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Macular *NEWS*

www.eye.usyd.edu.au/research/macular.html

Our aim is to develop new treatments that reduce blindness from macular disease, through multidisciplinary, patient oriented, world class research



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Where are we located?

The Macular Research Group

Professor Mark Gillies leads the Macular Research Group of the University of Sydney's Save Sight Institute. The retina is like the film in a camera and the macula is at the centre of the retina where it is responsible for seeing what the eye is looking at. The Macular Research Group is dedicated to finding new treatments for blinding macular diseases. The group includes both clinical and laboratory research teams.

In future newsletters we will explain what the clinical and laboratory research teams do and provide some examples of the work currently being undertaken. Here is a brief overview.

The Clinical Research Unit

undertakes trials and studies involving research into the treatment and mechanisms of age-related macular degeneration, diabetic retinopathy, central and branch retinal vein occlusion and macular telangiectasia. Since 1998 we have conducted four major clinical trials, each lasting 3 – 5 years, that have been hailed internationally as major advances in the treatment of macular disease.

The Laboratory Research Unit

studies what makes retinal blood vessels leak and what damages the macular cells that detect light (photoreceptors) using laboratory and animal models. The Unit has recently engineered a unique mouse model of a disease called macular telangiectasia to study retinal disease processes more deeply. The laboratory research we conduct is designed to identify and evaluate new treatment for macular disease that can then be offered to patients through clinical trials conducted by our clinical research unit.

You will find us at the Save Sight Institute, located at:▯
South Block, Sydney Hospital,
8 Macquarie Street, Sydney NSW 2000

The team



From left: An Nguyen, Mila Kolmogorova, Daniel Barthelmes, Meidong Zhu, Ling Zhu, Sook Chung, Prof Mark Gillies, Nathan Coorey, Briony Glastonbury, Ann Gould, Narelle Jay, Weiyong Shen.

Absent: Haipha Ali, Ilhem El Kochairi, Dr Samantha Fraser-Bell, Christine Gaston, Pari Herrera-Bond, Grace Hunt, Dr Alex P Hunyor, Mohammad Irhimeh, Marty Lee, and Maria Williams

**In this issue
we introduce
you to our
cutting edge
STEM CELL
RESEARCH and
give you the
opportunity to
support it**

Stem cells have the remarkable potential to develop into many different cell types in the body. In many tissues they serve as a sort of internal repair system, dividing essentially without limit to replenish other cells. When a stem cell divides, each new cell has the potential either to remain a stem cell or become another type of cell with a more specialized function, such as a brain cell, a retinal cell or a cell that can repair a blood vessel.

Until recently, scientists mainly worked with two kinds of stem cells from animals and humans: "embryonic" stem cells and non-embryonic or "adult" stem cells. Scientists discovered ways to get embryonic stem cells from early mouse embryos nearly 30 years ago. The detailed study of the biology of mouse stem cells led to the discovery, in 1998, of a method to get stem cells from human embryos and grow the cells in the laboratory. These cells are called human embryonic stem cells.

The embryos used in these studies were created for reproductive purposes through in vitro fertilization procedures. When they were no longer needed for that purpose, they were donated for research with the informed consent of the donor.

Stem Cell Research

In 2006, researchers made another breakthrough by identifying conditions that would allow some specialized adult cells to be "reprogrammed" genetically to assume a stem cell-like state. This new type of stem cell is called induced pluripotent stem cells (iPSCs).

Stem cells are important for living organisms for many reasons. In the 3- to 5-day-old embryo, called a blastocyst, the inner cells give rise to all of the many specialized cell types and organs in the body. In some adult tissues, such as bone marrow, muscle, and brain, some adult stem cells generate replacements for cells that are lost through normal wear and tear, injury, or disease.

Given their unique regenerative abilities, stem cells offer new potentials for treating disease. However, much work remains to be done in the laboratory and the clinic to understand how to use these cells for "cell-based" therapies, which is also referred to as "regenerative" or "reparative" medicine.

Laboratory studies of stem cells enable scientists to learn about the cells' essential properties and what makes them different from specialized cell types. Scientists are already using stem cells in the laboratory to screen new drugs and to develop model systems to study normal growth and identify the causes of birth defects.

Research on stem cells continues to advance knowledge about how an organism develops from a single cell and how healthy cells replace damaged cells in adult organisms. Stem cell research is one of the most fascinating areas of contemporary biology, but, as with many fields of science, research on stem cells raises more scientific questions as rapidly as it generates new discoveries.

Endothelial progenitor (stem) cells (EPCs) are a rare population of cells that circulate in the blood with the ability to differentiate into vascular endothelial cells, the cells that make up the lining of blood vessels. The process by which blood vessels are made from endothelial progenitor cells is known as vasculogenesis.

Diabetic retinopathy, a disease of the retina which is one of the major complications of diabetes, is the most common cause of blindness in the working-age population. One of the early steps in the development of diabetic retinopathy is the development of leakiness of the retina's blood vessels due to a malfunction of EPCs that usually renew and repair the inner lining of the blood vessels – the endothelium – which is of utmost importance for normal blood vessel function.

Disease of the retinal blood vessels results in either leakage of the blood vessels with consequent swelling of the retina ("macular oedema"), or in occlusion of blood vessels, which in turn leads to a lack of oxygen ("ischaemia").

At the Save Sight Institute our stem cell research group aims to elucidate the mechanisms of EPC malfunction in people with diabetes using laboratory models. From this we hope to devise new treatments for retinal vascular repair in eyes that are losing vision from diabetic retinopathy despite conventional treatment. This year we have engaged a stem cell scientist, Dr. Mohammad Irhimeh, to supervise these studies.

Support our research

The entire research group relies exclusively on external grants and fundraising. We receive funding from sources such as:

- National Health and Medical Research Council (NH&MRC);
- Royal Australian & New Zealand College of Ophthalmologists – Eye Foundation; and
- Lowy Medical Research Institute.

However funding from these sources is generally for the wages of scientists to work on specific projects.

Currently the sophisticated machines and technology that are required for stem cell research are only available at the University of Sydney's main campus, which is across town from our labs in the Save Site Institute on Macquarie Street.

We are now fundraising to establish facilities for stem cell research in our laboratories at the Save Sight Institute. These facilities will not only let us conduct our own research more efficiently, they will also allow us to quickly provide stem cell treatments to people with eye disease when these treatments inevitably become available in the medium-term future. We estimate that around \$500,000 is required.

To make a donation to support establishing an ophthalmic Stem Cell Research and Treatment Centre at the Save Sight Institute and the Sydney Eye Hospital, you may send a cheque to Professor Gillies made out to the "Macular Research Group" at the address below. No amount is too small or too large. Any excess funds will be used to establish a scholarship for future PhD students, of which we start around one every year.

Alternatively you may complete the enclosed donation form.

You have received this newsletter because you have, or you have shown interest in, macular disease. If you do not want to receive this newsletter, just let us know on 02 9382 7309.

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