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SURE 2019 Undergraduate Science Conference Booklet

SURE Network

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2nd Annual Conference

SURE



Science Undergraduate Research Experience

27th September 2019

Sharing Discovery

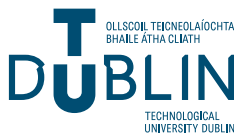


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Welcome from the SURE Network

The Science Undergraduate Research Experience (SURE) Network was established in 2017 by a community of Irish institutions interested in enhancing practice in undergraduate research in the Sciences. In September 2018, the SURE Network ran its first series of regional undergraduate conferences in the Sciences, in Athlone, Dublin and Waterford. These conferences proved to be hugely successful, with hundreds of final year students attending the various sessions and workshops. In recognition of the success of the conferences, the SURE Network was awarded “Best Academic Partnership” at the 2019 Education Awards. This was a fantastic achievement for the network and helped establish the network as a key participant in the national discussion regarding the strengthening of the connections between teaching and research in Higher Education.

On behalf of my colleagues on the SURE Network Committee throughout Ireland, I am delighted to welcome you to the second annual conferences of the SURE Network. Three conferences are taking place today, in Carlow, Dublin and Sligo. Each conference has been organised by a Local Organising Committee whose hard work and commitment over the past year is culminating with today's events. Each conference provides recently graduated students with an opportunity to present their work for the first time at an academic conference. Each conference also provides final year students with their first opportunity to attend an academic conference and participate as audience members in a scientific discussion with peers and experts. This represents a very important part of the education of students, many of whom will transition to research careers following the completion of their undergraduate studies.

In addition to our second series of conferences, this year also sees the launch of the SURE Journal, a high-quality, international, open access, online, double blind reviewed publication which deals with all aspects of undergraduate research in the broad Sciences. This is a very exciting development that adds to the opportunities for our students to submit their work for publication.

We are hugely grateful to all of our generous sponsors for their support for the SURE Conferences, and for the important contributions of all of our committee members, reviewers, academic colleagues and students in implementing our second series of SURE conferences. We acknowledge the excellent work of both the students and the supervisors of the research work set out in this book of abstracts. The work is a hugely impressive reflection of the excellence that is achieved by our students on an annual basis. We hope to see you all again next year at our SURE 2020 conferences in Cork, Dublin and Galway.



Ciaran O'Leary, SURE Network Chairperson

SURE Network Committee (Current members)

Dina Brazil, Institute of Technology, Carlow
 Greg Byrne, Technological University Dublin
 Eva Campion, Institute of Technology, Sligo
 Emma Caraher, Technological University Dublin
 Tracey Coady, Waterford Institute of Technology
 Gordon Cooke, Technological University Dublin
 Mary Deasy, Technological University Dublin
 Julie Dunne, Technological University Dublin
 Karen Finn, Galway-Mayo Institute of Technology
 Laura Keaver, Institute of Technology, Sligo
 Claire Lennon, Waterford Institute of Technology
 Andrew Lloyd, Institute of Technology, Carlow
 Sinead Loughran, Dundalk Institute of Technology
 Fiona McArdle, Institute of Technology, Sligo
 Valerie McCarthy, Dundalk Institute of Technology
 Hugh McGlynn, Cork Institute of Technology
 Therese Montgomery, Athlone Institute of Technology
 Anne Marie O'Brien, Athlone Institute of Technology
 Eileen O'Leary, Cork Institute of Technology
 Ciarán O'Leary, Technological University Dublin
 Carloalberto Petti, Institute of Technology, Carlow
 Cormac Quigley, Galway-Mayo Institute of Technology
 Lisa Ryan, Galway-Mayo Institute of Technology
 Arjan van Rossum, Dundalk Institute of Technology
 Barry Ryan, Technological University Dublin
 Matt Smith, Technological University Dublin
 Nicolas Touzet, Institute of Technology, Sligo
 Janette Walton, Cork Institute of Technology

Conference Committees

SURE 2019 Local Organising Committee – Carlow

Carloalberto Petti
 Dina Brazil
 Paula Rankin
 David Dowling
 Mary Bates
 Thomae Kakouli Duarte
 David Phelan
 Una Ni Ghogain
 Guiomar Garcia Cabellos

SURE 2019 Local Organising Committee – Dublin

Emma Caraher
 Gordon Cooke

SURE 2019 Local Organising Committee – Sligo

Eva Campion
 Fiona McArdle
 Laura Keaver
 Nicolas Touzet

Conference Coordinating Committee

Emma Caraher
 Julie Dunne
 Ciarán O'Leary
 Anne Marie O'Brien

The three local organising committees would like to thank the undergraduate students, postgraduate students and academic colleagues who have assisted with the running of the SURE 2019 conferences.

Reviewers

Maire Callaghan, Technological University Dublin

Eva Campion, Institute of Technology, Sligo

Emma Caraher, Technological University Dublin

John Cassidy, Technological University Dublin

Laura Cleary-Keogh, Technological University Dublin

Tracey Coady, Waterford Institute of Technology

Kieran Collins, Technological University Dublin

Mary Costello, Technological University Dublin

Bernie Creaven, Technological University Dublin

Lisa Cronin, Institute of Technology, Sligo

Mary Deasy, Technological University Dublin

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Fintan Kelleher, Technological University Dublin

Claire Lennon, Waterford Institute of Technology

Anne Marie O'Brien, Athlone Institute of Technology

Claire Mc Donnell, Technological University Dublin

Fiona McArdle, Institute of Technology, Sligo

Aoife McCarthy, Cork Institute of Technology

Dale McGrath, Institute of Technology, Carlow

Luke McGuigan, Technological University Dublin

Therese Montgomery, Athlone Institute of Technology

Shane Murphy, Technological University Dublin

Ciaran O'Leary, Technological University Dublin

Donagh O'Mahony, Cork Institute of Technology

Graham O'Neill, Technological University Dublin

Liz O'Sullivan, Technological University Dublin

Carloalberto Petti, Institute of Technology, Carlow

Paul Robinson, Technological University Dublin

Barry Ryan, Technological University Dublin

Bianca Schoen-Phelan, Technological University
Dublin

Richard Sherlock, Institute of Technology, Sligo

Aubrey Storey, Waterford Institute of Technology

Maureen Walsh, Technological University Dublin

Janette Walton, Cork Institute of Technology

SURE 2019 Conference

The SURE Network is delighted to host the Second Annual Science Undergraduate Research Experience (SURE) Conferences (SURE 2019) in Institute of Technology, Carlow; Technological University Dublin and Institute of Technology, Sligo. The aims of the conference are to:

- Provide current students with an opportunity to gain an understanding of the work which has been undertaken by recent graduates, and the career opportunities that exist for graduates in Scientific disciplines.
- Provide recent graduates with an opportunity to gain a reviewed publication based on the scientific research undertaken by them during their undergraduate studies.
- Celebrate the academic achievements of recent graduates in the scientific disciplines.
- Provide a multi-disciplinary scientific forum through which undergraduate research outputs can be disseminated to students, researchers, academic professionals and industry.

Students from throughout Ireland who completed their Final Year Project in 2018-19 submitted their undergraduate research work to this conference. Submissions were received for the following, and related, disciplines:

<ul style="list-style-type: none"> • Analytical Science • Biology • Biopharmaceutical Science • Chemistry • Computing • Food Science • Health Science & Nutrition 	<ul style="list-style-type: none"> • Land Sciences • Mathematics • Nursing • Pharmaceutical Science • Physics • Sport Science
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Three SURE 2019 conferences are running simultaneously in venues around the country today.

Students from the following institutions will present at the conference in Institute of Technology, Carlow:

- Institute of Technology, Carlow (host institution)
- Waterford Institute of Technology
- Cork Institute of Technology

Students from the following institutions will present at the conference in Technological University Dublin:

- Technological University Dublin (host institution)
- Dundalk Institute of Technology

Students from the following institutions will present at the conference in Institute of Technology, Sligo:

- Institute of Technology, Sligo (host institution)
- Athlone Institute of Technology
- Galway-Mayo Institute of Technology
- Letterkenny Institute of Technology

Conference Sponsors



NATIONAL FORUM

FOR THE ENHANCEMENT OF TEACHING
AND LEARNING IN HIGHER EDUCATION

The National Forum for the Enhancement of Teaching and Learning in Higher Education is the national body responsible for leading and advising on the enhancement of teaching and learning in Irish higher education. In partnership with students, staff and leaders in Irish higher education, the National Forum works to develop an inclusive, collaborative and innovative culture that maximises learning impact for the success of all students. An independent review of the National Forum, published in 2018, deemed it to be an 'essential component of the national-level infrastructure for higher education in Ireland' and recommended its establishment on a sustainable basis.





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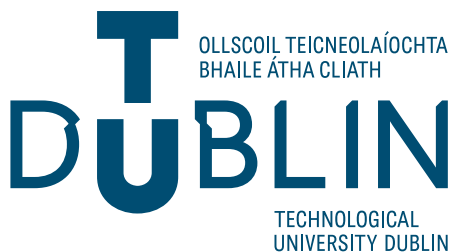


INSTITUTE of
TECHNOLOGY

CARLOW

At the heart of South Leinster





Waterford Institute of Technology
INSTITIÚID TEICNEOLAÍOCHTA FHORT LAIRGE

'Microbial Antibiotic Resistance in Aquatic Environments' by Tracey Hutton (Waterford Institute of Technology), Karen Tambling

'Analysis of Deficient Vitamin B12 Data for the South-West Population of Ireland' by Lisa Kelliher (Cork Institute of Technology), Helen O'Shea, Norma Reidy

'Multi-step Reactions Employing Biocatalysis and Organocatalysis' by Patrick Ojwe (Waterford Institute of Technology), Claire Lennon

'Orange Peels and Nut Kernels as Efficient Renewable Adsorbents for Removal of Pollutants from Water' by Samantha O'Neill (Institute of Technology, Carlow), Ray Benson

'Reducing Nitrogen Emissions from the Irish Dairy Sector via Genetic Improvement' by Katie O'Toole (Waterford Institute of Technology), Denise O'Meara

'Development of Molecular Sex Determination Methods for Small Mammal Remains Found in Barn Owl Pellets' by Emily Quann (Waterford Institute of Technology), Denise O'Meara

'Macronutrient Intake of College Students and Factors Affecting Food Choice' by Aoife Rodgers (Cork Institute of Technology), Aoife McCarthy

SURE 2019 Poster Presentations Carlow Conference

'Determination of Allinase activity in *Allium sativum* and Establishment of Allicin Antimicrobial Properties against Selected Bacterial Species' by Levente Agardi (Institute of Technology, Carlow), Kevin Brennan, Bazla Alam, Carloalberto Petti, Jim Nolan

'Multi-step 'unnatural' C-C Bond Forming Reactions Employing Hydrolytic Enzymes' by Rupali Ahashan (Waterford Institute of Technology), Claire Lennon

'The Development of pHEMA Contact Lenses for the Controlled Release of Ocular Therapeutics' by Saoirse Casey-Power (Waterford Institute of Technology), Laurence Fitzhenry, Gautam Behl

'Western Blot Transfer and Detection of a Novel Biopharmaceutical Protein' by Jennifer Drohan (Waterford Institute of Technology), Lee Coffey

'An Investigate into Shell Biorefinery – Valorization of Shellfish Waste in Commercial and Pharmaceutical Applications' by Yi Xin Moey (Waterford Institute of Technology), Mike Kinsella, Helen Hughes

'Methods of Detecting *Clostridium perfringens* in Anaerobic Digestate' by Chloe Quinn (Waterford Institute of Technology), Nabla Kennedy

'Determination of *Viburnum opulus* Pigments, their pH Responses and Evaluation of its Antimicrobial Properties' by Daniel Raheem, Dale McGrath, Valentine Dehays (Institute of Technology, Carlow), Carloalberto Petti, Jim Nolan

'Determination of Total Phenolics and Total Pigments in *Euonymus europaeus* (European Spindle), and their Responses to pH and Light' by Megan Savidge, Adam Lovett, Yvonne Lawler (Institute of Technology, Carlow), Carloalberto Petti, Jim Nolan

'Investigation of the Antioxidant Activity of Methyl Violet and Hydroxyl Groups' by Marcel von Ascheraden (Cork Institute of Technology), Nikolay Petkov

'The Effect of Dietary Additions (Garlic, Onions, Seaweed) on Methanogens in Ruminants' by James Waters (Waterford Institute of Technology), Nabla Kennedy

'An Analysis of Methods to Improve Turnaround Times in Methicillin Resistant *Staphylococcus aureus* Screening' by Robert Kelleghan (Technological University Dublin), Celine Herra, Sandra Bennett, Eamonn Hyland, Niamh O'Sullivan

'Comparing *Escherichia coli* Strains from Breast Fed and Formula Fed Neonates' by Juanita Kelly (Technological University Dublin), Gordon Cooke

'A DNA-Based Survey of Irish Moth Species' by Clodagh King (Dundalk Institute of Technology), Andrew Harrington

'Investigation of Autism Genes by Examining Gene Expression across Different Areas of Healthy Brains' by Daria Matynia (Technological University Dublin), Eugene Hickey

'A Comparison of the Effects of two Protocols of Eccentric Hamstring Strength Training on Muscle Function and Jump Performance in Gaelic Football Athletes' by Tara O'Brien (Technological University Dublin), Brian Keenan

'*In Vitro* Expansion of Human Placental Amnion Epithelial Cells' by Aine O'Connor (Technological University Dublin), Brenda Brankin, Roberto Gramignoli

'Optimising Silver Nanoparticles Size as a Novel Cancer Therapy in Combination with Cold Atmospheric Plasma' by Valya O'Donovan (Technological University Dublin), James Curtin

'Characterization of a Large Group of *Listeria monocytogenes* using Whole Genome Sequencing: Assessing their Virulence Potential' by Natalia Unrath (Technological University Dublin), Celine Herra, Evonne McCabe, Daniel Hurley, Séamus Fanning

SURE 2019 Poster Presentations Dublin Conference

'Optimisation and Verification of OCT4 and Glypican-3 Antibodies for use in the Differential Diagnosis of Testicular Germ Cell Tumours' by Lorraine Bredin (Technological University Dublin), Kathleen Brosnan, Julie Gorman, John Harford, Tom Crotty

'Development and Trial of a Protocol for Training a Quantitative Descriptive Panel in Temporal Dominance of Sensations for the Sensory Evaluation of Wet-aged Beef Longissimus Lumborum Muscle' by Mawadah Bajrai (Technological University Dublin), Greg Burke, Carol Griffin

'The Weiss Reaction' by Louisa Coates (Technological University Dublin), Brian Murray

'Rapid Detection of Respiratory Pathogens - A Challenge for Diagnostic Microbiology Laboratories' by Nicole Kavanagh (Technological University Dublin), Celine Herra, Jennifer Tormey, Edel O'Regan

'An investigation into the knowledge and attitudes of allergens and adverse reactions to food among food service staff' by Michelle Kearns (Technological University Dublin), Mairead Stack

'The In-Season Anthropometric and Physiological Profiles of Elite International Female Field Hockey Players across the Positional Lines of Play' by Karla Kennedy (Technological University Dublin), Kieran Collins

'The Influence of Environmental Conditions on Lactic Acid Bacteria and Bacteriocin Production' by Melody Kwenda (Technological University Dublin), Emma Caraher

'Investigating whether Anaerobic Conditions Influence the Virulence of Cystic Fibrosis pathogens' by Oyin Lawal (Technological University Dublin), Emma Caraher

'Assessment of Microplastics in Farmed and Processed Blue Mussels (*Mytilus Edulis*)' by Pamela Madden (Technological University Dublin), Michelle Giltrap

'The Strengths and Weaknesses of the Irish Infant Formula Industry - Baby Steps to a Booming Industry' by Lorna Martyn (Technological University Dublin), Orla Cahill

'Predicting whether a Cancer is Benign or Malignant using the Wisconsin Diagnostic Breast Cancer Dataset' by Angelika Matynia (Technological University Dublin), Eugene Hickey

'A Validation Study of a Novel Sensory Sock (Sensoria) when Measuring Foot Strike and Cadence' by Claire McCarthy (Technological University Dublin), Joe Warne

'Evaluation of the Alere™ PBP2a SA Culture Colony Test for Rapid MRSA Identification' by Laura Mcguire (Technological University Dublin), Celine Herra, Niamh Clarke, Nuala Kealy

'Evaluation and Comparison of Two Liquid Swab Transport Systems using CLSI M40-A2 Guidelines' by Nicola McNally (Technological University Dublin), Celine Herra, Patricia O'Brien

'Investigating the Effects of Dietary Nitrates on the Augmentation Index in Healthy, Normotensive, Technological University Dublin Students' by Sarah O'Keeffe (Technological University Dublin), Oscar Mac Ananey

'Analysis of Amblyopia and Anisometropia in Ireland' by Aisling Roche (Technological University Dublin), Molly Thunder (Technological University Dublin), Aoife O'Donnell (Technological University Dublin), Michael Moore

SURE 2019 Poster Presentations Dublin Conference

'Extracellular Vesicles in Eisenmenger Syndrome: Investigating the Effect of Dual Endothelin Receptor Antagonism Therapy' by Zoe Ryan (Technological University Dublin), Claire Wynne, Karl Egan, Fionnuala Ni Ainle

'Validation of a Screening Method for the Detection of Tetracycline in Bovine and Porcine Tissue Samples' by Grace Walsh (Technological University Dublin), Sylvia Healy, James Gibbons

SURE 2019 Oral Presentations**Sligo Conference**

'Forensic DNA Phenotyping: Gender and Eye Colour Determination from Forensic Science' by Lea Erjavc (Galway-Mayo Institute of Technology), Karen Finn

'A Mechanistic Study of the Non-Genotoxic Carcinogenicity of the Food Additive Semicarbazide' by Daniel Fitzpatrick (Athlone Institute of Technology), Antoinette Sweeney

'The Assessment of Mitochondrial Toxicity' by Carina Hardy (Athlone Institute of Technology), Neasa Kinsella

'An Investigation of the Antiproliferative and Cytotoxic Properties of Honey in the Lung Carcinoma Cancer Cell Line A549' by Helen Herbert (Institute of Technology, Sligo), Eva Campion

'It's in the education: Lived Experiences of Breastfeeding Initiators 6 Months Post-Partum' by Briana Kane (Institute of Technology, Sligo), Margaret McLoone, Gemma McMonagle

'Growth Patterns in a Paediatric Outpatient Clinic and its Association with Parental Feeding Style in Children Aged 2-5 Years' by Aisling Lee (Institute of Technology, Sligo), Laura Keaver

'Investigating the Activity of Antimicrobial Peptides using Minimum Inhibitory Concentration Assays' by Lydia Lyons (Galway-Mayo Institute of Technology), Joan O'Keefe, Orla Slattery

'Are Urban Waste Water Treatment Plants (UWWTPs) a Source of Microplastics to Irish Rivers? Experiences from the River Slaney Catchment' by Nicole Perich (Galway-Mayo Institute of Technology), Heather T. Lally

SURE 2019 Poster Presentations Sligo Conference

'The use of Synthetic Chemosensitizers in Reversing Antibiotic Resistance in Multidrug Resistant *Klebsiella pneumoniae* MGH78578, *Salmonella indiana* 664 and *Salmonella typhimurium* D23580' by Sarah Daly (Galway-Mayo Institute of Technology), Debbie Corcoran

'Accuracy and Precision of Energy Dispersive X-ray Spectrometer' by Chinazo Hope Emeh (Institute of Technology, Sligo), Richard Sherlock

'Affective Responses to Self-Selected and Prescribed Exercise Intensity among College-aged Students' by Caera Grady (Institute of Technology, Sligo), Joanne Regan

'Participants' Perceptions of a Community-Based Exercise Programme for People with Chronic Conditions in Sligo, Ireland' by Orla Fahy (Institute of Technology, Sligo), Margaret McLoone

'Investigation of an Ecologically Relevant Freshwater Algal for Toxicity Testing' by Maeve Farrell (Athlone Institute of Technology), Andy Fogarty

'Differences in Physical Activity and Pulmonary Function in Smokers and Non-Smokers' by Mary Gaughan (Institute of Technology, Sligo), Edwenia O'Malley

'An Investigation into the Common Lower Limb Injuries of Competitive Female Irish Dancers in Ireland and how they are Treated' by Ruth Gillespie (Institute of Technology, Sligo), Victoria Stevens

'Employment of a Rapid Fungal Detection System for High Throughput Screening of Basidiomycete Transformants' by Christopher Golden (Institute of Technology, Sligo), Mary Heneghan

'Classification of Music Genres using Spectrograms and Back-propagation Neural Networks' by Bastian Graebener (Galway-Mayo Institute of Technology), John Healy

'The Effects of Static and Dynamic Stretching on Power and Speed' by Amy Harkin (Institute of Technology, Sligo), Eimear Donlon

'Growth patterns in a Paediatric Outpatient Clinic at Sligo University Hospital and its Association with Child Food Preference and Parental Perception of Child Weight Status' by Christine Houlihan (Institute of Technology, Sligo), Laura Keaver, Annette Lalor, Louise Rattigan, Dara Gallagher, Hillary Greeny

'Factors that Affect Willingness of a Segment of the Irish Population to Try Insects' by Briana Kane (Institute of Technology, Sligo), Maria Dermiki

'Iodine Intake in Women of Childbearing Age (Aged 30-45 years) in the Midlands of Ireland' by Emma Kane (Athlone Institute of Technology), Patricia Heavey

'Investigation of the Immuno-modulatory Effects of Vitamin D' by Niamh Kennedy (Athlone Institute of Technology), Sinead Devery

'Development of Lateral Flow Immunoassay for Mycobacterium Paratuberculosis (MAP)' by Khadija Khalid (Institute of Technology, Sligo), Steven Daly

'The Investigation of the Effects of Land Management Practices on the Soil Ecosystem' by Aoife Kiernan (Athlone Institute of Technology), Sile O'Flaherty

SURE 2019 Poster Presentations Sligo Conference

- 'The Association between Hamstring Strength and Previous Hamstring Injury' by Conor Lavin (Institute of Technology, Sligo), Eimear Donlon, Kenneth Monaghan
- 'Improving the Process of Mitigating Daratumumab Interference in Pre-transfusion Compatibility Testing' by Ciara Liptrot (Galway-Mayo Institute of Technology), Helen Cregg, Edel Scally
- 'Transfer and Persistence Studies using Glitter in a Forensic Context' by Lucy Matthews (Institute of Technology, Sligo), Aodhmar Cadogan
- 'The Forensic Analysis of Glass' by Lauren McArdle (Institute of Technology, Sligo), Aodhmar Cadogan
- 'Confidence Levels and Historical Injury among Gaelic Football and Basketball Players in Ireland' by Machailla McCabe (Institute of Technology, Sligo), Tony Partridge
- 'Spectroscopic and Molecular Docking Analysis of the Non-Covalent Interactions between 1-(2-Chloroethyl)-3-Cyclohexyl-1-Nitrosourea and DNA' by Pádraig McDonagh (Letterkenny Institute of Technology), Garrett Farrell
- 'Voice Recognition using Vowel Sounds' by Samera Mc Grath (Institute of Technology, Sligo), Richard Sherlock
- 'The Knowledge and Behaviour of IT Sligo Students in Relation to Binge-Drinking' by Gráinne McNulty (Institute of Technology, Sligo), Órla Warren
- 'Folic Acid Supplement Use among Reproductive Aged Women in Ireland' by Shannon Mulvaney (Institute of Technology, Sligo), Rosemary Stamm
- 'Nutritional Knowledge and Attitudes of Female Elite GAA players' by Emily Mulvihill (Institute of Technology, Sligo), Edwenia O'Malley, Irina Uzhova
- 'Exploring the Perceptions of the Irish Sugar Sweetened Beverage Tax among Young Female Adults' by Aoife Murtagh (Athlone Institute of Technology), Sharon Murtagh
- 'MicroRNA Expression in Mesenchymal Stem Cells' by Esther Obasi (Athlone Institute of Technology), Cathy Brougham
- 'The Development of a Novel Vector for *Coprinopsis cinerea* LT2 Transformation' by Finian O'Brien (Institute of Technology, Sligo), Eva Campion
- 'Investigation of the *Coprinopsis cinerea* OAT gene during Mushroom Fruiting Body Development.' by Fionnuala O'Connor (Institute of Technology, Sligo), Eva Campion
- 'Adherence to the Food Pyramid and its Association with Anthropometric Measurements and Prevalence of Overweight and Obesity' by Andrea O'Donohoe (Institute of Technology, Sligo), Irina Uzhova
- 'Investigation of the Presence of Caffeine and two of its Metabolites in Treated Wastewater (TWW) in the North West of Ireland' by Conor O'Hanlon (Institute of Technology, Sligo), Fiona McArdle
- 'Investigation of the Stability of Aspirin' by Akaotah Okri (Athlone Institute of Technology), Carmel Donoghue
- 'The Anticancer Properties of Curcumin in Liver Carcinoma' by Temi Oyelola (Athlone Institute of Technology), Anne Friel

'Development of a Novel Folic Acid Delivery System' by Hannah Phillips (Athlone Institute of Technology), Patricia Heavey, Clement Higginbotham

'Singing for your Supper! An Exploration of the Health Benefits of Singing on Members of an Intergenerational choir' by Rebecca Prunty (Institute of Technology, Sligo), Margaret McLoone, Rebecca Prunty, Margaret McLoone, Anne McAteer

'The Comparison of the Crossover Point in Healthy Trained and Healthy Untrained Individuals' by Elaine Shelly (Institute of Technology, Sligo), Eimear Donlon

'An Investigation into the Effect that a 2-Week PNF, Static or Dynamic Stretching Programme has on IT Sligo Soccer Players' Lower Body Power Output' by Ben Treanor (Institute of Technology, Sligo), Padraig McGourty, Eimear Donlon

'Fabrication and Evaluation of Novel Bacteriostatic Wound Dressings' by Zabira Zulfiqar Ali (Institute of Technology, Sligo), Ailish Breen

**SURE 2019
Book of Abstracts**

**‘Forensic DNA Phenotyping: Gender and Eye Colour Determination from Forensic Science’ by
Lea Erjavc (Galway-Mayo Institute of Technology), Karen Finn**

Forensic science is always challenged with the need to improve evidence analysis. In forensic DNA analysis, PCR has become the major technique in the investigation of missing persons and disaster victim samples, where determining gender eliminates half of the population. Several sex-determining genes have been identified including *SRY* (Sex-determining region Y), *AMEL* (Amelogenin) and *ZF* (Zinc-finger) genes. Although it is a very reliable method, there have been studies published where *AMEL* was unsuccessfully amplified (male sample was identified as female). Based on these data, this study aimed to optimise PCR-based assays to amplify both the *AMEL* and *ZF* genes for sex determination. In addition, several methods of DNA isolation and purification were also compared. The *AMEL* PCR successfully determined gender from DNA samples, however *ZF* amplification was unsuccessful in multiplex PCR with collected DNA samples, thus indicating that amplification of the *AMEL* gene is more reliable and specific than the *ZF* gene in this particular study. This project also investigated the ability to identify an external visible characteristic, eye colour, in known DNA samples. Being able to distinguish eye colour, hair colour and skin colour based on DNA evidence would increase the speed of forensic investigation. *OCA2* and *HERC2* are two genes associated with eye colour. This study specifically examined *HERC2*, whose gene product inhibits *OCA2* which is responsible for producing pigment. The PCR-based assay for *HERC2* was successfully optimised and amplified product could be sent for sequencing to identify specific single nucleotide polymorphisms (SNPs) associated with eye colour.

'A Mechanistic Study of the Non-Genotoxic Carcinogenicity of the Food Additive Semicarbazide' by Daniel Fitzpatrick (Athlone Institute of Technology), Antoinette Sweeney

Semicarbazide was brought to the forefront of scientific discussions in the early 2000's, as the substance was discovered in several food products from both natural and synthetic sources. Although semicarbazide was processed through several toxicological assays and classified as a non-genotoxic carcinogen, underwhelming amounts of toxicological data exists for the compound.

The present study is one of the first in-vitro studies to examine the relationship between pathophysiological concentrations of reactive oxygen species and the anomalous non-genotoxic carcinogenicity induced by semicarbazide through the upregulation of intracellular signaling pathways. It was important to use normal rat kidney (NRK) cells (86032002 ECACC) for this study as they play a vital role in immune regulation within the tumour microenvironment. Immune regulation is dictated by extracellular matrix remodeling, as it is responsible for regulating proliferation and differentiation.

A novel finding of this study was where NRK cells were exposed to μM concentrations of semicarbazide, an inverse relationship between protein kinase C activity and free radical concentrations proportionally increased > 2 -fold.

It is the hypothesis of the present study that the > 2 -fold increase in free radical concentration and protein kinase C activity has the capacity to alter physiological signaling mechanisms into a pathophysiological state. Induced upregulation of protein kinase C activity can be extrapolated to downstream mediators of the calcium dependent signaling pathway and the mitogen-activated protein kinase signaling pathway.

In conclusion, the author classifies semicarbazide as an intracellular signaling mitogen based on its capacity to modulate protein kinase C activity and reactive oxygen species.

‘A DNA-Based Survey of Irish Moth Species’ by Clodagh King (Dundalk Institute of Technology), Andrew Harrington

Moths belong to one of the largest and most diverse insect orders in the world, with over 150,000 described species of moth. However, the abundance and diversity of moths and other invertebrates is plummeting, with the main drivers of their decline including habitat loss, pesticide usage and climate change. This is alarming as they are a major part of our biodiversity, playing roles as herbivores, detritivores, defoliators, pollinators and prey, as well as providing ecosystem services to humans. The aim of this study was to collect Irish moths and identify them using both conventional taxonomic methods and DNA barcoding, to understand some of the roles they play in Irish ecosystems, and the evolutionary relationships among species.

In total, 21 different species representing 142 individuals were identified via PCR amplification of a 710 bp fragment of the mitochondrial cytochrome c oxidase subunit 1 (COI) gene from 25 specimens and carrying out bioinformatics using the sequences obtained.

When comparing the moth identifications determined by conventional taxonomy and those determined by DNA barcoding, it was confirmed that the latter was more reliable when attempting to identify moths down to species level. However, it is suggested to use both methods in unison for the most accurate results.

In addition, through phylogenetic analysis, a new COI haplotype in Irish *Selenia dentaria* populations was discovered, revealing new genetic diversity in Irish populations. Moreover, phylogenetic analysis showed that one species (*Pleuroptya ruralis*) may potentially be classified in the wrong family as the current family-level taxonomy described for some moth species lacks certainty.

'Microbial Antibiotic Resistance in Aquatic Environments' by Tracey Hutton (Waterford Institute of Technology), Karen Tambling

Antibiotics have been used for decades to treat bacterial infections curing more diseases than any other drug class combined. However, antibiotics and their residues enter aquatic environments through anthropogenic activities resulting in the proliferation and dissemination of antibiotic resistant bacteria (ARB) and antibiotic resistance genes (ARGs) across the globe. With ARB now an emerging pollutant, there's a possibility that the world could revert back to the pre-antibiotic era where bacterial infections were the leading cause of death. By 2050, it's predicted that 10 million people will die annually due to antibiotic resistant bacterial infections if action is not taken (O' Neill, 2014). This study screened four samples across the Three Sisters region in the South-East of Ireland including the Barrow, the Nore and the Suir rivers and Woodstown strand. After filtration of water samples, selective enrichment in antibiotic containing media led to the culturing of numerous antibiotic resistant strains. Phenotypic tests including gram-stains and biochemical tests, as well as genotypic methods such as PCR, DNA sequencing and analysis to identify ARGs and ARB present. Microbial resistance was noted against Neomycin, Penicillin G, Cefoxitin, Kanamycin and Amikacin via disk diffusion. The presence of *sull* and *tetB* were detected in the river Suir sample by DNA sequencing and the *bla-SHV* gene was detected by gel electrophoresis. The strain harbouring the *tetB* gene was identified as a *Providencia* sp. through 16S rRNA gene amplification and sequencing. This research study gives an insight into the extent of microbial antibiotic resistance in the South-East of Ireland.

‘An Analysis of Methods to Improve Turnaround Times in Methicillin Resistant *Staphylococcus aureus* Screening’ by Robert Kelleghan (Technological University Dublin), Celine Herra, Sandra Bennett, Eamonn Hyland, Niamh O’Sullivan

MRSA is a significant pathogen causing uncomplicated to life-threatening infections, with increased mortality in bloodstream infections due to MRSA compared to methicillin sensitive *S. aureus* (O’Connell and Brennan 2016, ECDC 2017). Currently at CHI at Crumlin, the turnaround time (TAT) for a negative MRSA screen is 48 hours, and 72-96 hours for a positive. The present method of screening for MRSA involves a pre-enrichment step in 3% NaCl nutrient broth and subculture onto MRSASelect II.

This project was designed to determine if the use of pre-enrichment is contributing to the detection rate of MRSA colonisation. If so, does it justify the extended TAT of 24 hours or can it be replaced by direct culture. This was done by comparison of direct culture to pre-enriched culture with 861 MRSA screening swabs. Reducing TAT was further investigated by testing isolates directly from chromogenic media using the Xpert® MRSA NxG kit. This eliminates the need for incubation of conventional media, giving a confirmed positive after 24 hours.

There were 79 positive MRSA samples from 27 patients, of which 70 were true positives. The 9 false negative screens were from patients who had a previous history of MRSA. Each of these patients had MRSA detected in another sample or another MRSA screening site on the same day. Direct culture had a sensitivity of 88.61% and specificity of 100%. The benefits of an improved TAT (reduced time in isolation and cost for the hospital with reduction of bed days) support the removal of the pre-enrichment step. Going forward in CHI at Crumlin, the TAT for MRSA screening will be greatly improved, with a negative result in 24 hours and a confirmed positive in 48 hours.

'Analysis of Deficient Vitamin B12 Data for the South-West Population of Ireland' by Lisa Kelliher (Cork Institute of Technology), Helen O'Shea, Norma Reidy

Background: Deficiency of vitamin B12 is common among vegetarian, low income populations, and the elderly, due to poor dietary intake and reduced malabsorption capabilities. Deficiency of vitamin B12 can cause megaloblastic anaemia, depression, cognitive decline and most concerning neurological disorders. Prevalence of vitamin B12 deficiency varies in Western counties, but the research is conclusive in that elderly individuals are at higher risk for B12 deficiency.

Objective: To analyse low vitamin B12 data in the South-West population of Ireland to evaluate the demographic determinants and vitamin B12 deficiency. To assess the issue of lot-lot variability for the serum vitamin B12 assay.

Methods: Research was conducted at the haematology department, Cork University Hospital. Low for vitamin B12 serum samples (>120ng/ml) were collected and analysed (Access Vitamin B12 assay) on the Immunoassay System analyser.

Results: There was an association between age and vitamin B12 status with a variation between males and females. Females accounted for a higher percentage ≤ 45 years-old, and males ≥ 55 years-old. Two percent were care home patients. Areas of low socioeconomic status in Cork City accounted for 39% of all Cork City participants. The degree of variability between lot numbers was mostly acceptable (12-15%) but unacceptable (19%) between lot no. 871145 and lot no.971004. The findings support the estimated prevalence (as per CUH figures) of B12 deficiency is about 2% of the population of Ireland.

‘Comparing *Escherichia coli* Strains from Breast Fed and Formula Fed Neonates’ by Juanita Kelly (Technological University Dublin), Gordon Cooke

Exclusive breastfeeding is the recommended form of nutrition for a newborn until the age of six months old. However, Ireland continues to have one of the lowest breastfeeding rates in the world with only 46.3 % of mothers exclusively breastfeeding when discharged from hospital. In comparison to the United Kingdom which has a breastfeeding initiation rate of 81 %. Breast milk is a complex fluid containing hormones, growth factors, anti-inflammatory factors, bioactive compounds, and approximately 109 microbes/litre. Companies producing infant formula attempt to mimic the components of breast milk by supplementation with structurally similar compounds. It is thought that this difference in human milk and infant formula is the reason for the variation of microbial composition of breast fed and formula fed neonates. *Escherichia coli* is a dominant bacteria in both breast fed and formula fed infants.

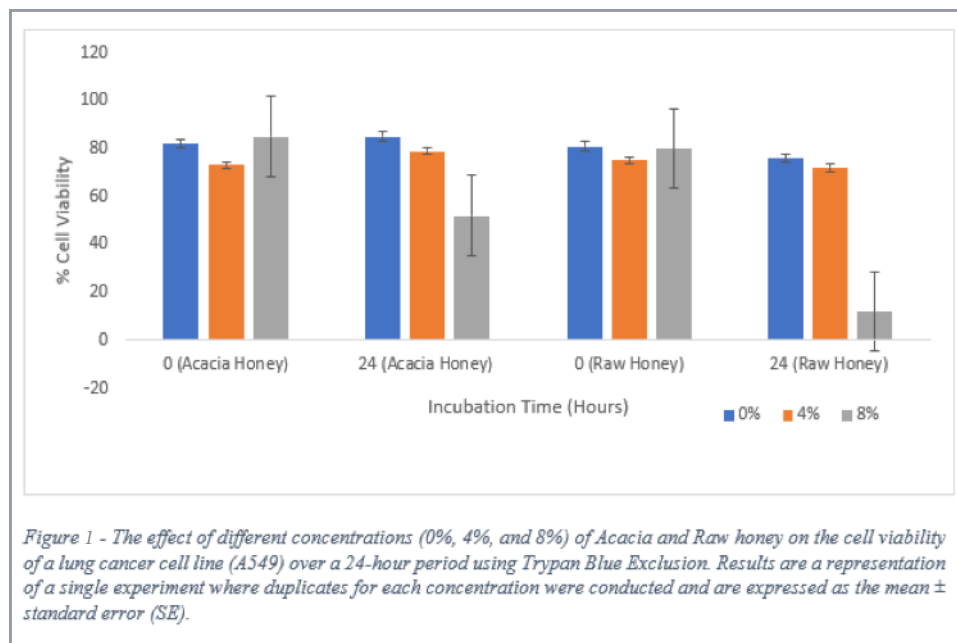
This project aims to characterise four clinical isolates of *Escherichia coli*, two exclusively breast fed and two exclusively formula fed. The isolates are compared on the basis of phenotypic analysis. This includes gram stain, selective agars and motility. Genotypic analysis is carried out by 16s PCR and ITS PCR, with the amplicons analysed by agarose gel electrophoresis. The antibiotic susceptibility of each isolates with three antibiotics is also determined. The two breast fed isolates behaved similarly in the assays carried out. One formula fed isolate performed differently in each of the assays. Overall despite trends, a significant difference was not determined however further studies and replicates of the assay could yield differences.

‘The Assessment of Mitochondrial Toxicity’ by Carina Hardy (Athlone Institute of Technology), Neasa Kinsella

In recent decades there has been a significant increase in the reported and documented cases of toxic effects of drugs and pollutants on mitochondria (Meyer et al., 2018), research into mitochondrial dysfunction has contributed to a growing understanding of mitochondrial chemical toxicity, highlighting the importance of mitochondria in the pathogenesis of diseases. From a drug safety perspective, the mitochondrion is a “target rich” environment (Neustadt and Pieczenik, 2008). Drug induced damage to the mitochondria is now recognised to play a role in pathogenesis of a wide scope of seemingly unconnected disorders such as bipolar disease, diabetes and Parkinson’s (Dyken and Will, 2010). A large proportion of drugs have “off target” effects, particularly targeting the critical function of the mitochondria, undermining the function via several mechanisms (Dyken and Will, 2010). Assessing the potential toxicity of drugs by circumventing the Crabtree effect leads to the possibility of detecting toxicity pre-market. Metformin, the drug of concern, is a biguanide oral antihyperglycemic drug which is routinely used for non-insulin dependent diabetes mellitus. Metformin poisoning has been documented to cause severe complications such as lactic acidosis, haemolytic anaemia and pancreatitis. Despite significant evidence that inhibition of mitochondrial respiratory complex I by Metformin is the primary cause of its cell-lineage-specific actions and therapeutic effects, the molecular interactions between Metformin and complex I remain uncharacterized. The study revealed that Metformin did cause a decrease in cell viability, ATP content, an increase in ROS, and affected intracellular mechanisms. By using the two different mediums, glucose and galactose, to circumvent the Crabtree effect the true toxic potential of Metformin was uncovered.

'An Investigation of the Antiproliferative and Cytotoxic Properties of Honey in the Lung Carcinoma Cancer Cell Line A549' by Helen Herbert (Institute of Technology, Sligo), Eva Campion

Globally, cancer is a leading cause of death and continues to pose a significant challenge to treatment. Recently, there have been several studies which focused on the use of natural products for cancer treatment. One of these natural products is honey, and it has historically been employed for its many medicinal uses, including its antibacterial, anti-inflammatory, antimicrobial, antioxidant and anti-cancer properties. Prior research has suggested that the possible mechanisms of action may be due to the induction of apoptosis, the disruption of the mitochondrial membrane and also cell-cycle arrest. The aim of this study was to observe the potential effects of two different honey types; Acacia and raw honey, on the lung cancer cell line, A549. The antiproliferative and cytotoxic activity of both varieties of honey on the A549 cell line were measured using Trypan blue exclusion and the MTT assay. The antiproliferative activity of both honey varieties was first determined after a 24-hour incubation period using Trypan blue exclusion. The results indicate that both honeys exhibit potent antiproliferative and cytotoxic effects on the lung cancer cell line, in a time-and dose-dependent manner. Furthermore, the cytotoxic impact of cell viability was seen after a 24-hour incubation using the MTT assay. The present results indicate a putative role for honey in the treatment of lung cancer, but additional study is required to further investigate the significance of this data.



‘Investigation of Autism Genes by Examining Gene Expression across Different Areas of Healthy Brains’ by Daria Matynia (Technological University Dublin), Eugene Hickey

Autism is a multifactorial disorder, caused by a diverse collection of both genetic and environmental factors which occur in a variety of complex combinations, making the task of pinpointing the exact genetic underpinnings of the disorder extremely difficult. Although it is known that autism is not caused by a single factor but rather an array of various factors, evidence has shown that strong genetic components are involved in its development and hence a deep examination of the genetics of autism is of great significance. The aim of this project was to investigate whether the genes implicated in autism exhibit differential expression across the various areas of the brain and whether these genes can then be sub-divided and grouped based on their expression patterns. This investigation was carried out using R and the Allen Brain Atlas dataset, from which 79 autism genes were extracted. With the use of clustering techniques such as kmeans and hierarchical clustering, it was uncovered that the selected genes split into four major clusters based on their expression profiles. Using multiple independent methods of network analysis (igraph, qgraph and WGCNA) the gene-gene correlations within the network based on their expression profiles were also examined. Using the WGCNA method, three hub genes (CUL3, BCL11A and POGZ) were identified. As these genes play critical roles in neurological and developmental processes across the brain, further analysis of their functions with respect to autism development could be of special interest as they could perhaps act as specific biomarkers of the disorder.

‘It’s in the education: Lived Experiences of Breastfeeding Initiators 6 Months Post-Partum’ by Briana Kane (Institute of Technology, Sligo), Margaret McLoone, Gemma McMonagle

Aim: The purpose of this study was to explore infant feeding (IF) experiences of mothers in Ireland approximately 6 months post-partum in order to determine facilitators and challenges to breastfeeding (BF).

Methods: 309 mothers were recruited from three maternity hospitals in Ireland to take place in a larger infant feeding study. For the current study, 11 breastfeeding mothers participated in interviews at approximately 6 months postpartum. The interviews were recorded, transcribed and uploaded onto qualitative data analysis software WebQDA for coding. The 6 phases of thematic analysis was used to analyse the data as outlined by Braun & Clarke (2006) in their framework.

Results: Six themes were derived from the analysis: advantages and disadvantages of BF, maternal attitude, supportive environments, IF experience, culture and misinformation.

Discussion: Advantages such as convenience and health benefits of BF facilitated the mothers, while disadvantages such as pain or frequency of feeding posed a challenge. While some mothers praised the hospital staff for their support, others expressed a desire to be better informed about the challenges of BF, as they felt messages were oversimplified. The mothers identified confidence and self-determination to be helpful in overcoming challenges associated with BF. These attitudes allowed them to overcome the negative impact of culture in particular, which was the most prominent theme. Conclusion and Recommendations: BF rates could be improved by raising awareness and improving education in various settings especially the health services and community settings. This could improve awareness, knowledge and acceptance of BF, thus influencing BF uptake and continuation.

'Growth Patterns in a Paediatric Outpatient Clinic and its Association with Parental Feeding Style in Children Aged 2-5 Years' by Aisling Lee (Institute of Technology, Sligo), Laura Keaver

Background: Monitoring a child's growth pattern allows clinical practitioners to detect an over/underweight status⁽¹⁾. Current literature states that the recognition of childhood obesity outside of medical professionals is poor^(2;3;4;5). A child's set of eating behaviours is said to be influenced by parental feeding style (PFS)^(6;7) which consequently impacts the weight status of children^(8;9;10).

Aim: To determine; (1) the weight status of children aged 2-5 years attending Sligo University Hospital (SUH); (2) parent's ability to correctly classify their child's weight status and (3) preferred parental feeding style and association with weight status.

Method: Cross-sectional study in SUH Paediatric outpatient department between September and November 2018. Anthropometric measurements were taken and a demographic and validated parental feeding style questionnaire⁽¹¹⁾ was completed. Data was analysed using SPSS v24 and significance was set at P<0.05.

Results: Thirty-five parents and children were recruited. 80% of children were within a healthy weight range. There was a significant difference between the child's actual weight status and parental perception of the child's weight status. Parents who were overweight/obese were more likely to misperceive their child's weight status than parents who were normal weight. The most frequently used PFS was encouragement feeding (80%). The weight status of the child didn't influence PFS.

Discussion/conclusion: Although parental feeding style was not found to be associated with weight status, parents were found to be poor at recognising an overweight/obese weight status in children aged 2-5 years which supports current literature^(12;13). Interventions need to be implemented to improve parental recognition of childhood overweight/obesity.

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'Investigating the Activity of Antimicrobial Peptides using Minimum Inhibitory Concentration Assays' by Lydia Lyons (Galway-Mayo Institute of Technology), Joan O'Keeffe, Orla Slattery

Antimicrobial peptides (AMPs) may provide a hopeful solution to global antibiotic resistant organisms, due to their ubiquity across the animal kingdom, low levels of resistance and sophisticated antimicrobial activity.

To explore this activity, minimum inhibitory concentration (MIC) assays by the broth microdilution method were performed for this project. Various antimicrobials were tested against human pathogens including *E.coli* and *S. aureus*, and fish pathogens including *V. anguillarum*, *A. salmonicida* and *Y. ruckeri*. This was a continuation of a previous 2018 MFRC study, in which MICs of various antimicrobials including ampicillin, kanamycin and chloramphenicol antibiotic controls as well as melittin and a synthetic AMP combination (magainin 1 and melittin) were established against the test pathogens.

This study confirmed those findings and performed additional MICs against the pathogens for an ampicillin-synthetic AMP combination and a purified MBP- β -defensin 3 fusion protein, which was generated in the laboratory. The purified fusion protein provided novel findings by exerting antimicrobial activity against *E. coli* and *Y. ruckeri*, but showed no activity against the remaining pathogens. The ampicillin-synthetic AMP combination showed improved antimicrobial activity against *S. aureus* compared to ampicillin alone.

The findings of this study provided confidence in the broth microdilution method established by the laboratory, through agreement in results of the current and 2018 study. The novel fusion protein findings provided preliminary results regarding the future use of β -defensin peptides in the MFRC. Importantly, the ampicillin-synthetic AMP combination provided significant preliminary findings regarding the possibility of antibiotic-AMP combinations in reducing antibiotic therapy.

‘A Comparison of the Effects of two Protocols of Eccentric Hamstring Strength Training on Muscle Function and Jump Performance in Gaelic Football Athletes’ by Tara O’Brien (Technological University Dublin), Brian Keenan

Background: Hamstring injuries are the most prevalent injury in Gaelic football and athletes who sustain hamstring injuries are highly susceptible to reinjury. In team sports such as soccer, cricket and rugby, the eccentric Nordic hamstring exercise (NHE) has proven to significantly reduce the incidence of hamstring injury. The eccentric Askling L-Protocol (ALP) has shown to be an effective hamstring injury rehabilitative tool. Objective: The aim of this study is to compare the effects of two protocols of eccentric hamstring strength training (the NHE and the ALP) on muscle function and jump performance, in a 6-week intervention study in injury-free Gaelic football athletes.

Methods: Twelve senior, Division 1, male Gaelic football athletes ($n=12$, age: 24.4 ± 5.8 years; training age: 6.6 ± 6.1 years; weight: 84.48 ± 4.18 kg; height: 180.59 ± 3.92 cm) were assigned to an NHE group ($n=6$) or an ALP group ($n=6$) based on age and training age. Pre- and post-testing involved assessing hamstring muscle function on the Hamstring Solo Elite device, and countermovement jump (CMJ) performance. Each progressive program included three exercises aimed to activate the different muscles of the hamstring group.

Results: Irrespective of groups, the eccentric hamstring exercise interventions elicited statistically significant improvements in bilateral peak eccentric force ($p \leq 0.001$), unilateral peak eccentric force as demonstrated in the weaker limb ($p \leq 0.001$) and stronger limb ($p \leq 0.01$), and the relative peak eccentric torque ($p \leq 0.024$). Significant improvements were also observed in CMJ performance ($p \leq 0.002$). The eccentric hamstring exercise interventions did not produce significant changes in bilateral imbalance ($p = 0.128$). No significant differences on any of the dependent variables were observed between groups ($p > 0.05$).

Conclusion: 6-weeks of eccentric hamstring strength training significantly improved muscle function and jump performance in Gaelic football athletes, while no significant differences were observed between the two protocols. Thus, the ALP may be an effective injury prevention protocol.

'In Vitro Expansion of Human Placental Amnion Epithelial Cells' by Aine O'Connor (Technological University Dublin), Brenda Brankin, Roberto Gramignoli

Liver failure represents a major public health concern worldwide. During the twentieth century, hundreds of thousands of patients with end-stage diseases have been rescued by solid organ transplants as the ultimate treatment option, despite this, organ donor availability remains one of the main constraints on health services. Modern medicine has focused on ameliorating this problem with the use of cell-based therapy, however limitations including tumour propagation and reduced functionality have impeded their complete transition from bench to bedside.

The amniotic epithelial (AE) cells are a promising non-controversial source of potential stem cells. Their constitutive ability to mature into different cell type have highlighted them as a potential candidate for liver-based therapy. We isolated AE cells from 6 term placentas which generated high amounts of cells (up to 240 million AE cells per placenta) characterised by high viability ($91.5 \pm 3.4\%$). Ex vivo expansion of AE cells may be important to generate an adequate yield for transplantation, in addition to reduce the number of allogenic donor AE cells per recipient. Whilst preserving several of their characteristic features, we successfully expanded AE cells in a xenobiotic-free culture medium (PneumaCult™) supplemented with human platelet lysate in comparison with gold standard medium formulation. Our results showed AE cells proliferated robustly as far as 5 passages and potentially longer in new conditions. Notably, expanded AE cells maintained epithelial marker expression (CD326 and cytokeratin 18) with marginal expression of stromal marker Vimentin. Human Albumin ELISA Quantitation Set was used to quantify soluble human albumin in cell cultures. AE have been able to secrete human albumin, to an inferior level compared to normal human hepatocytes but without any genetic manipulation or the need for a differentiation protocol.

‘Optimising Silver Nanoparticles Size as a Novel Cancer Therapy in Combination with Cold Atmospheric Plasma’ by Valya O’Donovan (Technological University Dublin), James Curtin

Background: Glioblastoma Multiforme (GBM) is the most common and malignant type of glioma with a survival rate of 15 months post diagnosis; and the greatest number of years of life lost for any adult tumour. This highlights the significance in developing new treatments. Silver nanoparticles (AgNPs) have potential as diagnostic and therapeutic vehicles. However, uptake of AgNPs into the cells limits efficacy. Cold atmospheric plasma (CAP) results in synergistic anti-cancer cytotoxicity when combined with AgNPs (see Fig. 1).

Aims and Objectives: The aim of this study was to determine the optimal AgNP size to induce cytotoxicity when combined with CAP. The objectives were achieved by treating U373MG cells with varying concentrations of 5, 10, 25 and 50nm AgNPs combined with CAP, using the dielectric barrier discharge (DBD) and Pin systems. Cytotoxicity was determined using the alamar blue assay obtaining IC50 values.

Findings: This study found that synergistic cytotoxicity was observed for the polyvinyl alcohol (PVA) coated 10nm AgNPs using the DBD when compared to the Pin system. It was also found that synergy was not observed for the polyvinyl pyrrolidone (PVP) coated 5, 25 and 50nm AgNPs.

Conclusions: CAP devices, AgNPs size, surface charge and chemistry were important factors in determining the degree of synergistic cytotoxicity. The charge and coating of the AgNPs had a greater effect on the rate of uptake and cytotoxicity of the AgNPs rather than size. Therefore, size is not the major determinant for cytotoxicity in combination with CAP and future research can focus on charge and surface coating properties.

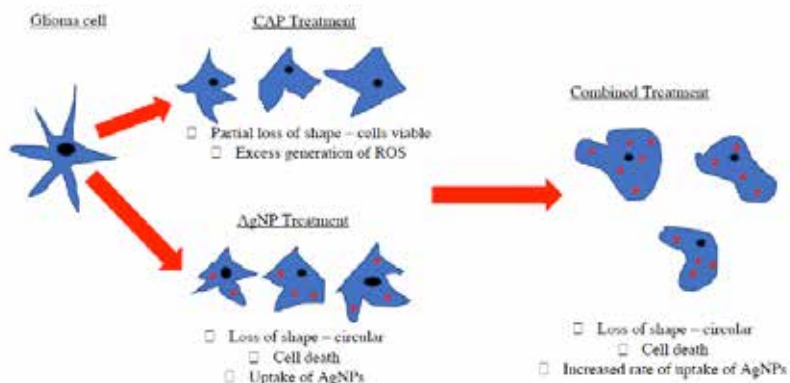


Figure 1: Graphical abstract

'Multi-step Reactions Employing Biocatalysis and Organocatalysis' by Patrick Ojwe (Waterford Institute of Technology), Claire Lennon

Chiral diols, especially 1,3 chiral diols are important building blocks in the synthesis of pharmaceuticals such as; Compactin and Lonomycin. There are several methods for the synthesis of 1,3 chiral diols which can produce equal or varying quantities of four possible stereoisomers (racemic diols). Since the thalidomide disaster, the need for chiral molecules as pure single enantiomer/diastereomer has increased extensively in recent years. Chemoenzymatic methods employing organocatalysis and biocatalysis offer more effective, and simpler routes to form a single stereoisomer of 1,3 chiral diols. The main objective of this project was to combine the use of organocatalyst (L-proline) and biocatalyst (Baker's Yeast) and investigate their selectivity in the synthesis of a single stereoisomer of 1-(4-nitrophenyl) butane-1, 3-diol in a multistep reaction involving an aldol reaction and reduction reaction.

Initially, L-proline was used to catalyse aldol reaction between acetone and 4-nitrobenzaldehyde, and a high yield of 73% was obtained. We also found that the reaction was enantioselective with enantiomeric excess of 71% determined by HPLC using Chiralpak[®] column AS-H after confirmatory analysis by NMR.

We then carried out reduction of the aldol product by Baker's Yeast. Baker's yeast also showed great selectivity in the reduction of β -Hydroxy ketone with diastereomeric excess of 73%. Both a two-step with purification and sequential two step reaction without intermediate purification were investigated. We found that Baker's yeast reduction was not affected without workup of intermediate. Therefore, in the future this can be eliminated which reduces cost in term of solvents usage and time.

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'Orange Peels and Nut Kernels as Efficient Renewable Adsorbents for Removal of Pollutants from Water' by Samantha O'Neill (Institute of Technology, Carlow), Ray Benson

Removal of heavy metals and organic dyes present in wastewater is problematic for many countries at this present time. Current approaches can be costly, time-consuming and can lead to the production of toxic and undesired by-products. Bi-sorption is a process which represents a biotechnological innovation as well as a cost effective method of removing heavy metals and organic dyes from wastewaters. In this study, two natural materials – orange peels and pistachio shell were selected and used as simple and renewable adsorbents for water purification. The presence of surface functional groups such as carboxylic acid and hydroxyl groups were identified for the orange peel using Fourier Transform Infra-Red Spectroscopy. Both adsorbents were capable of adsorbing the organic dye, Methylene Blue, but the orange peel had a greater capacity to adsorb (0.5320 mg/g) in comparison to the pistachio shell (0.3628 mg/g). The orange peel was an excellent adsorbent of heavy metals. The orange peel showed adequate extraction capacity for lead (2.0910 mg/g) and for zinc (0.1927 mg/g). Furthermore, when subjected to acidic conditions (pH 4), showed an increase in adsorption capacity for lead (2.698 mg/g). Basic conditions (pH 10) showed a decrease in adsorption for lead (1.02 mg/g). Moreover, adsorption kinetics were also studied by pseudo first order and pseudo second order models for the adsorption of zinc and it was found that the adsorption followed a pseudo second order model. The pistachio shell showed negligible extraction capacity for the metals lead and zinc.

‘Reducing Nitrogen Emissions from the Irish Dairy Sector via Genetic Improvement’ by Katie O’Toole (Waterford Institute of Technology), Denise O’Meara

Pollution from urine patches created from livestock grazing is a major source of the Greenhouse Gases emitted from the agricultural sector. Dairy cows excrete excess nitrogen fed in the form of dietary protein via faeces, urine and milk. High levels of nitrogen excretion are associated with a reduction in milk production and fertility. Levels of Milk Urea Nitrogen (MUN) in dairy cows’ milk is as a proxy to measure overall nitrogen emission as it closely corresponds to nitrogen emitted via urine. High levels can be corrected through dietary manipulation by reducing protein. A previous study showed that allelic variants of the stearoyl-coenzyme A desaturase 1 (SCD) gene were associated with MUN in Italian Swiss Brown cows. In this study, novel primers were designed to amplify the SCD-1 polymorphism using DNA extracted from hair samples (N = 25) on an Irish dairy farm containing Jersey-Holstein crosses. Using a combination of PCR, gel electrophoresis and DNA sequencing, two SNPs were successfully analysed from 19 of the samples processed revealing T (N = 11) and AT (N = 8) polymorphisms. Milk samples were collected from each of the cows genetically analysed and measured for MUN. The AT variant was found to be associated with lower MUN levels (P = 0.04). Other milk production traits were also analysed but were not found to be significant. With further sampling and statistical support, associations between this gene and MUN could be exploited in gene-assisted selection programmes for genetic improvement purposes to create more environmentally efficient cows by breeding from cows with the AT variant.

‘Are Urban Waste Water Treatment Plants (UWWTPs) a Source of Microplastics to Irish Rivers? Experiences from the River Slaney Catchment’ by Nicole Perich (Galway-Mayo Institute of Technology), Heather T. Lally

Urban wastewater treatment plants (UWWTPs) are considered a significant point source of microplastic (MP) pollution to the aquatic environment following treatment of municipal waste waters. MPs are classified as synthetic, solid particles 1 mm – 5 mm in size. This study investigated the MP abundance of river water samples upstream and downstream of three UWWTPs discharge points along the River Slaney, including one reference site over a 12 month period. The primary aims were to characterise and quantify MPs in water samples and assessing the spatial and temporal distribution of MPs in the River Slaney. Approximately 16,800 litres of water was filtered on-site using a 150 µm mesh size sieve and captured a total of 1035 ± 79.09 items m^{-3} ($n=84$). Overall, MPs were prevalent at all sites but remain significantly lower than MPs abundance recorded in Europe (316.8 ± 4664.6 items per $1000 m^{-3}$). Although, no statistical difference was found between upstream and downstream sites, two of the three UWWTPs had a higher total MP abundance downstream. The highest abundance recorded was at the reference site where no UWWTPs were present. While no seasonal trend were demonstrated, a negative correlation between monthly rainfall data and the average MP abundance (m^3) recorded downstream of UWWTPs was discovered. Furthermore, the most abundant MP type recorded across all three UWWTPs and reference site were fibres (93%). These findings suggest that while existing treatment processes within UWWTPs are not efficient at removing MP particles, other sources such as industry, landfill sites, household effluent, agricultural plastics and atmospheric fallout are potentially making a much bigger contribution.

‘Development of Molecular Sex Determination Methods for Small Mammal Remains Found in Barn Owl Pellets’ by Emily Quann (Waterford Institute of Technology), Denise O’Meara

Barn owl (*Tyto alba*) populations have declined due to the removal of habitat and the impact of secondary poisoning due to the widespread use of rodenticides used to reduce rodent populations. Barn owls predate on rodents and small mammals as has been revealed through the visual inspection of the regurgitated pellet. Two of the key small mammals include the Bank vole (*Myodes glareolus*) and the Wood mouse (*Apodemus sylvaticus*). Determining the sex ratio of the small mammals present within the diet is important for understanding the population dynamics of the small mammals required to support the Barn owl population. However, visual methods of dietary inspection are not always reliable.

Genetic analysis of the pellets has proven to be a reliable method for the species identification of the small mammal species present using species-specific primers and real-time PCR. However, such techniques have not been developed to determine the sex of the small mammals present within the pellet. During this study, a number of sex-specific genes (*ZFX*, *ZFY*, *SRY* and *DBY*) and associated primer sets previously developed for other species were tested with DNA extracted from known sex Bank vole and Wood mouse species. Sex specific PCR products were subsequently DNA sequenced, and the DNA sequences were analysed in relation to other small mammal species using phylogenetic analysis with a view to design sex-specific primers that could amplify low quality DNA for various small mammal species extracted from Barn owl pellet debris. To get a clear understanding of the Barn owl diet a sex and species-specific primer pairs must be used.

'Macronutrient Intake of College Students and Factors Affecting Food Choice' by Aoife Rodgers (Cork Institute of Technology), Aoife McCarthy

Third level students represent a vulnerable population group at greater risk of poor dietary intake and nutritional status. This study aims to determine the macronutrient intake and nutritional status of Irish college students and identify the factors affecting their food choices. Participants (n=60) completed a 4-day semi-weighed food diary and supplementary questionnaire. A nutritional assessment was also completed using a Tanita scales. The average student BMI classification was overweight ($25.5 \pm 3.95 \text{ kg/m}^2$). The majority of students did not meet the WHO recommended intakes for energy (58.93%), while 51.7% of students consumed insufficient carbohydrate. Contrastingly, protein and fat intakes were within WHO recommendations for 98.2% and 67.9% of students, respectively. In relation to factors affecting food choice, 76.5% of students reported negative alterations to their dietary intake during exam periods. Furthermore, taste was recorded as the most influential factor affecting food choice (38.3%), followed by perception of healthiness (21.7%), cost (20%) and convenience (18.3%). This data provides an insight into the dietary intakes, nutritional status and factors affecting food choice of the third level student population in Ireland. Larger-scale observational studies are warranted to further develop the current understanding, thereby forming an evidence base to inform interventions to positively influence the nutritional status of college students.

‘Characterization of a Large Group of *Listeria monocytogenes* using Whole Genome Sequencing: Assessing their Virulence Potential’ by Natalia Unrath (Technological University Dublin), Celine Herra, Evonne McCabe, Daniel Hurley, Séamus Fanning

Listeria monocytogenes is the etiological agent of Listeriosis, a foodborne illness associated with high hospitalization and mortality rates. *L. monocytogenes* can persist in food associated environments for years and persistent strains have been linked to outbreaks of foodborne disease with high mortality.

In this study, whole genome sequencing (WGS) was applied on 143 *L. monocytogenes* isolates from a longitudinal study of a small food production facility, collected from 2014 to 2017. Post sequencing, MLST and SNP analysis were performed to characterize the isolates. In order to assess the virulence potential of the isolates, the sequence data was also used to detect the presence/absence of the four gene clusters known as Listeria Pathogenicity Islands (LIPIs). The study therefore aimed to improve food-borne subtyping and identification of persistent and virulent *Listeria monocytogenes* in food associated environments through the application of WGS. MLST *in silico* and SNP analysis allowed for the detection of persisting strains in this study. The assessment of virulence profiles also allowed to group the isolates into hypovirulent, intermediately virulent and hypervirulent strains based on the presence/absence of LIPIs.

WGS can achieve more than just discrimination between unrelated isolates. An additional benefit of WGS is the opportunity to extract specific information, such as, the determination of virulence, antibiotic or biocide resistance status, as well as, the assignment to serotypes. WGS is the ultimate method for characterization of bacterial isolates as it provides the highest possible resolution in strain typing and represents a new paradigm for outbreak investigation and contamination-source tracking.



Masters in Biopharmaceutical Technology Athlone Institute of Technology

Why take this course?

The Master of Science/ Postgraduate Diploma (MSc/PgD) in Biopharmaceutical Technology builds on the expertise and industry links AIT has developed. This programme was conceived in response to significant job opportunities within Ireland's large and expanding biopharmaceutical sector. In addition to lectures and laboratory sessions at AIT, and site visits to local biopharmaceutical plants, students on the MSc/ PgD will receive practical training at the National Institute for Bioprocessing Research & Training (NIBRT) in Dublin.

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Commencing

September 2019

Contact us

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Further details of our research centre can be found at

<http://www.envirocore.ie> or by contacting the CORE directors; Dr. Thomae Kakouli Duarte (Thomae.Kakouli@itcarlow.ie) and Dr. Kieran Germaine (Kieran.Germaine@itcarlow.ie)

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Research in Sciences & Health

Research plays an increasingly important role in both the teaching and training of students in the Sciences and in Health in TU Dublin. It is broadly described in terms of four thematic areas, namely:

- **Information, Communications & Media Technologies;**
- **New Materials & Devices;**
- **Environment, Energy & Health;**
- **Society, Culture & Enterprise**

Much of this research, although by no means all, is conducted in various Research Centres and Groups which are mainly based in Research Institutes. Two of the larger Research Institutes house much of this research activity. The FOCAS Research Institute is located in Camden Row behind the City Campus and opened in 2004. It has had a major impact on the University's national and international research profile. The other large Institute, the Environmental Sustainability and Health Institute, (ESHI) is located in the Grangegorman campus and opened in early 2016. A third Research Institute, the Information, Communications and Entertainment (ICE) Institute, is housed in the City Campus.

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Research in Sciences & Health

The Centre of Applied Science and Health is a government funded Research Institute with state of the art facilities and support networks for the research groups/centres focused on research related to health.

Linked to the Centre is MiCRA (Microsensors for Clinical Research and Analysis). Academics from the CASH Centre lead out on research in MiCRA for their commercial products. MiCRA-Biodiagnostics is part of Enterprise Ireland's Technology Gateway Network, which provides technology solutions and support to Small/Medium Enterprises (SME's).

High-level objectives to create a connected system of research, innovation and commercial translation with attendant research expertise and technological capability to bring research findings to clinical and commercial settings.

Research Themes

- Microbial Disease Control
- Design & Synthesis of Novel Therapeutics
- Drug Delivery Systems
- Biomedical Sensors & Devices
- Implant & Biomaterial Design
- Pharmaceutical & Materials Analysis
- Nutraceuticals
- Cardiac Rehabilitation
- Smart Sensors
- Microfluidic Systems
- Data Analytics
- Sports Performance & Health
- The Role of Exercise & Diet on Disease Control

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Science Undergraduate Research Experience



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