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NEWSLETTER

SCHOOL OF
Biochemistry & Immunology

Trinity College Dublin
The University of Dublin

Since our last update, many new discoveries have been made by researchers in the School, some of which have been heavily reported by media around the world. Undoubtedly, the relocation of our School into Ireland's largest biomedical sciences complex has encouraged new multidisciplinary research projects to flourish. We will be highlighting some of our cancer research successes on the 16th September 2015 during Cancer Week Ireland, where some of our youngest and brightest scientists will present their discoveries in the Trinity Biomedical Sciences Institute. While many new amazing anti-cancer drugs have come online in the last decade there is still an overwhelming need for new cellular targets to be discovered and new drugs to be synthesised. The need for basic science discovery in the cancer area has never been greater and therefore we are showcasing cutting edge research findings during this Cancer Drug Discovery Day. You are very welcome to attend!

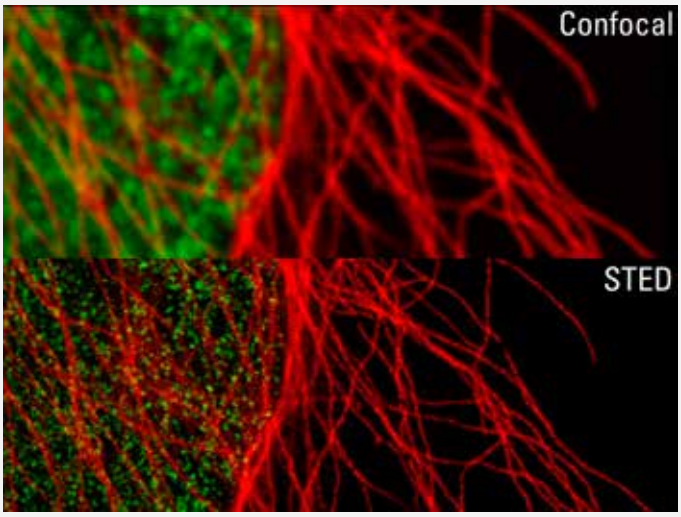
Best wishes,

Gavin Davey

Professor Gavin Davey
Head of School

New State-of-the-Art Microscopy Facility

The Super Resolution Confocal Microscopy Suite in the School of Biochemistry & Immunology, the first of its kind in Ireland, was launched by Minister Paul Kehoe, Government Chief Whip and Minister of State at the Departments of the Taoiseach & Defence. These microscopes were supplied by Leica Microsystems and were funded by Science Foundation Ireland, the Higher Education Authority Programme for Research in Third-Level Institutions (PRTLI) and Trinity. The highest resolution (using STED technology) is 50nm, or 1/2000 the thickness of a human hair, filling the gap between traditional confocal microscopy and electron microscopy. The images below show a comparison between STED and conventional confocal microscopy. The image shows a neuromuscular junction. Substructures can now be visualised with the STED technology, which were otherwise unrecognisable in conventional confocal microscopes.



European Federation of Immunology Societies Medal Awarded to Professor Luke O'Neill

Professor Luke O'Neill, Chair of Biochemistry, has been awarded the prestigious European Federation of Immunology Societies medal for being an 'outstanding European immunologist'. Professor O'Neill was nominated for the award by the German Society for Immunology, and was presented with the accolade at the annual meeting of the Society in Bonn, Germany.

Professor O'Neill gave the keynote address and was presented with a medal which depicts two of Europe's most eminent immunologists, Ilyi Mechnikov and Paul Ehrlich. Professor O'Neill was honoured for his critical contribution to the field of innate immunity over the past 15 years and for his capacity to inspire other scientists and students in the field of immunology was noted. He said: "I am delighted to accept this award on behalf of all the students and postdocs who have worked with me over the years."

Professor O'Neill's group has recently uncovered a marvel molecule that blocks a key driver of inflammatory diseases. The finding could meet a major clinical need by inspiring new non-invasive treatments for arthritis, multiple sclerosis and Muckle-Wells syndrome, among a myriad of other inflammatory diseases.

In a study published in *Nature Medicine* the international research team led by Trinity and the University of Queensland Australia showed how the molecule *MCC950* can suppress the 'NLRP3 inflammasome', which is an activator of the key process in inflammatory diseases.

Professor Luke O'Neill with his students

High-Resolution Crystal Structure Provides a Potential Target for Treating *Pseudomonas aeruginosa* Infection

Professor Martin Caffrey

Pseudomonas aeruginosa is a resilient and adaptable species of bacteria that causes disease by infecting damaged tissue and overpowering people whose immune response is compromised. It is particularly associated with cystic fibrosis and is often implicated in cross-infection cases in hospitals. A recent paper by Professor of Membrane Structural and Functional Biology Martin Caffrey and colleagues reports the X-ray structure of alginate, a major virulence factor of the bacterium. This work provides a blueprint of the cellular machinery used by *Pseudomonas aeruginosa* to produce alginate which may be used to design specific drugs that prevent the production of this potentially deadly component.

Professor Caffrey, who recently helped to develop a high-throughput method that is much more efficient at producing protein crystals for use in drawing up protein blueprints, added: "The method is proving to be hugely useful and is being implemented in academic and industrial labs worldwide. Of particular note is the contribution it made to the 2012 Nobel Prize in Chemistry awarded to my collaborator, Professor Brian Kobilka, at Stanford University School of Medicine."

Tan J, Rouse SL, Li D, Pye VE, Vogeley L, Brinth AR, El Arnaout T, Whitney JC, Howell PL, Sansom MS, Caffrey M. Acta Crystallogr D Biol Crystallogr. 2014 70 2054-68 A conformational landscape for alginate secretion across the outer membrane of Pseudomonas aeruginosa.

Protective Influence of Vitamin A against Inflammatory Bowel Disease

A research group led by Professor of Experimental Immunology Kingston Mills has made novel discoveries about the protective influence of Vitamin A against the damaging immune responses that lead to inflammatory bowel disease. Inflammatory bowel diseases (IBD) which include Crohn's disease and ulcerative colitis are characterised by inflammation and damage to the intestine caused by a combination of genetic and environmental factors. The damaging inflammation is mediated by immune cells that infiltrate the gut tissue and are activated locally by bacteria normally resident in our gastrointestinal tracts. The immune system normally protects us from infection by disease-causing bacteria and viruses but in some people genetic or environmental influences upset the regulation of the immune system resulting in excessive inflammation and disease. Professor Mills's group have found that retinoic acid, a dietary metabolite of Vitamin A, can protect against intestinal inflammation by improving the balance of pro-inflammatory and anti-inflammatory cytokines. In addition to providing an insight into the regulation of the immune system this work confirms the importance of a vitamin A-rich green and root vegetable diet.

Professor Kingston Mills

Dr David Finlay

Starting Investigators and Development Awards

Three young researchers from the School have been awarded Starting Investigator Research Grants or Career Development Awards from Science Foundation Ireland (SFI) to help to support their transition to becoming fully independent researchers. They are: Ussher Assistant Professor in Cancer Biology, Dr David Finlay, Research Fellow in Biochemistry, Dr Annie Curtis, and Research Fellow in Immunology, Dr Frederick Sheedy. Dr Finlay will investigate the role of Natural Killer (NK) cell metabolism in resisting tumour development, Dr Curtis will research how biological molecular clocks control inflammation and Dr Sheedy will attempt to engineer a better vaccine for TB. These awards help to ensure that Ireland's most talented young researchers are encouraged to remain in Ireland, while also helping to attract excellent young researchers from other countries to base themselves here.

Nature Award for Mentoring in Science

Professor of Comparative Immunology Cliona O'Farrelly has won a 2014 *Nature* Award for Mentoring in Science at Science Foundation Ireland's 2014 Summit. The leading international journal *Nature* hosts these awards annually to champion the importance of mentoring and inspiring future generations of young researchers. Professor O'Farrelly's achievements have been in bringing together various disciplines across the scientific spectrum in both human and veterinary clinical sciences to better understand immunology and infectious diseases. Her research group has been successful in describing unique immunological features and functions in the human gut, liver and uterus.

Professor Cliona O'Farrelly

The Keith Tipton Medal for Best Undergraduate Research

The Medical Supply Company sponsored the inaugural Keith Tipton Prize for best undergraduate researcher which was awarded to Simon Lawless, a PhD student in Dr David Finlay's laboratory. Simon's work is on mTorc1-regulated glucose metabolism and Natural Killer cell function. A specially designed medal was presented to Simon by Professor Tipton. The prize is in honour of former Head of School Professor Keith Tipton, a world-renowned biochemist, who has contributed many discoveries in the areas of enzyme function and neurochemistry and is still an active researcher in the School.

Professor Keith Tipton

Outreach Activities

The School supports a variety of outreach activities including a highly successful series of public lectures. Topics at these lectures have ranged from inflammation to cloning. In 2014 Dr Emma Creagh spoke about how too much of a good thing – such as inflammation – can actually be bad for our health while Dr Vincent Kelly spoke about recent advances in cloning and other DNA-modifying techniques and highlighted their impact on our understanding and treatment of diseases.

Discover Research Night Dublin showcased what researchers really do and why research matters. The public were invited to explore abstract and practical questions through a variety of unique digital and traditional formats and went behind the scenes in the School of Biochemistry and Immunology where cutting-edge medical and scientific research takes place.

Twice a year 25 Transition Year students spend an action-packed week in the School where they learn about the research activities, hear about life as a student in TCD and get the opportunity to work in a laboratory.

Pupils from four primary schools attended the 'Immunewars: Bugs and Beyond' interactive workshop hosted by Dr Rachel McLoughlin and Dr Nigel Stevenson where they learned about the immune system.

Save the Dates

21-23 August 2015
Alumni Weekend at TCD
– more information will be provided in due course at
www.tcd.ie/alumni/events

16 September 2015
Cancer Drug Discovery Day
More information will be provided in due course at
www.tcd.ie/Biochemistry/news/

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