

Save Sight Institute
Sydney Medical School



THE UNIVERSITY OF
SYDNEY

THE SAVE SIGHT INSTITUTE

A CENTRE OF SYDNEY UNIVERSITY

ANNUAL REPORT 2009

THE SAVE SIGHT INSTITUTE & LIONS NSW-ACT SAVE SIGHT FOUNDATION



The following Lions members were elected for 2009:

- a) To the board of the Save Sight Institute:
Max Holmes, Jean-Claude Legrand and Kerry Williams.
- b) To the board of the Lions Eye Bank:
Michele Bentley, Jim Field, Jean-Claude Legrand and Owen Quinn.

In 1984 at the annual Lions convention in NSW, Professor Frank Billson spoke of the urgent need for an eye institute to be associated with Sydney Eye Hospital. Following further meetings with representatives of NSW Lions Clubs, the Lions Save Sight Foundation and Lions Clubs of NSW agreed to provide seed funding for an Institute to be established as a not-for-profit Foundation.

Later that year, a proposal for the Save Sight Institute to be a Foundation of the University of Sydney was agreed to by the Vice Chancellor, Professor John Ward, and supported by the Dean of the Faculty of Medicine, Professor Richard Guy. It was agreed that the Institute be established in the teaching unit of the Crown Street Women's Hospital, which had recently been closed. Professor Billson, Head of the Department of Ophthalmology, was appointed Director of the Save Sight Institute (SSI).

In 1985 the Institute was opened by the Governor of New South Wales, Sir James Roland, in the presence of the Chancellor of the University of Sydney, Sir Hermann Black; the Mayor of Sydney, Douglas Sutherland; local Member of Parliament, Michael Yabsley; the Chairman of Lions Save Sight Foundation, Ted Wilson; and past District Governors, Ron Reavly and Keith Small.

In 1997, the Institute was offered accommodation in the South Block of the Sydney Hospital, Macquarie Street, which had housed hospital wards since 1867. Fundraising activities for the refurbishment of the Institute were undertaken by Professor Billson. Laboratories were commissioned, clinical areas established and the Institute provided accommodation for the Lions NSW Eye Bank, Foresight Australia and the University of Sydney's Department of Clinical Ophthalmology.

Lions NSW-ACT Save Sight Foundation was instrumental in the formation of the Save Sight Institute in 1984 through seed funding and has maintained continual support through research and equipment grants as well as other financial assistance. The Save Sight Institute has three Lions representatives on its Board of Directors.



Kerry Williams, Jim Field, Ken Coles, John McAvoy and Max Holmes

DIRECTOR'S REPORT

Professor Peter McCluskey



2009 has been of my first year as the Director of the Save Sight Institute. It has been a time of great change within the Save Sight Institute and a period of significant reorganisation. Whenever leadership positions within an institution change, there is the opportunity to review the state of the institution, its organisation and to reassess its strategic goals. 2009 has certainly been a period of reflection, review and change at the Save Sight Institute.

The Save Sight Institute has undergone a major organisational change. In line with the University of Sydney policy for institutions, the Save Sight Institute has gone from being an independent institute associated with the University to a complying institute of the University of Sydney. This has meant that there have been major changes in the oversight procedures for the Save Sight Institute, the role of the Board of the Save Sight Institute and a review of the overall composition and structure of the staff of the Institute. Some of these changes have been completed but others remain a work in progress. The Board of the Save Sight Institute has changed from a Board of Governance to a Medical Advisory Board. A separate fundraising board with separate, independent oversight and governance requirements within the University of Sydney is in the process of being constituted. The administrative infrastructure within the Save Sight Institute is currently undergoing a review to determine what changes in its organisational structure will be necessary.

In 2009, Professor Paul Martin, Associate Professor Ulrike Grunert and their research group have joined the Save Sight Institute. Professors Martin and Grunert are internationally regarded researchers in the field of colour vision and visual physiology. We are fortunate indeed that such a prestigious research group has been recruited to the Save Sight Institute by the Faculty of Medicine and the University of Sydney and we warmly welcome them to the Save Sight Institute. A new laboratory, the Billson Research Laboratory is currently being constructed to house their research group and the other new research group which is currently being constituted within the Save Sight Institute.

The other new research group will be Cornea and Stem Cell Research Group to be headed by Professor Gerard Sutton, who has recently been appointed as the Professor of Corneal and Refractive Surgery at the University of Sydney. Professor Sutton will be commencing his appointment in July 2010.

The Billson Research Laboratory has been funded by a most generous donation from Mrs Marno Parsons AM and we

eagerly await the completion of the renovations in the Centre Block of Sydney Hospital, where the new laboratory will be housed.

As foreshadowed in my Director's Report in 2008, the Save Sight Institute is at the crossroads. Over the past 25 years, it has grown from nothing to an institution with an annual income in excess of \$4 million. It has grown from extremely small physical resources and infrastructure to a research institute with more than 50 employees occupying three floors of the South Block of the Sydney Hospital campus. We have run out of physical resources and particularly space to accommodate our research students and our staff. We are currently negotiating with the University of Sydney to gain access to space within the former Law Faculty building in Philip Street in the CBD and this will provide much needed space for accommodation, teaching and administrative services. This building is "a blank canvas" and will require significant funding to convert it from an open space to useable accommodation and teaching infrastructure.

As well as these major changes, those of us working at the Save Sight Institute have been working hard, re-establishing and re-connecting our links with our major stakeholders, both within the health sector and the community. Members of the Save Sight Institute are working closely with NSW Health, the Faculty of Medicine, the South East Sydney/Illawarra Area Health Service, the NSW & ACT Lions Eye Research Foundation, the Lions NSW Eye Bank, Vision 2020 and Foresight Australia to ensure that the Save Sight Institute has a voice in decision-making within the eye health care sector, the University of Sydney and the community.

Trying to exist as an academic research institute in a shrinking and largely capped funding environment is a great challenge. Rather than challenges, I see our uncertain time as a real opportunity to cement the place of the Save Sight Institute as one of the great ophthalmic research institutes in Australasia.

I am looking forward to 2010 and the years beyond, as a time of great opportunity to continue our vision to build the Save Sight Institute into the top ophthalmic research institute in the country. I look forward to everyone's continuing support.

Peter McCluskey

SAVE SIGHT INSTITUTE A CENTRE OF THE UNIVERSITY OF SYDNEY



*Back Row: Chris Peterson, George Harris, Max Holmes;
2nd Row: John McAvoy, Peter Ketley, John Grigg;
Front Row: Giovanni Crasto, Ken Coles, Peter McCluskey, Ramzi Fayed, Kerry Williams.*

The following have been appointed to the Management Committee and to the Advisory Board. Their appointments are to be ratified and confirmed at the Annual General Meeting in August for the year ahead to serve until the end of the Annual General Meeting in 2011.

MANAGEMENT COMMITTEE

Professor Peter McCluskey - Director & Chair
Designated University Officer - The Dean of the Sydney
Medical School, Professor Bruce Robinson
Professor Ramzi Fayed
Professor Mark Gillies
Dr John Grigg
Professor John McAvoy
Professor Paul Martin

ADVISORY BOARD

Professor Ramzi Fayed - Chairman
Mr Ken Coles AM
Mr Jim Field-ex-officio*
Mr George C. Harris
Mr Max H. Holmes*
Mr Peter Ketley
Mr Jean-Claude Legrand *
Mr Ben Meek
Dr Chris Peterson
Dr Justin Playfair
Mr Kerry Williams (PDG)
*Lions Clubs representatives

The following have been appointed Interim Members of the Council of Save Sight Institute Foundation. Their appointments are to be ratified and confirmed at the Annual General Meeting in August with each to serve at the pleasure of the Management Committee or until the end of the Annual General Meeting in 2011.

SAVE SIGHT INSTITUTE FOUNDATION

Mr Ken Coles AM - Chairman
Professor Ramzi Fayed
Mr George C. Harris
Mr Max H. Holmes*
Mr Peter Ketley
Dr Chris Peterson
*Lions Clubs representative

HEAD OF DISCIPLINE'S REPORT

Dr John Grigg



2009 has been an exciting year for the Save Sight Institute and the Discipline of Ophthalmology. We have welcomed Professor Peter McCluskey as he took up his position full time at the Save Sight Institute in March 2009. During 2009, the Discipline of Ophthalmology and the Save Sight Institute have worked closely together on a number of new initiatives.

Education of medical students, post-graduate students and vocational ophthalmology registrars is one of the core concerns of the Discipline and the Save Sight Institute. There has been great success with the Masters programs offered by the Discipline of Ophthalmology. The first year of the new Masters in Refractive Surgery was successfully completed. This is an innovative course providing the first tertiary qualifications in this expanding ophthalmic field. We had ophthalmology fellows and experienced practitioners from private practice undertake the program. There has been exceptional feedback from the initial cohort of students and we now have our first graduates. This program places the Discipline of Ophthalmology and the Save Sight Institute on the world arena for this emerging discipline. I congratulate Clinical Associate Professor Gerard Sutton, Drs John Males and Con Petsoglou, who were integral in setting up the course and organising the content and tutors.

2009 also saw the first graduate from the Masters of International Ophthalmology program, Dr Marcelino Correia. This is an area where the Save Sight Institute and Foresight Australia have a strong association. Professor Frank Billson AO, Dr Nitin Verma and Dr Geoffrey Painter have been instrumental in the development of this program. We see this as a mechanism for providing training and leadership in ophthalmic clinical practice and science for developing countries. The Masters of International Ophthalmology program currently has four units of study which are aimed at medical practitioners from developing countries where there is no, or limited, recognised vocational training program. It is anticipated that the international ophthalmology program will be expanded by the addition of new units of study to provide greater clinical and scientific ophthalmic education for medical practitioners from developing countries in which there is an established vocational ophthalmology training program, but limited opportunities for advanced study or fellowships.

The Masters of Ophthalmic Science continues to attract students from all over Australia who are interested in

pursuing a career in ophthalmology or in visual science. I congratulate

the winners of the Adam Locket prize for highest marks in ophthalmic anatomy: Dr Simon Skalicky and the Frank Billson prize for the student achieving the highest marks in Ophthalmic Physiology: again Dr Simon Skalicky.

The University of Sydney has been undertaking a number of strategic reviews in 2009. This has been both at the Faculty level and a University-wide level. The Discipline of Ophthalmology has participated in these. The success of the Ophthalmic Masters programs has been recognised by the Faculty and has been chosen for accelerated expansion. The Discipline of Ophthalmology is one of only five disciplines to be selected for the first round of expansion.

The Discipline of Ophthalmology, through its clinical and academic staff, provides expertise to the Sydney Eye Hospital. One area of special significance is the role of special investigations. Discipline staff are involved in special investigations in all aspects of the eye including corneal assessment with confocal microscopy, and retinal evaluation using fluorescein angiography, fundus autofluorescence and electrophysiological assessment.

2009 our vision scientists, Dr Maria Korsakova and Ms Asya Klistorner, attended the World International Society for Clinical Electrophysiology of Vision (ISCEV) meeting in Padua, Italy and then spent time visiting electrophysiology units in London. The scientific and practical knowledge gained there has been applied to our procedures in the Save Sight Institute.

We are now able to offer electrophysiological testing to children from birth through to adults of any age. This service helps to provide information for referring ophthalmologists with regard to the status of a child or adult's vision. With new techniques we are now able to provide prognostic information for a number of conditions. In the area of genetic testing, accurate diagnosis is crucial and improvements in electrophysiology and retinal imaging enable us to provide the clinical geneticists with more precise diagnoses to help refine the genetic testing.

I would like to thank the staff for their continued hard work in progressing clinical and visual science research on our campus.

John Grigg

RESEARCH at the SAVE SIGHT INSTITUTE

The Research Report

Professor John McAvoy

2009 was another year of significant progress. Research at the Save Sight Institute focuses on the major causes of human blindness. From both clinical and laboratory perspectives the research groups aim to understand the world's major blinding conditions and to develop strategies to prevent them. The research is carried out in twelve groups that work in close collaboration. The membership of these groups is shown on page 7 of the report of the SSI as a Foundation. The details of the work of each group is set out in a separate Research Report that is posted on the web with the annual reports at www.eyesyd.edu.au/news/annualreports.html.

Progress on mfVEP Technology

Early in 2009 Dr Chris Peterson was appointed to the board of the Save Sight Institute with a particular brief to help progress this work being led by Associate Professor Alexander Klistorner. This was followed by establishing a board sub-committee consisting of Professor Peter McCluskey, Dr John Grigg, Dr Chris Peterson and Mr Ken Coles together with Professor Alexander Klistorner.

This work has progressed in both research and commercialization.

Research

The mfVEP technology is an SSI invention where the patient looks steadily at the centre of a computer screen where a special pattern is displayed. Electrodes at the back of the head pick up the response that the eye sends to the brain in response to this pattern. This permits two types of measures to be made; the first is the sensitivity of different segments of the retina of the eye, the second is the time delay of the signal from each segment of the retina to the brain.

These measurements potentially allow a range of diagnoses to be made in addition to mapping the sensitivity of each part of the retina. Multiple Sclerosis (MS) can damage the optic nerve; the mfVEP technology can measure the decrease in nerve transmission speed before there is noticeable vision loss, hopefully allowing early diagnosis of MS. A study was done in 2009 into the viability of this technique using optic neuritis as a model of multiple sclerosis.



Associate Professor Alexander Klistorner

Until now the computer screen image that the patient looks at has had black and white segments. A study into the use of blue-yellow stimuli was undertaken in an attempt to detect glaucoma at an earlier stage. This is showing much promise, sufficient to commence a 5 year research trial to investigate the predictive power for glaucoma of this particular innovation.

A new system has been tested where each eye has its own computer screen: each eye can only see the screen it is supposed to see. Built in cooperation with Macquarie University, this allows the small constant movements of each eye to be monitored and corrected for, this is expected to improve the speed and precision of the mfVEP technique.

Commercialization

There has been considerable work done in close cooperation with Sydnovate in commercialization of the mfVEP technology. The present stage of support for the licensee of the relevant patents commenced in January 2010 and is continuing.

OCCASIONAL RESEARCH LECTURES

Professor John McAvoy spoke on 13th March 2009 on Lens Research – Developmental Biology and Cataract.

Lens opacification (cataract) is the most common cause of blindness in the world today. Surgery is generally very effective in removing the damaged cells from the lens and restoring sight; however, a common complication is the development of a secondary cataract. This is caused by residual lens cells undergoing a wound healing response and generating scar tissue. A central aim in our laboratory is to prevent this complication by promoting normal patterns of lens cell growth and differentiation after surgery so that the lens repairs itself. There is now compelling evidence that members of the FGF growth factor family are the prime regulators of normal lens growth processes. Research is directed at understanding how key molecular regulators ensure that FGF signalling promotes the differentiation of highly elongated fibre cells in the correct place. We are also investigating how the Wnt/planar cell polarity (PCP) signalling pathway that is activated by FGF, promotes elongation, directed migration and precise alignment of the fibre cells; processes that are critical for the formation of a clear lens with the correct curvature needed to focus light on the retina. Collectively this work is aimed at fulfilling our long-term goal of identifying the factors and conditions necessary to promote normal lens regeneration after cataract surgery.

Peter McCluskey's spoke on 15 May on HLA B27 and Uveitis: What do we know?

Uveitis refers to inflammation involving the uvea or middle vascular coat of the eye. It is classified anatomically into anterior intermediate posterior and pan uveitis.

Uveitis can be caused by either systemic disease involving the eye or as a localised ocular inflammatory process. Uveitis can be caused by infectious agents, by endogenous inflammation and least commonly, by neoplastic processes, particularly lymphoma, melanoma and metastatic secondary cancers.

Uveitis is amongst the commonest causes of blindness in patients of working age and is responsible for between 10 and 15% of blind registrations. Uveitis is frequently complicated by vision-threatening complications such as cataract, glaucoma and macular oedema.

Treatment of uveitis depends on the cause and the threat to vision. Anterior uveitis, inflammation involving the anterior segment of the eye, is overwhelmingly the most frequent pattern of uveitis seen in clinical practice and accounts for up to 90% of patients with uveitis. Fortunately, anterior uveitis typically responds to intensive topical steroid therapy and it is uncommon for it to require treatment with systemic medication. Anterior uveitis also has a relatively good visual prognosis. Uveitis involving the posterior segment of the eye, such as intermediate uveitis, pan uveitis and posterior uveitis represent a much higher threat to vision and typically require treatment with regional steroid injections or systemic steroids and immunosuppressive drugs.

At the Save Sight Institute and Sydney Eye Hospital, dedicated uveitis clinics have been established to assess and treat patients with vision threatening uveitis and other forms of inflammatory eye disease and to gather patient data to improve our understanding of the causes and best treatments for uveitis and other forms of ocular inflammation. Additionally, the Save Sight Institute is establishing a Biobank to store patient DNA and peripheral blood samples for future laboratory research.



*Professor John McAvoy, Professor Roger Truscott,
Dr John Grigg*

OCCASIONAL RESEARCH LECTURES

Dr John Grigg spoke on 5th June 2009 on Paediatric Glaucoma: The Challenges in Management.

Paediatric glaucoma is one of the most challenging ocular conditions to treat. Recognition is the first step in managing the problem and this seminar outlined the important signs of an enlarged eye, cloudy cornea, sensitivity to light and tearing. Early detection helps prevent a lifetime of visual impairment.

Glaucoma in children may be a primary condition or may be secondary to other ocular problems. The seminar highlighted the work done by the institute in advancing our knowledge in understanding glaucoma that is seen in patients who have had successful surgery for congenital cataracts. The research found that 13.4% of patients undergoing paediatric cataract surgery developed glaucoma. The mean time to develop glaucoma was 5 years highlighting the need for regular follow-up. Interestingly those children who had an intraocular lens inserted at the time of primary surgery appear to be less likely to develop glaucoma.

Professor Jonathan Stone spoke on 3rd July 2009 on The Stability and Death of Neurones: Concepts from the Analysis of Retinal and Cerebral Degenerations

Jonathan Stone discussed ideas arising from his laboratory's work on degenerative diseases of both the retina and brain. In animal models of human retinal degenerations, such as retinitis pigmentosa and age-related macular degeneration, the lab group and international collaborators have explored four ways of improving the stability of retinal photoreceptors. They have used light management, oxygen management, the powerful anti-oxidant herb saffron and photobiomodulation (the wound-healing properties of low-energy infrared light) to decrease stress on photoreceptors and accelerate their self repair. Each approach opens an avenue to prevention, stabilisation and, in some instances, the partial reversal of these degenerations.

Because the retina is an extension of the brain, this success prompted the group to analyse the cerebral degeneration which occurs in age-related dementia (Alzheimer's disease). The starting point was evidence that each of the senile plaques, which form in abnormally high numbers in the dementing brain, is the site of a small, asymptomatic bleed from a brain capillary. Evidence was reported from animal models that cerebral haemorrhage can account for many aspects of senile plaques. Given evidence from other laboratories that haemorrhage involves ischaemia,

and chronic oxidative stress to surrounding tissue, it was suggested that techniques which stabilise and promote the repair of retinal photoreceptors may prove relevant to cerebral degenerations.

Dr Robyn Jamieson, for the Eye Genetics Research Group, spoke on 25th August 2009 on Investigation and Therapy in Genetic Eye Disease.

Dr Jamieson presented the Eye Genetics Research Group's progress and approach in gene discovery, functional studies of eye disease genes and treatment applications in genetic eye disease. New high resolution sequencing approaches are being used for disease gene identification in conditions including small or absent eyes, cataracts, glaucoma and retinal diseases. Novel gene changes have been found in the SOX2 gene which is associated with small or absent eyes. Mouse models of abnormal eyes are also being examined to understand the functions of these genes in making the eye work. Progress is being made towards characterisation of patients with retinal conditions where future gene therapy and stem cell therapies may be helpful for treatment.

Professor Mark Gillies spoke on 23rd October 2009 about the work that his unit is conducting on the MacTel project aimed to identify the cause and treatment of a poorly understood condition, Macular Telangiectasia Type 2 (MacTel).

This work is generously supported by the Medical Research Institute. Clinical studies performed in Sydney have demonstrated that MacTel may have a genetic basis, the nature of which is being explored with collaborators at Columbia University, New York. There are 50 participants in the clinical study at the Sydney site and 100 relatives have been screened. This is the biggest of 23 clinics participating in the project from Australia, Europe and the United States.

Based on observations from a sample of a MacTel eye donated after death, the lab group has formed the hypothesis that MacTel is due to a deficiency of a specific cell type in the retina: the Müller cell. They have engineered a transgenic mouse model in which Müller cells can be selectively knocked out. It is anticipated that this will not only lead to a greater understanding of the disease, it will also represent an animal model in which prospective treatments can be screened prior to being tested on humans.

POSTGRADUATE OPHTHALMOLOGY STUDENTS

Postgraduate Coursework Coordinator Discipline of Ophthalmology

Dr John Grigg

Unit of Study Coordinators 2009

Ophthalmic Anatomy: Clinical Associate Professor Kathy McClellan

Ophthalmic Physiology: Dr. John Grigg

Ophthalmic Optics: Associate Professor Gordon Sanderson,
University of Otago

International Ophthalmology 1: Dr. Geoff Painter

International Ophthalmology 2: Dr. Nitin Verma

Refractive Surgery 1: Dr Gerard Sutton

Refractive Surgery 2: Dr John Males

Ophthalmology Graduates - Research

Doctor of Philosophy

Allende, Marie Alexandra

Balachandran, Chandra

Quin, Godfrey

Zhang, Xinyuan

Master of Medicine (Research)

Chang, Colin

Ophthalmology Graduates - Coursework

Master of Medicine (Ophthalmic Science)

Cheng, Sean

Sharma, Abhishek

Tan, Teng Han

Wan, Sue Ling

Warrier, Sunil

Graduate Diploma in Medicine (Refractive Surgery)

Berdoukas, Paula



POSTGRADUATE OPHTHALMOLOGY STUDENTS

Postgraduate Research Students

Doctor of Philosophy

Barthelmes, Daniel
Jay, Narelle
Lawlor, Mitchell
Martins, Alessandra
Succar, Anthony

Master of Philosophy

Hooi, Michelle
Lyons, Brian

Postgraduate Coursework Students

Master of Medicine (Ophthalmic Science)

Brettell, Daniel James
Brown, Tani
Camuglia, Jayne
Chen, Jern Yee
Cheng, Sean
Chong, Chee Foong
Chu, Edward Rickie
Clark, Georgina
Davies, Michael John
Dubey, Rahul
Dura, Robert
El-Haddad, Carlos
Hogden, John
Karaconji, Tanya
Karim, Rushmia
Kuo, Chih-Hung
Kvannli, Line
Leong, Belinda
Lim, Li-Anne Soon Ling
Marshall, Drew Terence
Nagubandi, Shyam Dinesh
Nguyen, Ethan
Ramakrishnan, Thushanthi
Shibeeb, O'Sam
Stewart, Christopher Michael
Tan, Terence Liew Yang
Ting, Daniel
Tran, Khoi Anh
Vogler, Catherine Marriott
Vootakuru, Lakshmi Nayana
Wei, Michael Chao-Lin

Whist, Eline
Win, Sai Htun Naing
Woo, David
Young, Thomas Kim

Master of Medicine (Refractive Surgery)

Karunaratne, Nicholas
Kumar, Nikhil Lala
Walker, Nathan James

Graduate Diploma in Medicine (Ophthalmic Science)

Gilchrist, Hannah
Holcombe, David James
Imo, Mauinuuese
Raffles, Alex
Skippen, Brent Andrew

Graduate Diploma in Medicine (Refractive Surgery)

Arora, Anil
Berdoukas, Paula
Duncan, Martin James
Mantell, Nicholas

PUBLICATIONS

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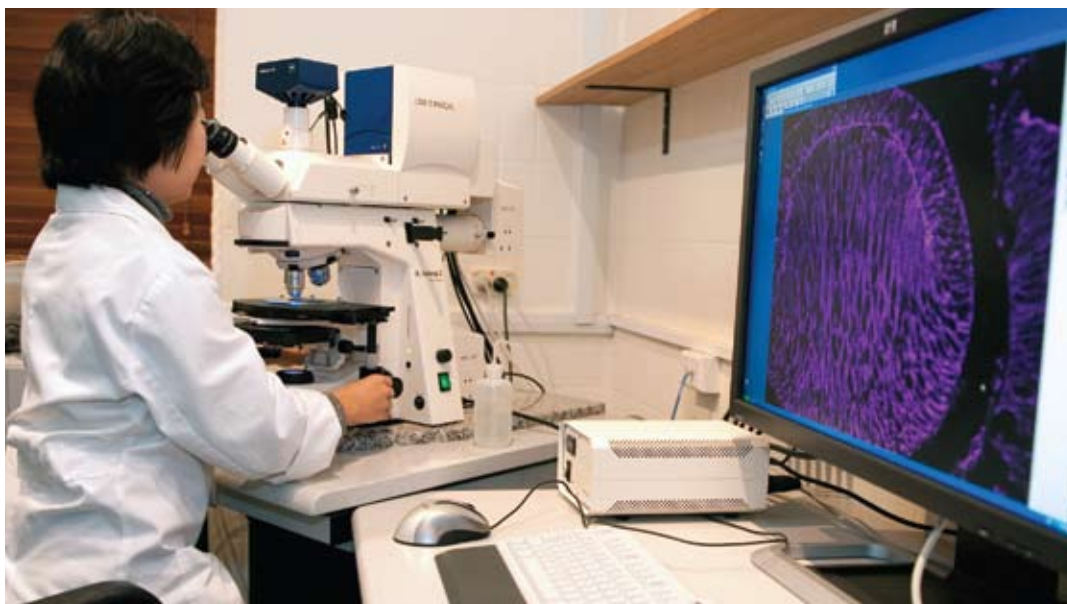
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FUNDED RESEARCH PROJECTS

Adolf Basser Fund: Klistorner A, Detection of early glaucoma- targeting specific visual pathways. \$80,000 in 2009.

Australian Research Council: Lamb T, Ibbotson M, James A, Maddess T, Provis J, Zeil J, Yu D, Cringle S, Srinivasan M, Martin P, Grünert U, Clifford C, Solomon S. Centre Extension - ARC Centre of Excellence in Vision Science. 2010-13: SSI award \$100,000/yr.

Australian Research Council: Lamb T, Ibbotson M, James A, Maddess T, Provis J, Zeil J, Yu D, Cringle S, Srinivasan M, Martin P, Grünert U, Clifford C, Solomon S. Centre Extension - ARC Centre of Excellence in Vision Science. 2010-13: SSI award \$130,000/yr.

Australian Research Council: Martin P, Metha A, Grünert U, Bedggood P. Functional imaging of colour pathways in the living eye. 2009-2011: \$35,000/yr.

Eye Foundation: Gillies M, McAllister I, Wong T. The fight retinal blindness project. \$181,800 in 2009.

International Program Development Fund at the University of Sydney: Gillies M, Shen W. Glial-vascular dysfunction in a primate model for macular telangiectasis. 2009:\$18,000.

Lowy Medical Research Institute: Gillies M, The macular telangiectasia project. \$333,211 in 2009.

National Institutes of Health (USA): McAvoy J, Lovicu F. Lens differentiation and cataract. 2009-11: US\$150,000/yr.

National Institutes of Health (USA): Truscott R. Studies on nuclear cataract. 2007-9: US\$115,000/yr.

National MS Society (USA): Klistorner A. Protective role of remyelination in optic neuritis: Exploring whether nerve fibers sustain injury in people with MS even if their coating of myelin insulation is consistently repaired by the body. 2008-11: US\$40,644/yr.

NHMRC: Grünert U, Martin P. Neural network properties of the primate retina. 2007-9: \$134,000/yr.

NHMRC: Klistorner A, Graham S, Srinivasan H. Optimising the detection of early glaucoma- targeting specific visual pathways in combination with structural measures 2009-11: \$134,100/yr.

NHMRC: McAvoy J, Lovicu F. Roles for MAPK/ERK1/2, β -catenin/TCF and Smad3 mediated signalling pathways in TGF β -induced cataract. 2008-10: \$113,750/yr.

NHMRC: Martin PR, Grünert U, Solomon S. Non-standard inputs to the primate visual system. 2008-10: \$109,750/yr.

NHMRC: Truscott R. NHMRC Senior Research Fellowship. 2007-11: \$125,000/yr.

NHMRC: Truscott R. Characterising protein and membrane changes in age-related cataract lenses. 2008-10: \$140,000/yr.

Ophthalmic Research Institute of Australia: McCluskey P. Inflammatory eye disease specimen storage biobank. 2009-10: \$35,000/yr.

Ophthalmic Research Institute of Australia: Shen W, Gillies M. Glial dysfunction in diabetic retinopathy. 2009: \$49,423.

Sydney Eye Hospital Foundation: McAvoy J. Postdoctoral research fellowship support for Dr Yuki Sugiyama, 2009: \$55,000.

Sydney Eye Hospital Foundation: Postgraduate scholarship: \$25,000.

Sydney Foundation for Medical Research: Klistorner A, Detection of early glaucoma- targeting specific visual pathways. 2008-10: \$90,000/yr.

Sydney Foundation for Medical Research: McAvoy J, Lovicu F. Growth Factor regulation of lens epithelial growth and differentiation: implications for understanding normal development and cataract. 2006-2010: \$277,000 in 2009.

Sydney Foundation for Medical Research: Madigan M, Photoreceptor death and survival in normal ageing and ARMD. 2008-10: \$70,000/yr.

University of Sydney Bridging Support Grant: Shen W, Gillies M. A novel treatment for diabetic retinopathy. 2009: \$50,000.

Vision CRC: McAvoy J, Lovicu F. Participant in Presbyopia Project: controlling lens epithelial cells: stream II. 2003-10: \$50,000/yr.

FUNDED RESEARCH PROJECTS

Collaborative Research Grants administered through other Disciplines/Institutions

ARC: Lamb T, Stone J, et al. ARC Centre of Excellence in Vision Science. 2005-10: Stone award \$100,000.

NHMRC: King N, Madigan M, Gillies M, Provis J. The blood-retinal barrier: Modelling mechanisms for maintenance, breakdown and repair. 2007-09: \$126,270/yr.

NHMRC: Lovicu F, McAvoy J. Regulation of lens cell behaviour by RTK antagonists. 2007-9: \$102,250/yr.

NHMRC: Rozenfeld A, Kron T, Conway M, Lerch M, Metcalfe P, Carolan M. High spatial resolution dosimetry for radioactive plaques used for radiotherapy of eye lesions. 2009-11: \$114,750/yr.

NHMRC: Vidyasagar T, Dreher B, Martin P. Cortical interactions between afferents channels in macaque visual system. 2008-10: SSI share \$120,000/yr.

NHMRC: Wakefield D, McCluskey P, Di Girolamo N. Toll like receptors in ocular inflammation. 2007-9: \$92,250/yr.

Ophthalmic Research Institute of Australia: Jamieson R, Grigg J. High resolution genomic techniques for novel gene identification in glaucoma. 2009: \$38,000.

Ophthalmic Research Institute of Australia: Volter-Kocsi K, Wong J, Provis J, Madigan M. Complement proteins and photoreceptor death in light-induced retinal degeneration. 2009-10: \$20,750/yr.

Rebecca Cooper Medical Research Foundation: Jamieson R, Grigg J. Discovery of novel disease genes in eye disorders. 2009: \$20,000.

Equipment Grants awarded from 2000 to 2009

2001: Molecular Biology Workstation. University of Sydney Major Equipment Scheme \$55,000, Lions NSW-ACT Save Sight Foundation \$46,861.

2002: Confocal Microscope. University of Sydney Major Equipment Scheme \$98,600, Sydney Eye Hospital Foundation \$33,780, Ramaciotti \$15,000.

2002: Rotary and Manual Microtomes. NHMRC \$16,040.

2003: Tissue Processor and Embedding Centre. University of Sydney Major Equipment Scheme \$36,500.

2004: Inverted Fluorescence Microscope Workstation. NHMRC \$31,694, Sydney Eye Hospital Foundation \$24,588, Honda Foundation \$13,302.

2004: Tissue Processor and Embedding Centre. Ramaciotti \$30,000.

2004: Equipment for Studying Factors Involved in Vascularisation. Rebecca Cooper Foundation \$12,894.

2005: High Pressure Liquid Chromatography System. NHMRC \$72,790.

2005: MALDI TOF Mass Spectrometer. Rebecca Cooper Foundation \$15,000.

2006: MALDI TOF Mass Spectrometer. University of Sydney Major Equipment Scheme \$147,000, Sydney Eye Hospital Foundation \$85,000.

2006: Syngene Gel Documentation System. Lions NSW-ACT Save Sight Foundation \$80,000.

2006: Equipment for Proteomics Based Investigations. Rebecca Cooper Foundation \$20,000.

2007: New Laboratory Construction (top floor Central Block). University of Sydney Major Equipment Scheme \$200,000.

2007: Digital Fundus Camera. Rebecca Cooper Foundation \$20,000.

2007: Tecan Infinite M200 Monochromator Microplate Reader and Detector plus Software. NHMRC \$47,628.

2007: Sorvall Discovery WX90 Ultracentrifuge. Trust Foundation Ltd \$20,000.

2008: Zeiss Axio Imager. University of Sydney Major Equipment Scheme \$57,450.

2008: Sorvall Discovery WX90 Ultracentrifuge. Lions NSW-ACT Save Sight Foundation \$33,969.

2008: New Laboratory Construction (top floor Central Block). Medical Foundation University of Sydney \$600,000.

2009: Zeiss Axio Imager. NHMRC \$50,115.

TOTAL: \$1,856,971.

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The Save Sight Institute

Sydney Eye Hospital Campus
Macquarie St
Sydney

GPO Box 4337
Sydney NSW 2001

T: 61 2 9382 7302

F: 61 2 9382 7372

W: <http://www.eye.usyd.edu.au/>



Ken Coles Editor and Production by Diana van Driel.
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