Straight-talking on radon wins AccesScience '09

Órlaith Burke from the UCD School of Mathematical Sciences won AccesScience '09 for her research to accurately measure indoor radon concentrations. She is trying to find statistical models that will take seasonal variations into account when measuring this radioactive gas. These factors will let her establish if the buildings we live and work in are as safe as we think.

Although it is harmless in the open air, radon can seep up through the soil into building foundations causing dangerous levels to become trapped indoors resulting in diseases such as lung cancer. It is critical to accurately assess the risk posed by radon. Radon emissions vary widely with the seasons making accurate assessment difficult.

Over 250 secondary school pupils were among the audience and heard presentations on the novel research being carried out by seven finalists from across the Colleges of Life Sciences and Engineering, Mathematics & Physical Sciences. UCD Conway graduate Sabrina Devereux from the School of Chemistry & Chemical Science & CSCB won the audience vote and 2nd place for her work on finding ways to deal with the 91,000 tonnes of solid waste generated from prepared potatoes in Ireland every year. 3rd place went to Isabela Aparicio from the School of Biomolecular & Biomedical Science & UCD Conway Institute for her research to destroy the defences of the malarial parasite by making it sensitive to free radicals.

The event took place in O'Reilly Hall, UCD with Mr Pat Kenny, RTE hosting the afternoon's proceedings and the task of judging falling to Dublin's 98 broadcaster, Siobhan O'Connor; singer/songwriter Cathy Davey; comedian Paddy Courtney; travel writer and broadcaster Fionn Davenport. Minister of State for Science, Technology & Innovation, Dr Jimmy Devins officiated at the awards ceremony. MacLachan & Donaldson, Merck Sharpe & Dohme, the Environmental Protection Agency and The Irish Times sponsored the event. Órlaith Burke will represent UCD in Science Speak on April 27th in the RDS.

AccesScience '09 winner Órlaith Burke from the UCD School of Mathematical Sciences

Science set for the DART

"Encouraging more students to choose science subjects at second and third level is a vitally important part of our national strategy to support competitiveness and employment", stated Minister Devins as he made presentations to the primary and secondary school winners of the AccesScience '09 poster competition on the theme of Science; what's on the horizon?

Ten primary and secondary schools from Dublin and Wexford entered the competition. Jamie Dixon, 5th class in Gorey Educate Together took first place in the primary school category; Sarah Dunne, a pupil at the Loreto Abbey in Dalkey won the secondary school category. Their posters will be displayed on DART trains and stations as part of the Science Track series, a joint initiative between Iarnroid Eireann and UCD Conway Institute.

AccesScience poster competition winners: Back row (L-R): Jasmine Talukder, Dominican College, Sion Hill (3rd); Gabriela Duffy-Morales (2nd) & Sarah Dunne (1st), Loreto Dalkey; Dr Jimmy Devins, Minister of State for Science, Technology & Innovation; UCD President Hugh Brady; Niamh Devitt, Molly Giblin & Jenny O'Neill; Manor House School, Raheny (Highly commended) Front row (L-R): Zara Martin (Highly commended), Sophie Ryle (3rd), Aine Dunne (2nd) & Jamie Dixon (1st); Gorey Educate Together. [Calvin Watson, St Peter Apostle NS – not pictured]

Student award at the 19th ESACT-UK conference

Doctoral student Britta Krampe won the award for best speaker at the 19th annual ESACT-UK (European Society for Animal Cell Technology-UK) meeting, held at the Wellcome Trust Hinxton Conference Centre, Cambridge on January 5th – 6th 2009. Britta works in the group led by Conway Fellow, Professor Mohamed Al-Rubeai at UCD School of Chemical and Bioprocess Engineering. She presented her research entitled "Physiological and transcriptional response to reduced growth rate in NS0 chemostat culture" to scientists from academia and industry active in the field of cell culture biotechnology. The meeting consisted of oral presentations, poster sessions and trade exhibitions.

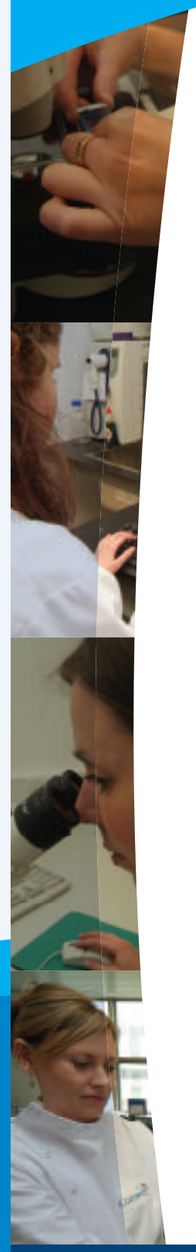
Funded through the Programme for Research in Third Level Institutions, administered by the HEA.

Elaine Quinn
Communications & Education Officer
UCD Conway Institute of Biomolecular & Biomedical Research
University College Dublin
Belfield, Dublin 4
Ireland

E: elaine.quinn@ucd.ie
T: (+353-1) 716 6706
F: (+353-1) 716 6701
W: www.ucd.ie/conway

April 2009 – Issue 6

conway focus



Novel insights to the hepatitis B virus

UCD Conway Fellow and Stokes lecturer, Dr Neil Ferguson and collaborators in Cambridge, UK have used a new approach to advance the current understanding of the structure and interactions of the hepatitis B virus at the molecular level. Recently published in the Journal of Molecular Biology, this research will help revolutionise the study of this virus and allow high resolution insights into the mechanics of replication. Ultimately, it should lead to the identification of new therapeutic targets and assisting design of novel antiviral molecules.

Over 350 million people have chronic HBV infections, resulting in 1 million deaths each year and a 100-fold increased risk of primary hepatocellular carcinoma. Current therapies on the market have limited value in treating chronic infections. The development of new therapies has been hampered by the limited understanding of the molecular mechanisms of HBV replication due to the challenges posed by the intrinsic properties of HBV biomolecules.

The current understanding of the structure and function of HBV proteins is based mainly on molecular virology studies and cryo-electron microscopy studies of nucleocapsids and viral particles. While these have provided valuable insights, they have been unable to characterise the finer molecular details of how the virus replicates. The hepatitis B core protein (HBc) plays a central role in replication. The critical interactions HBc makes in replication occur before the protein aggressively forms its protective capsid shell. The information from structural studies has focused on the later stages of the replication cycle after capsid formation and has not revealed detailed insights into molecular interactions important to virus replication

Dr Ferguson and his collaborators used a novel reductionist biophysical approach to deconstruct the HBc capsid. This 'downsizing' approach breaks an extremely complicated process into constituent steps. They were able to rapidly and directly measure the molecular interactions of the HBc at the atomic level and characterise its structural properties.

Commenting on the research, Dr Neil Ferguson said, "Using this reductionist approach, we can now connect the molecular virology viewpoint with the existing structural biology data to develop an atomic resolution picture of how this virus replicates. This is critical to better understanding the virus biology and developing novel antiviral molecules".

Dr Ferguson's research will now focus on the next stages in the process of identifying novel therapeutic targets and to use this information to rationally design and test the activity of new antivirals for HBV. Neil Ferguson believes that the multidisciplinary and collaborative ethos within UCD Conway Institute is central to the success of his research and will benefit from expert contributions from colleagues.

Neil Ferguson received a Science Foundation Ireland Stokes lectureship and came to UCD Conway Institute last year from the MRC Centre for Protein Engineering, Cambridge, UK. His interest in using biophysical, structural and protein engineering methodologies to study complex biological phenomena first began with protein folding mechanisms and the amyloid-like fibrils formed in neurodegenerative diseases.

Ribbon representation of a 2D section through a recombinant HBc capsid showing the four-helix bundle. HBc dimmers pack together at 5-fold and 6-fold axes to form spherical icosahedral capsids.

Director's Message

With this edition, I am delighted to welcome three leading international scientists to Ireland and UCD Conway Institute.

Professor Ulla Knaus works in the area of regulating the innate immune response in inflammation and infection and joins us from The Scripps Research Institute in California, USA. Professor Johan Ericsson has come from the Ludwig Institute for Cancer Research in Uppsala, Sweden, and is interested in insulin signalling and metabolic regulation. Professor Boris Kholodenko works in the area of systems biology and has come to Ireland from Jefferson University, Pennsylvania, USA.

All three have been awarded Science Foundation Ireland Stokes professorships. I have no doubt that, by bringing their individual expertise to these key strategic areas of the research programme and through forging new research collaborations, they will bring an exciting new dimension to the Institute.

Professor Des Fitzgerald,
Director

L'Oreal-Unesco international fellowship for Conway scientist

Lydia Lynch (back row) pictured with the other 14 L'Oreal-Unesco recipients at the awards ceremony in Paris

Dr Lydia Lynch is the first Irish woman to have been awarded an L'Oreal-Unesco international fellowship that will support a research internship in Harvard Medical School, Beth Israel Deaconness Medical Centre, Boston, USA.

Intended to support young female researchers at doctoral or postdoctoral level at a critical point in their career, the L'Oreal-Unesco international fellowships nurture the scientific talent of the future. Dr Lynch will receive $40,000 over 2 years to support her obesity research.

The fifteen international recipients from each of the five continents were selected by a jury of scientific experts chaired by Professor Ahmed H. Zewail, 1999 Nobel Laureate in Chemistry. With over 750 researchers participating from 191 countries, the L'Oreal-Unesco Women in Science awards motivate, inspire and support this global community as they advance scientific knowledge.

Dr Lydia Lynch is currently working with Conway Fellow, Professor Donal O'Shea in the obesity research group in the Education & Research Centre, St Vincent's University Hospital. She is looking at the human omentum as an immunological tool.

Omentum is the curtain of fat that hangs from the liver; surrounding and protecting other organs in the abdomen. Lydia's research found that large numbers of immune cells within omentum fat called invariant natural killer t-cells (NKT) can protect these organs from viruses and cancer. NKT cells detect and destroy tumour, bacterial or viral cells.

Lydia's research has found that despite increased levels of fat in super-obese patients, they have fewer and less effective NKT cells than lean people. "The natural killer cells are the body's first line of defence against cancer and viruses. Obese people get more cancers."

To date, Lydia has looked at these cells under laboratory conditions. Through the Uesco fellowship at Harvard, she will now be able to learn from research being done there in clinical trials with these cells. She says, "There are a tiny few of these cells in the blood compared to omentum. In Harvard, they are trying to expand them and put them into patients to kill cancer."

Lydia Lynch will bring the expertise learnt during her internship in Harvard back to the obesity research group in St Vincent's University Hospital.

Conway boasts new high-end technology for microscopy-based research

A new Andor Technology microscopy system has been installed in the Conway Imaging Facility, led by Professor Dimitri Scholz. This instrument will be used for advanced imaging of live cells. It was purchased through a Science Foundation Ireland grant awarded to Dr. Oliver Blacque, and co-applicants Prof. William Gallagher, Prof. Catherine Godson and Dr Gethin McBean.

Spinning disk confocal microscopy (SDCM) allows real-time imaging of fluorescent samples at high sensitivity and resolution, providing an unrivalled live-imaging technology to investigate dynamic and complex biological and non biological events.

Central to SDCM technology is the Nipkow spinning disk, which allows multi-beam scanning and provides the ability to image samples extremely quickly and at very high levels of sensitivity. This increased sensitivity means that samples are exposed to vastly reduced levels of laser energy excitation, which greatly decreases any potentially detrimental effects of phototoxicity and photo-bleaching.

The inverted Nikon TI-E fluorescent microscope provides fast 4D and 5D imaging and is equipped with the world's best lenses, motorised XYpiezo-Z stage and environmental chamber.

The microscope system will be used for a wide range of experimentation within the Institute including tracking fluorescence-tagged ciliary proteins within C. elegans sensory neurons (Blacque group); assaying mitochondrial membrane potential as a measure of apoptosis in drug-treated mammalian cells (Gallagher group); subcellular trafficking of membrane receptors in cell-based models of diabetic nephropathy (Godson group), and live cell imaging of calcium fluxes in astrocytes (McBean group). Katarzyna Kida will provide technical assistance and support for the microscopy system.

Andor Technology microscopy system in situ in the Conway imaging core facility

Novel research by UCD scientists sheds light on the balance between oxygen demand and supply.

While a good oxygen supply is critical to life, too much is definitely not a good thing. Conway Fellow, Prof. Cormac Taylor and colleagues in Ireland and the United States have uncovered a novel mechanism underlying the delicate balancing act of controlling oxygen demand and supply within skeletal muscle cells.

The Science Foundation Ireland funded research, recently published in the Proceedings of the National Academy of Sciences (USA) journal, demonstrates a process involved in the body's response to increased demand for oxygen during exercise. It also proposes a molecular pathway that may underpin the enhanced performance athletes achieve through training.

The group identified that PGC-1alpha increases oxygen demand in cells. This protein regulator is increased in exercise and drives the generation of energy creating mitochondria within our cells.

However, the very process of creating this energy requires more oxygen to fuel the reaction. The stimulus to increase the oxygen supply to the cell comes from hypoxia inducible factor (HIF). High levels of this protein increases blood vessel formation and dilation bringing vital oxygen to skeletal muscle cells or tissues. In this way, HIF activation matches the increased oxygen demand with an increased oxygen supply.

Commenting on the research findings, Prof. Cormac Taylor said, "Essentially, we have demonstrated that enhanced oxygen demand in skeletal muscle can be sensed by cells, which then respond by releasing factors that increase blood and oxygen supply to balance things out".

Dr Kathleen O'Hagen, QUB carried out much of the work as part of her doctoral thesis under the supervision of Prof. Taylor. The other lead investigators were Dr Bernard Allen, Genentech Inc, California and Prof. Dmitri Papkovsky, UCC.

Full publication available on www.pnas.org/cgi/doi/10.1073/pnas.0808801106

International multidisciplinary team advance eczema research

An international team led by Professor Padraic Fallon in Trinity College Dublin (TCD) and involving UCD Conway Fellow, Professor Sean Callanan as well as scientists in Scotland and Japan have identified a new animal model for human eczema.

This research, recently published in Nature Genetics, follows from previous groundbreaking work by some of the team who discovered that mutations in the filaggrin gene were responsible for up to 50% of severe eczema cases in children. The multidisciplinary team have now identified the identical mutation mechanism involving the filaggrin gene in the mouse strain. They have shown that the resultant damaged skin is permeable to allergens and develops a heightened inflammatory response similar to that in human eczema patients.

One in five Irish children suffers with eczema. They develop itchy, dry, red skin and can often develop crusted or open lesions. Current treatment typically involves minimising contact with potential sources of allergens and using topical corticosteroids. Children with the condition often develop other allergic conditions such as asthma later in life.

Professor Sean Callanan, a veterinary pathologist at UCD School of Agriculture, Food Science & Veterinary Medicine contributed the histopathological assessments on this research project funded by Science Foundation Ireland. His expertise in the area of veterinary pathology contributed to the results achieved by this multidisciplinary team that included immunologists, pathologists and dermatologists and, as such, has ensured a strong translational aspect to this and future work. This type of collaborative research leading to outstanding achievement resonates particularly in light of the recent commitment by TCD and UCD to the innovation alliance.

Further details available at http://www.tcd.ie/Communications/news/pressreleases/pressRelease.php?headerID=1141&pressReleaseArchive=2009

Beta test site for flow cytometry equipment

In collaboration with Dr Alfonso Blanco, Accuri Cytometers have selected UCD Conway Institute to be one of the five beta test sites in Europe for their Accuri C6 Flow Cytometer System, including the C6 Flow Cytometer™, CFlow™ Software and a computer.
Core technologist in the Conway flow cytometry facility, Dr. Blanco will cooperate with Accuri to implement any agreed test protocols. This will involve performing product validation and verification in a test environment that is consistent with product documentation and validation test plans; identifying product errors and inconsistencies, and deviations from the product documentation; critiquing product features, functionality, performance, operation, reliability, user friendliness, and competitiveness.
This information will be used by Accuri to streamline existing products and design the next generation of models. Dr. Alfonso Blanco considers that this may ultimately bring competitively priced and more user friendly instrumentation to the flow cytometry market.