

Faculty of Computing Health and Science

Research Unit Annual Report

RESEARCH UNIT NAME: Centre of Excellence for Alzheimer's Disease Research & Care

RESEARCH UNIT LEVEL (tick):

- Level I Research Group Level II Research Centre
 Level III Research Institute Centre of Excellence

YEAR: 2010

BRIEF OVERVIEW (1-2 paragraphs outlining major activities conducted in past year)

The past year ended with the announcement in December 2010 of our success in the highly prestigious Australian government's Co-operative Research Centre (CRC) and the creation of Australia's first CRC for Mental Health. The McCusker Alzheimer's Research Foundation Inc along with Western Australian participants ECU, UWA, Hall and Prior Aged Care and Alzhyme, as well as the Mental Health Research Institute, CSIRO, University of Melbourne and Pfizer Inc are the foundation partners in this new entity. The focus will be on two programs-neurodegeneration and psychoses with the federal government providing \$23 million over 7 years. Professor Ralph Martins (Centre Director) and his team will be leading major studies in the neurodegeneration program.

In 2010, one NHMRC grant was successfully completed and there was a continuation of another NHMRC funded Complimentary and Alternative Medicine Strategic Grant. Two new NHMRC funded project grants commenced in 2010, one evaluating, in animal studies, a novel peptide as a therapeutic strategy for Alzheimer's disease and the other investigating mechanisms underlying the impaired clearance of beta amyloid, which is now considered to play a significant role in the disease pathogenesis. In 2010 we applied for a number of grants including a NIH program grant, ARC discovery grant, two NHMRC project grants and the CRC (see above). In addition to the CRC the team was successful at obtaining the two NHMRC project grants that will commence in 2011. We also received funding from the West Australian State Government (\$2,205,000.00 over 4 years) to purchase a mass spectrometer and undertake brain imaging which will be essential to our biomarker discovery program. In addition, our role in the Dementia Research Centre (DCRC) has continued with successful renewal of funding (DCRC2).

The team presented their work at a number of national and international conferences in 2010 and have also participated in a number of public lectures. We were particularly represented at the International Conference on Alzheimer's disease, where 7 members attended and presented their work. Other successes, publications and conference abstracts are outlined below.

MEMBERSHIP (Full Title of Researchers, including staff, research students, adjuncts in the past year)

Staff:

Dr Kristyn Bates 2005 - 2010
Assoc. Prof. Jonathan Foster, Snr Research Fellow 2004-2010
Dr Ian Martins Research Fellow 2003+
Dr Simon Laws 2003 -2005; 2009+
Dr Giuseppe Verdile Research Fellow 2002 +
Dr Miroslava Rimajova 2006-2010
Dr Matt Sharman 2006+
Dr James Lui 2008-2010
Dr Veer Gupta 2008+
Dr Sajla Singh 2008+
Dr Hamid Sohrabi 2010+
Dr Renae Barr 2009-2010
Dr Cynthia Gregory 2010+
Dr Andrea Wilson 2010+
Dr Stephanie Rainey-Smith 2010+
Mr Kevin Taddei
Mr Manoj Agarwal
Mrs Tania Taddei
Mrs Georgia Martins
Ms Belinda Brown
Mr Daniel Ong
Ms Prita Asih
Ms Linda Wijaya
Mr Alinda Mondal
Mr Michael Morici
Mr Karl de Ruyck
Ms Samantha Gardener

Students

Dr Darshan Triveddi PhD student
Dr Eka Wahjopramono PhD Student
Mr Limbikani Kanyenda PhD Student
Mr Prashant Bharadwaj PhD Student
Ms Michelle Tegg Masters Student
Mr Avdesh Chaudhary PhD Student
Ms Rhona Creegan PhD Student
Mr Maxime Francois PhD Student
Ms Mengqui Chan PhD Student
Mr Vinh Dang, PhD Student

NEW GRANTS (Identify Funding Body, Value of grant, Years funded, Chief Investigator, collaborators, title)

DCRC2 Dementia Collaborative Research Centres on Prevention, Early Intervention and Risk Reduction. Grant funded by Australian Government Dept of Health & Ageing comprising Australian National University; University Melbourne; Alzheimer's Australia, Victoria; Edith Cowan University; University of Queensland. Amount awarded to ECU is \$690,000

Feilman Foundation (McCusker Alzheimer's Research Foundation.) Grant to purchase research supplies and minor equipment, \$14,000 June 2010

West Australian State Government Award RN Martins, \$2,205,000.00 over 4 years: 2010, 2011, 2012, 2013, for Discovery of biomarkers for the early diagnosis of Alzheimer's disease.

NHMRC 595312 Martins RN, Martins I, LaDu MJ, Sharman M, The effect of human apoE isoforms and apoE receptors on the clearance of oligomeric A 42 by hepatocytes in vitro \$409,650 2010; 2011, 2012.

NHMRC 595300 Martins RN, Martin-Iverson M, Taddei K, Enhancing peripheral clearance of beta amyloid as a treatment for Alzheimer's Disease \$529,125 2010; 2011, 2012.

NHMRC 634504 Bruce D, Starkstein S, Bucks R, Davis R, Davis T, Pierson R, Martins R, Lenzo N. Cognitive decline in Type II Diabetes Mellitus, Investigating the contribution of neurodegeneration and cerebro-vascular disease. 4 year grant Commencing 2010 \$624,000.

Early career research (University Internal Grant) from Edith Cowan University, Investigating the association between plasma apoE levels and Alzheimer's disease. \$24,830. Investigators: Veer Bala Gupta, Ralph Martins (2010-2011)

Small Faculty Grant Scheme, ECU, 2010 - \$10,000 - Potential Protective Effects of Curcuminoids against Beta Amyloid Toxicity, Sajla Singh and Ralph Martins 2010-2011

Hollywood Research Foundation for \$20,000. Investigating the association between *APOE* promoter polymorphisms and plasma apoE levels: a blood test for Alzheimer's disease. Investigators: Veer Bala Gupta, Ralph Martins (2010-2011).

PUBLICATIONS, REFERRED BOOKS, CHAPTERS, JOURNAL ARTICLES, CONFERENCE PAPERS, REPORTS

Ford AG, Flicker L, Alfonso H, Thomas J, Clarnette R, Martins RN & Almeida OP. Vitamins B-12, B-6 and folic acid for cognition in older men. *Neurology* (2010) 75; 1540-1547. Pre published online September 22 2010.

Kajiwara Y, Franciosi S, Takahashi N, Krug L, Schmeidler J, Taddei K, Haroutunian V, Fried U, Ehrlich M, **Martins RN**, Gandy SE, Buxbaum JD. Extensive proteomic screening identifies the obesity-related NYGGF4 protein as a novel LRP1-interactor, showing reduced expression in early Alzheimer's disease. *Molecular Neurodegeneration* (2010) 5(1) 1-11.

Newman, M., Wilson, L., Camp, E., Verdile, G., **Martins, R.** and Lardelli, M. A zebrafish melanophore model of amyloid beta toxicity. *Zebrafish* (2010) Vol 7 (2), 155-159.

Sharman, MJ, Shui Guanghou, Fernandis AZ, Lim, WLF, Berger T, Hone E, Taddei K, Martins IJ, Ghiso J, Buxbaum JD, Gandy S, Wenk M, & **Martins RN**. Profiling Brain and Plasma Lipids in Human APOE ϵ 2 and ϵ 4 Knock-in Mice Using Electrospray Ionization Mass Spectrometry. *Journal of Alzheimer's Disease* (2010) 105-111.

Sharman MJ, Morici M, Hone E, Berger T, Taddei K, Martins IJ, Lim WLF, Singh S, Wenk MR, ghiso J, Buxbaum JD Gandy SE, Martins RN, APOE genotype results in differential effects on the peripheral clearance of amyloid-beta 42 in APOE knock-in mice and knock-out mice. *Journal of Alzheimer's Disease* (2010) 403-409.

Rowe CC, Ellis KA, Rimajova M, Bourgeat P, Pike KE, Jones G, Fripp J, Tochon-Danguy H, Morandau L, O'Keefe G, Price R., Raniga P, Robins P, Acosta O, Lenzo N, Szoeki C, Salvado O, Head R, Martins RN, Masters CL, Ames D, Villemagne VL. Amyloid imaging result from the Australian Imaging, Biomarkers and Lifestyle (AIBL) study of aging. *Neurobiology of Aging* (2010) 31 1275-1283.

Frost S, Martins RN, Kanagasingam Y. "Ocular Biomarkers for Early Detection of Alzheimer's Disease". *J Alzheimers Dis.* 2010, Vol 22, No.1, pp 1-16.

Miklossy J, Qing, H. Radenovic A, Kis A, Vileno B, Laszlo F, Miller L., Martins RN, Waeber G, Mooser V, Bosman F, Khalili K, Darbinian N & McGeer PL. Beta amyloid and hyperphosphorylated tau deposits in the pancreas in type 2 diabetes. *Neurobiology of Aging* (2010) 1503-151

Barron A, Verdile G, Taddei K, Bates KA, and Martins RN (2010) Effect of chronic hCG administration on Alzheimer's – related cognition and A β accumulation in PSIKI mice. *Endocrinology*, (2010) 151(11):5380-8.

Taddei K, Laws SM, Verdile G, Munns S, D'Costa K, Harvey AR, Martins IJ, Hill F, Levy C, Shaw JE. & **Martins RN**. Novel phage peptides attenuate beta amyloid-42 catalysed hydrogen peroxide production and associated neurotoxicity. *Neurobiology of Aging* (2010) 31(2)203-214.

Jenner AM, Lim WLF, Ng, MPE, Wenk MR, Shui G, Sharman MJ, Gandy SE & Martins RN, The effect of APOE genotype on brain levels of oxysterols in young and old humans APOE ϵ 2 ϵ 3 and ϵ 4 knock-in mice. *Neuroscience* (2010) 169 109-115.

Rodrigues MA, Foster JK, Verdile G, Joesbury K, Prince R, Devine A. Mehta P, Beilby J. **Martins RN**. Predicting memory decline as a risk factor for Alzheimer's disease in older post-menopausal women: quod erat demonstrandum? *Int. Psychogeriatr.* (2010) Mar: 22(2) 332-5.

Lui JK*, Laws SM*, Qiao-Xin Li, Villemagne V, Ames D, Brown B, Bush AI, DeRuyck K, Dromey J, Ellis KA, Faux NG, Foster J, Fowler C, Gupta V, Hudson P, Laughton K, Masters CL, Pertile K, Rembach A, Rimajova M, Rodrigues M, Rowe C, Rumble R, Szoeki C, Taddei K, Taddei T, Trounsen B, Ward, V, **Martins RN**. Plasma amyloid beta as a biomarker in Alzheimer's disease: The AIBL Study of Ageing. *Journal of Alzheimer's Disease* Epub ahead of print April 22, (2010) 20(4) 1233-1242.* Contributed equally.

Ellis KA, Rowe CC, Villemagne VL, **Martins RN**, Masters CL, Salvado O, Szoeki C, Ames D, the AIBL research group. "Addressing population aging and Alzheimer's disease through the Australian Imaging Biomarkers and Lifestyle study: Collaboration with the Alzheimer's disease Neuroimaging Initiative" *Alzheimer's and Dementia* 2010. 6(3): 291-296 [doi: 10.1016/j.jalz.2010.03.009]

Bharadwaj P, Martins R, Macreadie I. Yeast as a model for studying Alzheimer's disease. *FEMS Yeast Res.* 2010 Dec;10(8):961-9. doi:10.1111/j.1567-1364.2010.00658.x. Review. PubMed PMID: 20618869.

Bourgeat P, Chetelat G, Villemagne VL, Fripp J, Raniga P, Acosta O, Szoeka C, Ourselin S, Ames D, Ellis KA, **Martins RN**, Masters CL, Rowe CC, Salvado O and the AIBL Research Group. A β burden in the temporal neocortex is related to hippocampal atrophy in non-demented elderly. *Neurology* 2010 74(2) 121-7 PubMed PMID 2006524.

Lau S, Bates KA, Sohrabi HR, Rodrigues M, Martins G, Dhaliwal SS, Taddei K, Laws SM, Martins IJ, Mastaglia FL, Foster JK, Phillips JK, **Martins RN**. Functional effects of genetic polymorphism in inflammatory genes in subjective memory complainers. *Neurobiol Aging*. 2010 Oct 18. [Epub ahead of print] PubMed PMID:20961668. doi:10.1016/j.Neurobiol Aging.2010.09.003

Chetelat G, Villemagne VL, Bourgeat P, Pike KE, Jones G, Ames D, Ellis KA, Szoeka C, Martins RN, O'Keefe GJ, Salvado O, Masters CL, Rowe CC; Australian Imaging Biomarkers and Lifestyle Research Group. Relationship between atrophy and beta-amyloid deposition in Alzheimer disease. *Ann Neurol*. 2010 Mar;67(3):317-24. PubMed PMID: 20373343.

Peiffer JJ, Galvao DA, Gobbs Z, Smith K, Turner D, Foster J, Martins R, Newton RU. Strength and functional characteristics of men and women 65 years and older. *Rejuvenation Res*. 2010 13(1) 75-82.

Chételat G, Villemagne V, Pike KE, Baron JC, Bourgeat P, Jones G, Faux NG, Ellis KA, Salvado O, Szoeka C, Martins R, Ames D, Masters CL, Rowe CC, and the AIBL Research Group. "Larger temporal volume in elderly with high versus low beta-amyloid deposition" *Brain* 2010 November; 133(11): 3349-58

HIGHER DEGREE BY RESEARCH LOAD (list name of candidate and degree type)

Dr Eka Wahjopramono PhD Student
Mr Limbikani Kanyenda PhD Student
Mr Prashant Bharadwaj PhD Student
Ms Michelle Tegg Masters Student
Mr Avdesh Chaudhary PhD Student
Ms Rhona Creegan PhD Student
Mr Maxime Francois PhD Student
Ms Mengqui Chan PhD Student
Mr. Vinh Dang, PhD Student
Mr Maxime Francois, PhD student
Dr Darshan Triveddi PhD student (UWA)
Dr Tejal Shah PhD student (UWA)
Miss Florence Lim, PhD student (UWA)
Miss Belinda Brown, PhD student (UWA)

HIGHER DEGREE BY RESEARCH COMPLETIONS (List name, degree, title of thesis)

Dr Sudarsan Krishnaswamy PhD, "Reconstructing the gamma-secretase complex using the MultiBac baculovirus system for expression of heterologous multi-protein complexes"

VISITORS AND COLLABORATIONS (List the organisation's name and short summary of the nature of the collaboration. Separate into local, national and international)

Cooperative Research Centre Program Grant, Australian Government, Dec 2010: Partner organisations will receive \$23million over seven years from 1 July 2011 for the establishment of a CRC for Mental Health, with two major programs – neurodegeneration and psychoses. Prof Ralph Martins will be a program leader in the neurodegeneration stream. Essential partners from Western Australia are the McCusker Alzheimer's Research Foundation Inc, ECU, Hall and Prior Aged Care, Alzhyme Pty Ltd and UWA. Other participants include Mental Health Research Institute, Uni of Melbourne, CSIRO, Pfizer, Austin Health and Mercy Health.

Ongoing collaboration continues with Professor Sam Gandy formerly at Farber Institute for Neurosciences, Thomas Jefferson University, Philadelphia, and now at the Mt Sinai Medical School, New York, into an interdisciplinary approach to Alzheimer Drug discovery

Close collaboration has been occurring since 2004 with Dr Markus Wenk and Dr RH Yang from the National University of Singapore. Project entitled "Lipidomics of neuronal membranes – Identification of lipids involved in neurosecretion and neurodegenerative diseases.

Professors Peter Hyslop and Paul Fraser from the University of Toronto - to identify genetic risk factors in Alzheimer's disease and understanding gamma secretase structure and function. Professor Fraser visited and presented to our group in 2010 and partner investigator on submitted ARC discovery grant.

Dr Imre Berger from the European Molecular Biology Laboratories (EMBL), Grenoble France on the reconstruction and structure of the g-secretase enzyme. Dr Berger is a partner investigator on a submitted ARC discovery grant.

Professor Judit Miklossy from the University Institute of Pathology, University of Lausanne in Switzerland and latterly from Centre for NeuroVirology and Cancer Biology, College of Science and Technology, Temple University, Philadelphia has supplied 200 brain samples from post-mortem confirmed Alzheimer's disease cases for biochemical and genetic studies. This collaboration has resulted in several publications.

The role of oestrogen in Alzheimer's disease is being undertaken in collaboration with Professor Susan Craft from the University of Washington.

The structure and function of the amyloid precursor protein in Alzheimer's disease is being studied in collaboration with Professor Toshihara Suzuki of Tokyo University and A/Prof Maho Morishima-Kawashima, Japan. A/Prof Maho Morishima is a partner investigator on submitted ARC discovery grant.

A study into the role of gonadotropins in the development and progression of Alzheimer's disease is being undertaken in a joint collaboration with Ass. Professor Craig Atwood from Wisconsin University Maddison Medical School, USA.

Collaboration has been instituted with Professor D. Allan Butterfield from the Dept of Chemistry and Centre of Membrane Sciences, University of Kentucky, Lexington USA. This collaboration is to study oxidative stress in Alzheimer's disease and one of our PhD students spent 6 months with Professor

Butterfield investigating the protective effects of apoE isoforms on Abeta induced oxidative stress in cell culture.

Collaboration is ongoing with Associate Professor Joachim Hallmayer from Stanford University Department of Psychiatry and Behavioural Science to identify genetic and molecular risk factors in neurodegenerative diseases. This collaboration has resulted in several papers.

Professor Hans Forstl from Klinik und Poliklinik für Psychiatrie und Psychotherapie der Technischen Universität München, Munich, Germany and Dr Nicola Lautenschlager from the School of Psychiatry & Clinical Neurosciences, UWA, Dept of Old Age Psychiatry, Royal Perth Hospital. Ongoing collaboration continues with Dr Lautenschlager and Professor Forstl into identification of biomarkers for cognitive decline in subjective memory complainers.

Collaborative work is being undertaken with the three major research groups working on Alzheimer's disease in Australia led by Professor Colin Masters at the University of Melbourne, Associate Professor Peter Schofield from the Garvan Institute in Sydney and Professor Tony Broe from the Prince of Wales Medical Research Institute, Sydney, New south Wales.

Collaboration is ongoing with Professor John Papadimitriou, Dr Terry Robertson, Department of Pathology, University of Western Australia and Associate Professor Alan Harvey, Department of Anatomy, University of Western Australia on the development of animal models for Alzheimer's disease 24

Collaboration continues with Professor Dharmarajan, Department of Anatomy, University of Western Australia studying the function of beta amyloid. This seminal work has recently been published.

Professor David Bruce and Dr Bu Yeap from University of Western Australia, School of Medicine and Pharmacology, Fremantle Hospital, Effect of androgens on cognitive function and evolution of dementia in older men.

Collaboration has been established with Professor Leon Flicker from the Department of Geriatric Medicine and Professor Osvaldo Almeida from the University Department of Psychiatry, Queen Elizabeth II Medical Centre, Perth to undertake an intervention study in patients with memory disorders.

Collaboration has recently been established with Professor Gary Hulse, from University of Western Australia's Unit for Research and Education in Drugs and Alcohol to analyse the effectiveness of a therapeutic agent for Alzheimer's disease.

COMMUNITY ENGAGEMENT ACTIVITIES AND LINKAGES (Provide a brief overview of any significant activity)

International

In February 2010 at the invitation of Dr Prasun Roy from the National Brain Research Institute in New Delhi Professor Martins attended the Conference on Reproductive Health & 20th Annual Meeting of the ISSRF, University India. February 10th 2010. The title of my presentation was: *Gonadotropins and testosterone as early predictive biomarkers for Alzheimer's disease*. Following this I travelled to Bangalore and the invitation of the Nightingales Medical Trust to visit their facility and give a talk to their medical staff. I was also invited by Dr Amit Dias from the Department of Preventative Medicine

at the Goa Medical College to make a presentation to the medical staff and students on Alzheimer's Disease.

Whilst in India Professor Martins met with the Australian High Commissioner in Delhi at his residence in company with Dr Benny Antony from Arjuna Medical Extracts who is now working collaboratively with our group.

In July Invited by Dr Pankaj Mehta to deliver a Presentation to Institute for Basic Research in Developmental Disabilities, Staten Island New York. Friday July 24th 2010.

Along with other members of my research team we attended ICAD 2010 in Hawaii where we had 7 Abstracts, one of which was selected for an oral presentation.

Local

During 2010 I have been invited to make presentations to several locally based community clubs including Rotary, Lions, Probus, and Country Womens Associations. I have also presented at the RAF Association, Rural Health West, the American Chamber of Commerce, the Lung Institute of Western Australia and the Western Australian Institute of Medical Research. I was also Invited by Dr Laki Kang to be the keynote speaker at the Open Day on Dementia Awareness Sunday August 1st 2010 at the Sikh Temple, Canning Vale.

In association with the McCusker Alzheimer's Research Foundation we had two public talks at the WA State Library Lecture Theatre to update our study participants and the public in general on the work that is being carried out on Alzheimer's disease. Both of these presentations were extremely well attended with the evening talk only having 15 vacant seats and the day time session being overly full with standing room only. These presentations highlighted both research by students as well as some of our scientists.

In addition to the above I have also been invited to make presentations to the following:

- 2Hr Presentation Neurodegenerative Diseases and Cognitive Health, Esplanade Hotel Fremantle. May 15th 2010
- ECU Faculty of Business and Law presentation March 19th 2010.
- Invited by Professor Jorge Imberger to make a presentation to Centre for Water Research, University of Western Australia June 9th 2010.
- Invited by the Perth Convention Bureau to make a presentation at the Novatel Langley Thursday June 10th 20210.
- Invited to give the Weatherburn Lecture UWA July 4th 2010.
- ECU Brain Degenerative Disease Research Presentation at Alexander Library August 17th 2010. Presentation by Prof Martins on Alzheimer's disease for ECU Research Week.

During 2010 I visited the following laboratories of some of our international collaborators:

- Centre for Neurodegenerative Disease, Toronto, Canada with Professor Paul Fraser and St George Hyslop. July 2010.
- Institute for Basic Research in Developmental Disabilities, Dr Pankaj Mehta July 2010.
- Baylor College of Medicine, Houston, University of Texas, with Professor Robert Tan. July 2010.
- Professor Barry Halliwell and Markus Wenk, National University of Singapore July 2010.

FUTURE PLANS AND DIRECTION (Provide an overview)

In 2011 we commence projects under the CRC for Mental Illness. Our aim is to meet milestones set in year one in order to leverage further funding. On the basis of our current work in which we have shown benefits of testosterone supplementation on improving cognition and reducing beta amyloid levels we have plans on undertaking a clinical trial with this hormone supplement. We have also been invited as one of four sites around the world (USA, UK, Russia and Australia) to be part of the first preventative trial for Alzheimer's disease commencing in 2011. The study will be referred to as OPAL (Oppportunity for the Prevention of Alzheimer's disease). We have also commenced, as part of our involvement with the CRC, establishing collaboration with the Michael J Fox foundation towards contributing to the study of Parkinson's Disease.

We are currently in discussion with several companies to bring F18-Pib capabilities to WA, leveraging off the tremendous success of the Australian Imaging, Biomarker and Lifestyle (AIBL) study and the fact that this cohort is now considered one of the leading AD cohorts in the world.

Funding will commence for two new NHMRC project grants. One investigating biomarkers in Alzheimer's disease with a particular emphasis on developing a plasma lipid signature for Alzheimer's disease through the rapid lipid-profiling of lipid classes and sub-classes and another investigating the mechanisms of action of a drug, Latrepirdine that has shown some promise in AD clinical trials. The team will continue applying for grants in 2011, and has already applied for 3 NHMRC project grants, 1 ARC discovery grant, 1 NHMRC Career Development Award, 2 Alzheimer Australian Alzheimer Association grants and 1 American Alzheimer Association grant. We have also submitted expressions of interest for funding from the Australia-India Strategic Research Fund "Grand Challenge" program and if requested we will be submitting a major grant in this area. Further, we will also be submitting applications for funding under the Australia-India Council grants scheme to foster the growing collaborations between our research group and India, with a particular emphasis on genetics and nutraceuticals.

We will also continue to publish in high caliber journals, in particular target submission to ERA tier A*, or A journals. In 2011, we have already published 9 peer-reviewed articles in A* or A journals such as Neurology, Lancet Neurology and Biochimica et Biophysica Acta. Members of the team will continue attending conferences and again we will have a large presence at the International conference on Alzheimer's Disease (ICAD) to be held in Paris in July, where we have a number of abstracts accepted for oral and poster presentations. Abstracts have also been submitted for presentations at the Society for Neurosciences conference to be held in November in Washington DC.

The Centre will also continue the mentoring and training of post-graduate students. We have recruited two additional PhD candidates and will have the opportunity to recruit another 2 PhD students within the next couple of years. In 2011 it is expected that there will be 2 higher degree by research completions.