ucc
Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland

science for all

SCIENCE FOR ALL

- Ocean Energy
- Colon Cancer
- Functional Foods
- Quantum Vs Classical Worlds
- Inflammatory Bowel Disease
- Ultra Cold Atoms

seventh annual

postgraduate student public presentation competition

30 MARCH 2011
7.00PM
UNIVERSITY COLLEGE CORK,
LECTURE THEATRE BOOLE 2

College of Science, Engineering & Food Science
www.ucc.ie/sefs

APC
Alimentary Pharmabiotic Centre
Mining Microbes for Mankind
http://apc.ucc.ie

Tyndall National Institute
www.tyndall.ie

Full list of entries for Science for All 2011 Competition

Anne Blavette	Grid Integration of Ocean Energy: the Generic Modelling Approach
Claire Buckley	How common are Lower Extremity (Lower Limb) Amputations in Diabetic patients?
Sinead Doherty	Dairy proteins – Undisputed ingredients with ambitious potential
Philana Fernandes	Chronic Inflammation in Colon Cancer
Thomas Fogarty	Decoherence: The veil that separates two worlds
Mary Frawley	New Adventures in Optical Trapping
Nicola LoGullo	Quantum mechanics is growing up
Tara Hennessy	Has Quantum Physics Lost its Marbles?
Caitriona Lyons	Inflammation and Signalling in Colon Cancer
Tatiana Marques	Benefits of Probiotic Action in the Gut
Naoise Mac Suibhne	From Cairo to Cork: The Life of a YouTube Video
Carola Murphy	Let there be light! A new model that illuminates cell trafficking in Inflammatory Bowel Disease
Grace O'Callaghan	Life in the Fas Lane – signalling in colon cancer
John O'Donoghue	The Other 1%: Platinum Anti-Cancer Research
Karen O'Donovan	Biofilm: Community of microbes
Alex Petcu	The Curious Case of Conical Refraction
David Russell	Soothing preterm infants by feeding a probiotic
Laura Russell	The Coldest Place In Ireland
Sinead Ryan	Using anti-inflammatory strategies to maintain neural stem cells in the brain
Amy Watkins	Optical Microresonators - How a Careless Whisper Made All the Difference

Students Communicating Science

You are all very welcome to our seventh annual Science for All Postgraduate Student Presentation Competition at University College Cork.

The purpose of our competition is to encourage young scientists to communicate the results of their researches to the general public in an easily understandable manner. Easy two-way communication between scientists and the public is very important in our modern world, which is so heavily dependent on science-based technology. Entry to this competition is open to postgraduate students in the College of Science, Engineering and Food Science and the College of Medicine and Health. Science for All is part of a postgraduate module on Science Communication and Outreach.

The competition is jointly organised by the College of Science, Engineering and Food Science, the Alimentary Pharmabiotic Centre and Tyndall National Institute, UCC.

The 6 postgraduate student finalists, who were chosen in preliminary heats on 11th March 2011, will present the results of their researches in a manner easily understood by non-scientists. The presentations will be judged for their effectiveness in this regard by a panel of lay judges. Tonight's judges are: Ms Jennie O'Sullivan, RTE Cork (Chair), Mr Niall Murray, Education Correspondent, The Irish Examiner, Mr. Trevor Holmes, Vice President for External Relations, UCC and Ms Siobhan Murphy, PharmaChemical Ireland.

We are most grateful to our judges - the panel who judged the heats, and the panel of judges who sit here tonight to judge the final. We would particularly like to acknowledge the input of Ms. Mary McNulty in providing training in the public presentation of science to all the entrants in our competition and Mr Dick Hogan in providing training in writing about science for a public audience.

We would like to acknowledge the continued sponsorship of the competition by UCC, the Alimentary Pharmabiotic Centre, Tyndall National Institute and Snap Printing.

Finally, we wish everyone a wonderful evening's enjoyment here at UCC in an atmosphere of Science for All.

Dr Catherine Buckley
Education and Outreach Manager
Alimentary Pharmabiotic Centre
UCC

Dr Jill Haynes
Projects Officer
College of SEFS
UCC

Ms Aoife O'Donoghue
Outreach Officer
Tyndall National Institute
UCC

Professor William Reville
Public Awareness of Science Officer
College of SEFS
UCC

Grand Final Judging Panel

Chairperson: Ms Jennie O'Sullivan, RTE Cork
Mr Niall Murray, Education Correspondent, The Irish Examiner
Mr. Trevor Holmes, Vice President for External Relations, UCC
Ms Siobhan Murphy, PharmaChemical Ireland.

Judges for the Science For All Heats

Ms Karen Coughlan, College of Arts Celtic Studies and Social Sciences, UCC
Mr Kevin Dalton, Commercialisation Specialist, Technology Transfer Office, UCC
Professor William Reville, Public Awareness of Science & Department of Biochemistry, UCC

Grand Final Programme

6.00pm: Welcome Reception for participants, judges, sponsors and guests

7.00pm **Welcome Address**
Professor William Reville MC

7.10pm Professor Patrick Fitzpatrick, Head of College of Science, Engineering & Food Science and Professor Alan Kelly, Dean of Graduate Studies

7.20pm Student Presentations

- **Anne Blavette**
  Grid Integration of Ocean Energy: the Generic Modelling Approach

- **Sinead Doherty**
  Dairy Proteins – Undisputed Ingredients with Ambitious Potential

- **Thomas Fogarty**
  Decoherence: the veil that separates two worlds

- **Carola Murphy**
  Let there be Light! A new model that illuminates Cell Trafficking in Inflammatory Bowel Disease

- **Grace O'Callaghan**
  Life in the Fas Lane – Signalling in Colon Cancer

- **Laura Russell**
  The Coldest Place in Ireland

9.00pm Presentation of Awards and Prizes

9.10pm Closing Remarks

Grid Integration of Ocean Energy: the Generic Modelling Approach

Anne Blavette
Hydraulics and Maritime Research Centre and
Department of Civil and Environmental Engineering

My research work focuses on the issues posed by the utilisation of electricity generated from sea waves. The Irish government target -500 MW of electricity from the ocean by 2020- makes this study a necessary step towards the large-scale exploitation of this new source of energy.

Contrary to coal-fired power plants, wave power plants, or "farms", have some characteristics that might make them currently unable to supply the network with safe and reliable electricity. One of these drawbacks is the potential variation of electricity generated from waves. The electricity produced from a conventional power plant may be dramatically different. This possible variability of wave electricity may then induce a certain level of instability in the network and hence the impact of wave farms has to be studied carefully.

Impact assessment studies are usually carried out under a software called "power system simulator". This simulator contains models of any electrical component of a network, for instance electrical lines or power plants. These models can be arranged within the simulator so as to reproduce any national grid numerically. However, there is no model for ocean energy converter as yet. This lack has heavy implications: currently, no assessment study can be performed, what leaves a high level of uncertainty regarding the integration of wave energy on a large scale. I hope to demonstrate the relevance of the "generic modelling" approach that has emerged as an alternative for the dynamic modelling of ocean energy converters.

Dairy proteins – Undisputed ingredients with ambitious potential

Sinead Doherty
Teagasc, Moorepark Food Research Centre & Dept. Microbiology

Consistent with the heightened consumer interest in functional foods, integration of probiotic bacteria into food systems represents a difficult challenge for food manufacturers due to viability losses associated with processing, storage and gastric transit. Thus, the framework of my Ph.D studies involved the design of an encapsulation technology for delivery of probiotics using dairy proteins. Initial studies validated whey protein micro-beads as probiotic delivery vehicles for *Lactobacillus rhamnosus* GG, during in vitro gastro-intestinal studies while progressive investigations demonstrated acid-stability and peptic-resistance of micro-beads during *ex vivo* stomach incubation. Enzyme-activated intestinal conditions triggered rapid micro-bead digestion, while the application of additional micro-bead coatings induced a delayed release mechanism (patent pending). Storage survival of free and encapsulated cells was also evaluated in fruit juices including cranberry juice. Encapsulated cells demonstrated no significant cell loss (9.1 log10cfu/ml) following 28-day storage at room temperature and subsequent gastric incubation at pH 1.6 (3 h; 37°C), while free cells expressed complete cell mortality. Micro-beads were also evaluated during in vivo animal studies. *Lb. rhamnosus* GG was recovered from the porcine intestine at similar levels whether ingested from coated or non-coated micro-beads (8.1 $\pm$ 0.4 log10cfu/ml); however, free cells experienced significant cell death (5.5 $\pm$ 1.6 log10cfu/ml). Contrary to non-coated micro-beads, multiple coated matrices illustrated delayed intestinal cell-release in addition to enhanced cell adhesion for desired probiotic functionality. Flow Cytometry also validated delivery of probiotic health benefits in all encapsulated treatments. Hence, this encapsulation method represents a platform technology making it possible to envision widespread commercial applications of encapsulation using whey protein matrices.

Decoherence: the veil that separates two worlds

Thomas Fogarty
Department of Physics

It might strike you as strange if you saw a wheel spinning clockwise and anti-clockwise at the same time or a cat being simultaneously alive or dead. However in quantum mechanics this scenario is commonplace and is called a superposition state. Quantum mechanics is the physics that concerns the very small, the way that tiny particles like atoms behave and interact. The physics that governs the world we are aware of is called classical physics and it describes everything from the motions of footballs to the orbits of satellites. You may be wondering where is the boundary between the world controlled by quantum mechanics and that controlled by classical mechanics? The simple answer is that there is no boundary. So then what happens, how come we never see dead/alive cats in cars with clockwise/anti-clockwise rotating wheels? The answer is decoherence, a process which quickly turns our superposition state in the quantum world into an exact definable state in the classical world. Decoherence is caused by the environment in which the state exists altering, or measuring our quantum state. Such measuring causes it come out of its superposition state, leave the quantum world and enter the classical world, as the cat becomes either dead or alive. The study of decoherence is therefore of fundamental importance in developing quantum information technologies such as quantum computers. To this end I am conducting research on decoherence in an ultracold gas of atoms for use in quantum technologies.

Let there be Light! A new Model that illuminates Cell Trafficking in Inflammatory Bowel Disease

Carola Murphy
Department of Medicine and Alimentary Pharmabiotic Centre

Inflammatory bowel disease (IBD) is an autoimmune disease characterised by chronic aggressive inflammation of the intestine. The two main subtypes, Crohn's disease and ulcerative colitis, are both extremely debilitating with symptoms that include severe abdominal pain, diarrhea and weight loss. In addition, long-term sufferers have increased risk of developing colon cancer. Approximately 3 in 1,000 people in Western Europe and the U.S. suffer from IBD.

Neutrophils are white blood cells that play a crucial role in our defense against infection and are the first cell type recruited to sites of inflammation. However, excessive, uncontrolled neutrophil recruitment to the intestine has been directly connected to the extensive tissue injury and subsequent symptoms of IBD. Therefore, blocking this neutrophil recruitment offers a potential therapeutic strategy for the disease. To efficiently track and quantify neutrophil migration to the intestine and thus test potential drugs aimed at blocking this recruitment, we developed a new model. We isolated neutrophils from genetically-modified mice that express light through firefly luciferase which could be detected using a special bioluminescence imaging machine. Transferring these light-expressing neutrophils into mice with IBD allowed us to track their recruitment into the inflamed intestine and also to demonstrate blockade of this recruitment by a potential drug. Our novel pre-clinical model can be used to dissect the biology of, and test new drugs that target, neutrophil migration during inflammatory responses in a range of diseases and would therefore be useful as an informative tool for both the pharmaceutical industry and the basic research community.

Life in the Fas Lane – Signalling in Colon Cancer

Grace O'Callaghan
Department of Medicine

Cancer is a disease that we are all familiar with. The likelihood of developing cancer is very high, affecting one in four people in their lifetime. I have undertaken my PhD project on Colon cancer, which is the second leading cause of cancer related death in Ireland. Our understanding of the signals that lead to cancer is improving but more remain to be identified.

Colon cancer involves multiple faulty signals which makes the task of identifying new drug targets complex. My project looks at how colon tumours survive and evade our immune system. One of the ways that a tumour does this is by a signalling system involving two proteins called Fas and Fas Ligand (FasL). This system is used in particular by our immune systems to kill cells. Tumour cells however do not die by this signal. Instead, in what has been coined 'The Counterattack' the tumour cell uses this system against your immune cell causing it to die. Hence, your tumour cell survives and your immune cell dies. I look at how this happens. FasL in particular interacts with another group of signals involved in colon cancer. I narrowed this down to one signal, transmitted by what is called EP1 receptor.

I next targeted this signal using a mouse model, whereby I gave the mice tumours and then treated them with a drug acting against this signal. This resulted in smaller tumours and highlights this signal as a new target against colon cancer.

The Coldest Place in Ireland

Laura Russell
Department of Physics and Tyndall National Institute

My research takes place in the Quantum Optics Laboratory in Tyndall National Institute, which also happens to be the coldest place in Ireland. We use lasers to push atoms in such a way as to slow them down. When an atom gets slowed down, its temperature also decreases. This technique is called laser cooling and was first demonstrated in 1978. Laser cooling allows us to dramatically cool a gas of atoms down to temperatures of -273 Celsius, or just above the coldest temperature that can theoretically be reached, Absolute Zero Kelvin.

My research investigates what happens when you move the cloud of cold atoms near a glass surface. This system gives rise to the van der Waals effect, which is the physical mechanism that allows geckos to stick to walls. This is a major concern for quantum devices of the future where cold atoms will be positioned near surfaces in order to be probed.

Currently, cold atoms allow us to define the second with extreme precision as well as prospect for oil and minerals under the Earth's surface. In the future, quantum computers may be developed using cold atoms. The cold atoms can act as quantum bits, or qubits, forming a binary system similar to modern day silicon-based computers. The advantage of using cold atoms is that computational tasks can be performed with far greater efficiency than the computers of today.

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