Vancouver, Canada, September, 2004.

Green A, Garrick T, Sheedy D, Blake H, **Harper C.** "Using our Brains" Tissue Donor Program. Presented at the University of Sydney College of Health Sciences 'Cell to Society' Conference, Sydney, November, 2004.

Green M. Context processing and social cognition in schizophrenia. Presented at the Australian Society for the Study of Brain Impairment, Brisbane, July, 2004.

Green M, Uhlhaas P, Slawitschka E. Short duration eye movements facilitate gestalt perception of faces. Presented at the Annual Meeting of the Cognitive Neuroscience Society, New York, April, 2005.

Green M, Waldron J, Coltheart M. Eye movements reflect aberrant processing of social context in schizophrenia. Presented at the International Congress on Schizophrenia Research, Savannah, USA, April, 2005.

Green M, Waldron J, Coltheart M. Mental state perception in schizophrenia: The role of context. Presented at the International Neuropsychology Society Conference, Brisbane, July, 2004.

Green M, Waldron J, Coltheart M. Social context processing and schizophrenia: A visual scanpath investigation. Presented at the Australian Conference of Cognitive Neuropsychology and Cognitive Neuropsychiatry, Sydney, July, 2004.

Hannan R, Karayanidis F, Pokoba D, Heathcote A, **Michie P**. ERP components associated with preparation for an impending switch in task. Presented at the International Conference on Attentional Control, Chai-Yi, Taiwan, January, 2005.

Hinton T, Johnston G. GABAA receptor subunit mRNA expression in human brain and evidence for changes in schizophrenia. Presented at the Australasian Winter Conference on Brain Research, Queenstown, New Zealand, August, 2004.

Huang XF, Chen F, Wang H, Huang X, Yu Y, **Zavitsanou K**, Lawrence A. Differential response of dopamine transporter in mice resistant to diet-induced obesity. Presented at the Australian Neuroscience Society Conference, Perth, January, 2005.

Hughes M, Michie P, Budd B, Fulham R, Badcock J. Right inferior frontal gyrus involvement in stop-signal inhibition: fMRI evidence. Presented at the International Conference on Attentional Control, Cha-Yi, Taiwan, January, 2005.

Hunt S, **Schall U**, Halpin S, Beckmann J, **Carr V.** Neurocognitive profiles of prodromal psychosis. Presented at the Australasian Society for Psychiatric Research Conference, Perth, December, 2004.

Hunt S, **Schall U**, Halpin S, Beckmann J, **Carr V.** Neurocognitive profiles of prodromal psychosis. Presented at the International Congress on Schizophrenia Research, Savannah, USA, April, 2005.

Johnston P, Devir H, Karayanidis F. Facial emotion processing deficits in schizophrenia: behavioural evidence against a negative emotion specific deficit. Accepted for presentation at the Australasian Society for Psychiatric Research Conference, Perth, December, 2004.

Johnston P, Schall U, Halgren E. BOLD fMRI Activation in patients with schizophrenia performing an implicit memory task. Presented at the International Congress on Schizophrenia Research, Savannah, USA, April, 2005.

Karayanidis F, Hannan R, Michie P. Differential positivity (D-pos) in cue-stimulus interval reflects anticipatory task-set reconfiguration processes. Presented at the World Congress of Psychophysiology, Thessaloniki, Greece, September, 2004.

Karayanidis F, Hannan R, Poboka D, Davies A, Heathcote A, **Michie P.** Anticipatory cognitive control in task-switching: differential effects of 'switch to' versus 'switch away' cues. Presented at the Experimental Psychology Conference, Melbourne, April, 2005.

Karayanidis F, Schall U, Hannan R, Meem L. Preparation in anticipation of a predictable task-switch in schizophrenia. Presented at the World Congress of the International Organisation of Psychophysiology, Porto Carras, Greece, September, 2004.

Karayanidis F, Hannan R, Pokoba D, Heathcote A, **Michie P**. Active preparation in task-switching: differential effects of 'switch-to' and 'switch-away' cues. Presented at the International Conference on Attentional Control, Chai-Yi, Taiwan, January, 2005.

Karl T, Herzog H. Y1 receptors regulate aggressive and anxious-like behaviours by modulating serotonin pathways. Presented at the Neuroscience Colloquium, Kioloa, Australia, March, 2005.

Langdon R, Corner T, McLaren J, **Coltheart M, Ward P**. Orienting attention in the direction of another person's gaze is abnormal in schizophrenia. Presented at the Cognitive Neuroscience Meeting, April, 2005.

Loughland C, Lewin T, Carr V, Harris A. Neuropsychological profiles within schizophrenia samples recruited from non-treatment settings. Presented at the International Congress on Schizophrenia Research, Savannah, USA, April, 2005.

Loughland C, Lewin T, Carr V. NISAD Schizophrenia Research Register: engagement of research participants and patterns of participation. Presented at the Australasian Society for Psychiatric Research Conference, Perth, December, 2004.

Loughland C, Sheedy J, Harris A, Lewin T, Carr V. Neuropsychological functioning within schizophrenia samples from different sources: comparisons with RBANS. Presented at the Australian Schizophrenia Conference, Brisbane, September, 2004.

Matthews N, Todd J, Michie P. Behavioural and brain measures of sound lateralisation in schizophrenia. Presented at the Australian Schizophrenia Conference, Brisbane, September, 2004.

McKay R, Langdon R, Coltheart M. The defensive function of persecutory delusions: An investigation using the Implicit Association Test. Presented at the VII International Symposium on Schizophrenia, Bern, Switzerland, March, 2005.

McKay R, Langdon R, Coltheart M. Models of misbelief: Integrating motivational and deficit theories of delusions. Presented at the Artificial Intelligence and the Simulation of Behaviour Convention, Hertfordshire, UK, April, 2005.

Michie P, Todd J, Schall U, Karayanidis F. Duration of illness and mismatch negativity in schizophrenia. Presented at the World Congress on Biological Psychiatry Meeting, Vienna, Austria, June, 2005.

Mitchell M, Boyes M, Garrick T. Schizophrenia, thought disorder and crossed wires: are researchers asking consumers the right questions? Presented at the Communication, Medicine and Ethics and Centre for Values, Ethics and Law in Medicine (Comet-Velim) Conference, Sydney, June, 2005.

Monterrubio S, Solowij N, Meyer B. Cannabis and schizophrenia: fatty acids and symptom distress differ with history of cannabis use. Presented at the Cannabis and Mental Illness Conference, Melbourne, August, 2004.

Moss B, Gorrell J, Ward P, Nash L, Tennant C, **Draganic D**, Rosen A. Pathways to care in early psychosis: an effective tool to map the pathway to effective treatment. Presented at the International Early Psychosis Conference, Vancouver, Canada, September, 2004.

Newell K, Zavitsanou K, Huang XF. Increased NMDA receptor density in the posterior cingulate cortex in schizophrenia: selective alterations in ionotropic glutamate receptors in the posterior cingulate cortex in schizophrenia. Presented at the Australian Neuroscience Society Conference, Perth, January, 2005.

Paulik G, Badcock J, Maybery M. The role of emotion in predisposition to auditory hallucinations. Presented at the Experimental Psychology Conference, Melbourne, April, 2005.

Rasser P, Johnston P, Peck G, Thompson P, Schall U. Cerebellar fMRI BOLD activation of first-episode schizophrenia patients during the Tower of London task. Presented at the Australasian Society for Psychiatric Research Conference, Perth, December, 2004.

Rasser P, Johnston P, Peck G, Thompson P, Ward P, Carr V, Schall U. FMRI BOLD cerebellar activation of first-episode schizophrenia patients during the Tower of London task. Presented at the International Congress on Schizophrenia Research, Savannah, USA, April, 2005.

Rasser P, Johnston P, Peck G, Thompson P, Ward P, Schall U. FMRI BOLD cerebellar activation of first-episode schizophrenia patients during the Tower of London task. Presented at the Australian Schizophrenia Conference, Brisbane, September, 2004.

Respondek C, Solowij N, Ward P. Memory functioning in long-term cannabis users: an fMRI investigation. Presented at the Australian Psychological Society Conference, Sydney, September, 2004.

Richards A, Todd J, Michie P. The contribution of contextual processing problems to reduced mismatch negativity (MMN) in schizophrenia. Presented at the International Society for NeuroImaging in Psychiatry and the EEG & Clinical Neuroscience Society Conference, California, USA, September, 2004.

Ross F, Tooney P, Brown A. Investigation of the complexation of dopamine D2 and cannabinoid CB-1 receptors using fluorescence resonance energy transfer (FRET) in schizophrenia. Presented at the Australian Neuroscience Society Conference, Perth, January, 2005.

Sarris M, Ng WY, Harper C, Dixon G. The role of white matter microglia in the pathogenesis of schizophrenia. Presented at the National Society Histotechnology Convention, Toronto, Canada, September, 2004.

Schall U, Johnston P, Budd B, Karayanidis F. Functional brain imaging of prepulse inhibition. Presented at the Australian Schizophrenia Conference, Brisbane, September, 2004.

Schall U, Johnston P, Todd J, Ward P, Michie P. Functional brain imaging of auditory mismatch processing in schizophrenia. Presented at the International Congress on Schizophrenia Research, Savannah, USA, April, 2005.

Schleimer S, Henderson J, Johnston G. Locomotor and social effects of neuroleptics in rodents. Presented at the Australian Schizophrenia Conference, Brisbane, September, 2004.

Schleimer S, Henderson J, Johnston G. Comparison of induced Parkinsonism and the effect of neuroleptics in rodents. Presented at the Australian Neuroscience Society Conference, Perth, January, 2005.

Sheedy D, Dedova I, Garrick T, Fortis A, **Harper C**. Brain Banking for neuroscience. Presented at the Australasian Health and Medical Research Congress, Sydney, November, 2004.

Sheedy D, Fortis A, **Dedova I,** Shingde M, **Harper C.** Is tissue pH a true indicator of post-mortem brain integrity? Presented at the Australian Neuroscience Society Conference, Perth, January, 2005.

Sheedy D, Fortis A, **Dedova I,** Shingde M, **Harper C**. Is tissue pH a true indicator of post-mortem brain integrity? Presented at the Research Society on Alcoholism Meeting, California, USA, June, 2005.

Todd J, Michie P, Schall U, Karayanidis F. MMN reduction in schizophrenia: not such a simple story. Presented at the Australasian Society for Psychiatric Research Conference, Perth, December, 2004.

Weidenhofer J, Bowden N, Scott R, Tooney P. Differential gene expression in the amygdala and superior temporal gyrus in schizophrenia. Presented at the Australian Schizophrenia Conference, Brisbane, September, 2004.

Weidenhofer J, Bowden N, Scott R, Tooney P. Gene profiling in the amygdala in schizophrenia. Presented at the World Congress on Psychiatric Genetics, Dublin, Ireland, October, 2004.

Wheeler D, Dixon G, Harper C. Quantitative study of the posterior cingulate cortex and visual cortex - neuronal density measurements; schizophrenia compared to controls. Presented at the Institute of Biomedical Research Meeting, Sydney, December, 2004.

Zavitsanou K, Katsifis A, Mattner F, Yu Y, **Huang XF.** Investigation of [3H] pirenzepine and [3H]AF-DX 384 binding to muscarinic receptors in the anterior cingulate cortex in schizophrenia and mood disorders. Presented at the Australian Neuroscience Society Conference, Perth, January, 2005.

ACCEPTED

Blair I, **Chetcuti A**, Badenhop R, Scimone A, Adams L, Craddock N, Green E, Kirov G, Owen M, Kennedy M, Miller A, Joyce P, Olds R, Donald J, Mitchell P, **Schofield P**. Positional cloning, association analysis, and expression studies provide convergent evidence that the cadherin gene FAT contains a bipolar disorder susceptibility allele. Accepted for presentation at the World Congress on Psychiatric Genetics, Boston, USA, October, 2005.

Bowden N, Weidenhofer J, Scott R, Schall U, Todd J, Michie P, Tooney P. Classification of schizophrenia using differential gene expression in peripheral blood lymphocytes. Accepted for presentation at the Human Genetics Society of Australia Meeting, Newcastle, July, 2005.

Chetcuti A, Adams L, Mitchell P, **Schofield P**. Identification of novel valproate regulated genes in the mouse brain. Accepted for presentation at the World Congress on Psychiatric Genetics, Boston, USA, October, 2005.

Dedova I, Schleimer S, Dedov V, **Johnston G, Henderson J**, **Matsumoto I**. Effects of chronic haloperidol treatment on proteomic profiles in the rat striatum. Accepted for presentation at the International Society for Neurochemistry Conference, Innsbruck, Austria, August, 2005.

Deng C, Huang X. Increased density of GABAA receptors in the superior temporal gyrus in schizophrenia. Accepted for presentation at the Conference of the Chinese Neuroscience Society, Chongqing, China, October, 2005.

Duncan C, Chetcuti A, Schofield P. Identification of genes associated with schizophrenia using an animal model of antipsychotic drug action. Accepted for presentation at the World Congress on Psychiatric Genetics, Boston, USA, October, 2005.

Garrick T, Azizi L, Harper C. Brain donation for research - strong support! Accepted for presentation at the Australasian Winter Conference on Brain Research, Queenstown, New Zealand, August, 2005.

Garrick T, Howell S , Terwee P, Redenbach J, Blake H, **Harper C**. Brain donation for research - who donates and why? Accepted for presentation at the Neuroscience: From Bench to Bedside Meeting, Sydney, July, 2005.

Harper C, Dedova I, Garrick T, Sheedy D, Kril J, Pamphlett R, Harding A, Matsumoto I. Brain banking for neuroscience research. Accepted for presentation at the Neuroscience: From Bench to Bedside Meeting, Sydney, July, 2005.

Johnston P, Schall U, Halgren E. Schizophrenia patients show reduced differentiation in BOLD signal between novel and repeated stimuli in an implicit verbal memory task. Accepted for presentation at the International Conference for Cognitive Science, Havana, Cuba, September, 2005.

Karl T, Herzog H. Y1 receptors regulate aggressive and anxious-like behaviours by modulating serotonin pathways. Accepted for presentation at the European Behavioural Pharmacology Society Meeting, Barcelona, Spain, September, 2005.

McKay R, Langdon R, Coltheart M. Jumping to delusions? Paranoia, probabilistic reasoning and need for closure. Accepted for presentation at the Canadian Society for Brain, Behaviour and Cognitive Science 15th Annual Meeting, Montréal, Canada, July, 2005.

Sheedy D, Garrick T, Dedova I, Harper C. An Australian Brain Bank: a critical investment with a high return. Accepted for presentation at the European Society of Biomedical Research on Alcoholism, Kent, UK, September, 2005.

NISAD SUPPORTED RESEARCH STUDENTS

DEGREES AWARDED

NISAD supported the following students who were awarded higher degrees in 2004-2005.

DOCTOR OF PHILOSOPHY

Dr Patrick Johnston
Department of Psychology, University of Northumbria

Dr Ryan McKay
Macquarie Centre for Cognitive Science, Macquarie University

MASTERS

Ms Holly Devir
School of Behavioural Sciences, University of Newcastle

Ms Rachel Taylor
Macquarie Centre for Cognitive Science, Macquarie University

HONOURS

Ms Amanda Brown
School of Biomedical Sciences, University of Newcastle

Ms Teresa du Bois
Department of Psychology, University of Wollongong

Mr Simon Howell
Department of Pathology, University of Sydney

Ms Kelly Skilbeck
Department of Pharmacology, University of Sydney

POSTGRADUATE STUDENT SUPPORT

In the past year NISAD has also supported the following students.

PhD STUDENTS

Mr Wayne Anderson
School of Biomedical Sciences, University of Newcastle

Ms Retta Andresen
Department of Psychology, University of Wollongong

Ms Maryanne Ayre
Centre for Mental Health Studies, University of Newcastle

Ms Aurelie Boucher
Department of Pharmacology, University of Sydney

Ms Nikola Bowden
School of Biomedical Sciences, University of Newcastle

Mr Nathan Clunas
School of Psychiatry, University of New South Wales

Ms Teresa Du Bois
Department of Biomedical Science, University of Wollongong

Ms Carlotta Duncan
Faculty of Medicine, University of New South Wales

Ms Mei Han
Department of Biomedical Science, University of Wollongong

Mr Matthew Hughes
School of Behavioural Sciences, University of Newcastle

Mr Takeshi Iwazaki
Department of Pathology, University of Sydney

Mr Aaron Kent
Department of Psychology & Department of Psychiatry and Behavioural Science, University of Western Australia

Ms Natasha Matthews
School of Behavioural Sciences, University of Newcastle

Ms Kathryn McCabe
School of Medical Practice and Population Health, University of Newcastle

Ms Sharon Monterrubio
Department of Psychology, University of Wollongong

Ms Kelly Newell
Department of Biomedical Science, University of Wollongong

Ms Penny Newson
School of Biomedical Sciences, University of Newcastle

Ms Rebecca Nicholson
School of Behavioural Sciences, University of Newcastle

Ms Georgina Paulik
School of Psychology, University of Western Australia

Ms Colleen Respondek
Department of Psychology, University of Wollongong

Ms Amy Richards
School of Behavioural Sciences, University of Newcastle

Ms Sonja Schleimer
Department of Pharmacology, University of Sydney

Ms Kelly Skilbeck
Department of Pharmacology, University of Sydney

Ms Judith Weidenhofer
School of Biomedical Sciences, University of Newcastle

Mr David Wheeler
Department of Pathology, University of Sydney

MASTERS STUDENTS

Ms Adele Sedgman
School of Behavioural Sciences, University of Newcastle

HONOURS STUDENTS

Ms Danielle Clark
Department of Pathology, University of Sydney

Ms Madeleine Hinwood
School of Behavioural Sciences, University of Newcastle

Ms Gabrielle McQueen
Centre for Mental Health Studies, University of Newcastle

Ms Wan Yi Ng
Department of Pathology, University of Sydney

Ms Elisabeth O'Brien
Department of Pathology, University of Sydney

Ms Jenn O'Reilly
Department of Pharmacology, University of Sydney

Ms Natalie Potter
Department of Psychology, University of Wollongong

Ms Siobahn Quinn
Centre for Mental Health Studies, University of Newcastle

Ms Calista Spiro
Department of Pathology, University of Sydney

NISAD SUMMER STUDENT SCHOLARSHIPS

Mr Kevin Aquino
Brain Dynamics Centre, Westmead Hospital

Ms Natalie Beveridge
School of Biomedical Sciences, University of Newcastle

Ms Danielle Clark
Department of Pathology, University of Sydney

Ms Madeleine Hinwood
School of Behavioural Science, University of Newcastle

Ms Kathleen Khoo
Centre for Mental Health Studies, University of Newcastle

Ms Gabrielle McQueen
Centre for Mental Health Studies, University of Newcastle

Ms Kelly Skilbeck
Department of Pharmacology, University of Sydney

SCHIZOPHRENIA RESEARCH INFRASTRUCTURE SUPPORT

Schizophrenia Research Register

The following schizophrenia research projects were provided with volunteers from the NISAD Schizophrenia Research Register in 2004-2005.

Andresen R, Oades L, Caputi P. The experience of recovery: towards an empirically validated stage model. Department of Psychology, University of Wollongong.

Baker A, Ayre M. The measurement of feelings, problem-solving and well-being in schizophrenia. Centre for Mental Health Studies, University of Newcastle.

Budd B, Michie P, Todd J, Schall U. The integrity of auditory temporal processing in the ascending auditory system in schizophrenia. School of Behavioural Sciences & Centre for Mental Health Studies, University of Newcastle.

Green M, Coltheart M, Ward P. Face processing in social contexts. Macquarie Centre for Cognitive Science, Macquarie University.

Green M, Langdon R, Coltheart M. Automatic thoughts study. Macquarie Centre for Cognitive Science, Macquarie University.

Green M, Uhlhaas P, Slawitschka E. Perceptual organization in schizophrenia. Macquarie Centre for Cognitive Science, Macquarie University

Langdon R, Stevenson R, Catts S, Coltheart M, Ward P. Olfactory hallucinations in schizophrenia. Schizophrenia Research Unit, Liverpool Hospital.

Langdon R, Ward P, Coltheart M. Executive function and social cognition in schizophrenia. Macquarie Centre for Cognitive Science, Macquarie University

Matthews N, Todd J, Michie P. Behavioural and brain measures of sound lateralization in schizophrenia. School of Behavioural Sciences, University of Newcastle.

McCabe K, Loughland C, Hunter M, Johnston P. Facial expression processing deficits in schizophrenia and first-degree relatives. Centre for Mental Health Studies, University of Newcastle.

Michie P, Karayanidis F, Hughes M, Hannan R. The spatial and temporal dynamics of motor and cognitive inhibition: An fMRI and ERP study. School of Behavioural Sciences, University of Newcastle

Mowry B, Pantelis C, Wood S, Chalk J, Rose S. Australian study of twins and psychosis. Department of Psychiatry, University of Queensland.

Rossell S, Egan G, McPhee A, Joshua N. A cognitive and neuroimaging investigation of the aetiology of delusions. Mental Health Research Institute of Victoria.

Russell T, Green M. Remediation of abnormal visual scan paths to faces in schizophrenia. Macquarie Centre for Cognitive Science, Macquarie University

Schall U, Ward P, Michie P, Thompson. Brain imaging studies of auditory processing dysfunction in schizophrenia. Centre for Mental Health Studies, University of Newcastle.

Solowij N, Respondek C, Ward P, Shnier R. Functional magnetic resonance imaging of verbal learning and memory in schizophrenia patients with long-term cannabis use. Department of Psychology, University of Wollongong.

Startup M, Sedgman A. Self-esteem instability and anomalous experiences in persecutory delusions. School of Behavioural Sciences, University of Newcastle.

NSW Tissue Resource Centre

The following schizophrenia-related research initiatives received tissue from the NSW Tissue Resource Centre in 2004-2005.

Clarke D, Dedova I. How protein expression changes in the anterior cingulate cortex of the schizophrenia brain. Department of Pathology, University of Sydney.

Rasser P. Comparison of postmortem tissue analysis with MRI based tissue classification methods. Centre for Mental Health Studies, University of Newcastle.

Saihara Y, Matsumoto I. Screening the human brain tissue (cerebellum) in schizophrenia prior to LCM-qPCR. Department of Pathology, University of Sydney.

Saihara Y, Matsumoto I. Analysis of human brain tissue (hippocampus) in schizophrenia by LCM qPCR. Department of Pathology, University of Sydney

Sivagnanasundaram S, Matsumoto I. Analysis of the proteome of the corpus callosum from post mortem samples of subjects affected with schizophrenia compared with controls. Department of Pathology, University of Sydney.

Tan YY, Huang XF. The roles of intracellular signal transduction pathways in schizophrenia. Department of Biomedical Science, University of Wollongong.

Tooney P, Weidenhofer. Gene expression patterns in schizophrenia - changes in the superior temporal gyrus. School of Biomedical Science, University of Newcastle.

Tooney P, Weidenhofer. Gene expression patterns in schizophrenia - changes in the amygdala. School of Biomedical Science, University of Newcastle.

Yoshikawa T. Molecular genetic analysis of functional psychosis using post mortem brains. RIKEN Brain Science Institute, Japan.

INFORMATION ON DIRECTORS

Christine Bennett
Deputy Chair, Non-Executive Director
Chief Executive Officer Research Australia, MBBS University of Sydney, Fellowship of the Royal Australasian College of Physicians, Master of Paediatrics, University of NSW. Director of HeartWare Ltd, Director of Resonance Health, Director of Pacific Nursing Solutions, Director of the Australia Israel Chamber of Commerce. Previously Partner of Health and Life Sciences at, KPMG (2000-2001), CEO of Westmead Hospital and Community Health Service (1997-2000), General Manager of the Royal Hospital for Women (1992 - 1996) and Associate Director of Services Planning, NSW Health (1985 - 1992)..
Board member since July 2001.

Vaughan Carr
Executive Director
Scientific Director of NISAD, Director Hunter Mental Health, Professor of Psychiatry, Director Centre for Mental Health Studies, Faculty of Health University of Newcastle, Past President Australasian Society for Psychiatric Research.
Board Member since April 2004

Stanley Victor Catts
Non-Executive Director
Founding Chair of NISAD 1995-1999, Professor of Hospital and Community Psychiatry, University of Queensland.
Special interest: Member of Scientific Advisory Committee and NISAD/NSW Health Partnership Project Committee.
Board member since 1995. Chairman 1995 to 2000.

Matthew Cullen
Non-Executive Director
Co-President of McKesson Asia-Pacific Pty Ltd and Visiting Medical Officer St Vincent's Hospital Sydney. Fellow Royal Australian and New Zealand College of Psychiatrists, Member Australian Institute of Company Directors, and Associate Fellow Australian College of Health Service Executives.
Previously Member NSW Mental Health Review Tribunal and Board Member Schizophrenia Fellowship of NSW.
Board member since April 2004.

Peter Dempsey
Chairman, Non-Executive Director
Director, Monadelphous Ltd., advisor to a range of private companies; Formerly Chief Executive Officer, Baulderstone Hornibrook Group.
Board member since 2001, appointed Chairman June 2003.

Ian Harrison
Non-Executive Director
President, NSW Bar Association; Chairman, Professional Conduct Committee #4 1998; Conducted Australian Federal Police Corruption Inquiry for Federal Attorney General (1996-1997); appointed Senior Counsel 1995; Lecturer in Law, UNSW Law School (1975-1980).
Board member since 1999, Chairman 2000 to 2003.
Retired October 2004.

Peter James Maher
Non-Executive Director
Group Head of Macquarie Bank Ltd's Financial Services Group, General Manager of the Marketing Group, Westpac from April 1997 to October 2000, prior to 2000 General Manager at DB Breweries (New Zealand's second largest liquor group).
Board member since June 2003.

Rita Mallia
Non-Executive Director
Senior Legal Officer / Co-ordinator for Construction Forestry Mining Energy Union, formerly Workers Compensation Officer. CFMEU representative re: Occupational Health and Safety and Workers compensation Advisory Council, Director of NSW Dust Disease Board, Member of Construction Industry Reference Group, Director of MEND Rehabilitation Services Pty Ltd.
Board Member since November 2003.

Don McDonald
Non-Executive Director
Director, NSW Institute of Psychiatry; Former Conciliator, NSW Government; Former Secretary, Construction Forestry, Mining Energy Union.
Board member since 1995. Deputy Chairman 1995-2001.
Retired June 2005.

Patricia Michie
Non-Executive Director
Professor of Psychology and Head of School, School of Behavioural Science, Faculty of Science and Information Technology, University of Newcastle, Adjunct Professor in School of Psychiatry and Behavioural Science, University of Western Australia, Member of Neuroimaging Consortium of NHMRC Network for Brain Research in Mental Disorders.
Board member since June 2000.

Andrew Mohl
Non-Executive Director
Managing Director and Chief Executive Officer, AMP Limited, ANZ Banking Group's Chief Economist and Managing Director of ANZ Funds Management, Reserve Bank of Australia from 1978 to 1986 as Deputy Head of Research, Chairman of the Investment and Financial Services Association in 2001 and 2002.
Board member since June 2002.

Irene Moss
Non-Executive Director
Part-time consultant to the Minster for Justice of NSW, reviewing legislation with respect to prisons and related matters. Officer in the General Division of the Order of Australia (AO) 1995. Previously Commissioner, Independent Commission Against Corruption (1999-2004), Ombudsman NSW (1995 - 1999), Magistrate (1994-1995), Federal Race Discrimination Commissioner, Human Rights and Equal Opportunity Commission (1986-1994).
Board member since April 2005.

Trish Oakley
Non-Executive Director
Media Partner, Brophy Oakley Consulting (Issues Management and Government Relations), Chief of Staff, Andrew Refshauge's Office, NSW Government (1995-1999), Press Secretary and Political Strategist for Dr Refshauge as Deputy Leader of the Opposition (1990-1995), former Journalist, Australian Broadcasting Corporation.
Board member since June 2001.

Christos Pantelis
Non-Executive Director
Professor of Neuropsychiatry, The University of Melbourne. Scientific Director, Melbourne Neuropsychiatry Centre, Department of Psychiatry, The University of Melbourne, at Royal Melbourne Hospital, Sunshine Hospital and National Neurosciences Facility. Clinical Director/Principal Specialist, Adult Mental Health Rehabilitation Unit (AMRHU), Sunshine Hospital, North Western Mental Health Program. Principal Fellow, Centre for Neuroscience, The University of Melbourne. Board Member, Mental Illness Fellowship of Victoria since 2004. Member of Psychiatric Sciences Victoria. Treasurer of Brain and Mind Australia. On Editorial Boards of Australian & NZ Journal of Psychiatry, Journal of Cognitive Neuropsychiatry, International Review of Psychiatry. Member of various advisory boards on cognition in psychosis, neuroimaging in psychiatry, and drug treatments in schizophrenia. Chief Investigator of 5-year NHMRC Program Grant on psychosis (commences in 2005).
Board Member since April 2004.

Alexandra Rivers
Non-Executive Director
Psychologist, former lecturer, (Special Education), Faculty of Education, University of Sydney, Board member Guardianship Tribunal, NSW, Guardian ad Litern, Children's Court, NSW, Guardian ad Litern, Administrative Decisions Tribunal NSW, Vice President Schizophrenia Fellowship of NSW, Board Member Mental Health Council of NSW, Board Member, Aboriginal Education Council of NSW, Carer.
Board Member since October 2003.

Graham Shaw
Non-Executive Director
Currently Managing Director of Interfine Holdings Pty Ltd; Commercial Services Manager, The Summerland Credit Union (1987-1995); Lifeline counsellor (1989-1993); Board Member, Chrysalis Northern Rivers (1991-1995).
Board Member since October 2003.
Retired August 2004.

Deborah Willcox
Executive Director
Executive Director of NISAD; Director, NSW Health Partnership Project. Formerly a Registered Nurse and Intensive Care Clinical Nurse Specialist. Completed a Diploma in Law with the Legal Practitioners Admission Board. A policy adviser to the New South Wales Minister for Health and subsequently, Chief of Staff to the Deputy Premier, Minister for Planning, Minister for Housing and Minister for Aboriginal Affairs. Most recently, Solicitor (in training) with Abbott Tout Solicitors, Sydney in the area of employment and industrial relations law.
Other interests; President Assistance Dogs Australia.
Board Member since June 2004.

Directors have been in office since the start of the financial year to the date of this report unless otherwise stated.

FINANCE

The abridged consolidated financial position accounts and financial performance for the year ended 30 June 2005 have been prepared from audited financial statements, passed by the Board of Directors, who are responsible for the presentation of those financial statements and the information they contain.

For a better understanding of the scope of the audit by KPMG, this report should be read in conjunction with KPMG's report on the unabridged financial statements. This report may be obtained from:

NISAD Schizophrenia Research
384 Victoria Street
Darlinghurst NSW 2010
Ph: (02) 9295 8407

Financial Performance
for the year ended 30 June 2005:

	2005	2004
INCOME		
Fundraising	572,085	699,434
External grant income	1,548,282	1,395,386
Sundry income	36,609	110,177
Total	2,156,976	2,204,997
LESS EXPENSES		
Research	1,549,296	1,398,438
Marketing & fundraising	449,500	363,028
Administration	263,083	254,769
Total	2,261,879	2,016,235
Net Surplus/(loss)	(104,903)	188,762
Opening retained earnings	1,076,688	887,926
Closing retained earnings	971,785	1,076,688
Transfer (to)/from reserves	–	–
Retained earnings	**971,785**	**1,076,688**

GRANTS, SPONSORS AND SUPPORTERS

Government Partner

NSW Health

Government Support

NSW Ministry for Science and Research

Scientific Grants

Alma Hazel Eddy Trust

Australian Rotary Health Research Fund

Baxter Charitable Foundation

Cecilia Kilkeary Foundation

JS Love Trust

National Alliance for Research on Schizophrenia and Depression (USA)

Sylvia & Charles Viertel Charitable Foundation

Major Support

AMP

Bovis Lend Lease - Building Workers at Jackson's Landing & Macarthur Square

Construction Forestry Mining & Energy Union (CFMEU)

KPMG Audit & Risk Advisory Services

3-Year Gold Sponsors

Ainsworth, Mrs Margarete

Janssen-Cilag

Macquarie Bank Foundation

St. George Foundation

Westfield Design and Construction

3-Year Silver Sponsors

Australand Holdings

Baulderstone Hornibrook

Ron & Peggy Bell Foundation

Tony Bleasdale & Associates

3-Year Bronze Sponsors

Abigroup Limited

Leighton Holdings Limited

Lundbeck Australia

Paynter Dixon Constructions

Workplace Giving Programs

ABN AMRO

Deutsche Bank

Insurance Australia Group

Wollongong City Council

Bequest and In Memoriam

Estate of the Late Allan Milton Hayward

Mrs Florence Maggs

The Bandy Family

The Jensen Family

The Pailthorpe Family

The Snow Family

Special Contributions

ORGANISATIONS

ASX-Reuters Charity Foundation

AstraZeneca

Australian Charities Fund

AW Edwards Builders & Contractors

Awesome Screen Printing

Axis Plumbing

Baratech

Baylin Industries

Bristol-Myers Squibb Australia

Charities Aid Foundation

City East Carpentry

Coates Hire

Commercial & Residential Waterproofing

De Martin & Gasparini

Deno's Cranes

Equipped Constructions

Groedel Kitchens

Hungerford Hill

Impact Scaffolding

Lidco

Linddales

Melrose Cranes and Rigging

Metrotex Painters & Decorators

Montano Property

NSW Tiling Services

Perform NSW

Petar Zlatar Partitions

Peter Favetti & Sons Bricklaying

Premier Plumbing Services

Qantas Airways

QBE Insurance

Ramrod Constructions

Sanofi-Synthelabo Australia

Telstra

Telstra Friends

Tony Bleasdale and Associates

Tyrrell's Vineyards

Ward Civil & Engineering

Wastecorp

Westpac Banking Corporation

Zenith Works & Co

CLUBS

ARAFMI Cowra Branch

Canberra Trademen's Union Club

East Maitland Beresfield Lioness Club

Leagues Clubs Association of NSW

Lions Club of Kiama

Lions Club of Mt Hutton

NSW Nurses Association

Northern Beaches Mental Health Support Group

Roseville Returned Servicemen's Memorial Club

Rotary Club of Albion Park

Rotary Club of Botany Bay

Rotary Club Of Picton

INDIVIDUALS

Armati, Mrs Kate

Barr, Justice Graham

Benkhauser, Mr Robert

Cutts, Dr David

Gibson, Mr Jack & Mrs Judy

Danyluk, Mr Harley

Davidson, Mr Ian

Ferguson, Mr Andrew

Henley, Mr Thomas

Hook, Mr David

James, Mr Abraham

Jucovic, Mr Thomas

Keane, Mr Garry

Kenealy, Mr Bill & Mrs Betty

Lees, Mr N

Maher, Mr Peter

Minogue, Mr N

Monk, Ms Bronwyn

Morfuni, Mr Clem

Moss, Mrs Irene

Poole, Ms Joan

Powell, Mrs Frances

Robberds, Mr Lionel

Salt, Mr Peter

Shedden, Mr Bryan & Mrs Fiona

Silverton, Mrs Beverley

Stewart, Mrs Heather

Swan, Mrs Susan

Titley, Dr Keith

Wakeford, Dr Peter

Weisser, Ms Rebecca

Williams, Mr John

Wran, Mrs Jill

NISAD GROUP MEMBERS

Friends of NISAD

NISAD Society Members

Neuroscience Institute of Schizophrenia and Allied Disorders

384 Victoria Street, Darlinghurst, NSW 2010.
Telephone: (02) 9295 8407 Facimile: (02) 9295 8415 Email: nisad@nisad.org.au
Website: www.nisad.org.au