EU GREEN

EUROPEAN ALLIANCE

Doctoral Training - Developing Modelling and Analytics skills for addressing SDGs

Dr. Marion McAfee, Dr.Leo Creedon, Dr. Eoghan Furey
Atlantic Technological University, Ireland

Ollscoil Teicneolaíochta an Atlantaigh
Atlantic Technological University

MISHE
Mathematical Modelling and Intelligent Systems for Health and Environment

MOCHAS
Modelling & Computation for Health And Society

Funded by the European Union

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Outline

- Introductions (All)
- Mapping Exercise – EU Green Research Themes and Horizon calls – Modelling/AI/Digital/Computational elements (Dr. Marion McAfee)
- Discussion: What skills and competency levels do we need to develop in our ESRs? (All)
- Case Study: MOCHAS PRTP at ATU – Developing modelling skills in interdisciplinary researchers – (Marion, Leo and Eoghan)
- Developing Transversal skills (Dr. Eoghan Furey)
- Case Study: 3Rs 'Twinning' Project: *in silico* tools for life science (Dr Leo Creedon)
- Actions for EU Green

Atlantic Technological University

149%

Increase in research provision in the past 3 years

Full-Time
63%

Remote / Online
26%

Part-Time
11%

Undergraduate
86%

Postgraduate
14%

MISHE

Mathematical Modelling and Intelligent Systems for Health and Environment

www.itsligo.ie/mishe

- 20 Principal Investigators
- 5 Postdoctoral Researchers
- 20+ PhD researchers

- **Call for speakers in 'MISHE Seminar Series'**
- Experienced researchers on the island of Ireland wishing to explore opportunities for collaboration
- Email: **mishe@atu.ie**

Core Research Areas:

- Mathematical and Computational Modelling
- Sensing Technologies and Control Systems
- Data Analytics and Statistics
- Machine Learning and AI
- Image Processing and Computer Vision

Application areas:

- Environmental Monitoring and Modelling
- Medical diagnostics and Medical Devices
- Materials Modelling and Discovery
- Autonomous Systems
- Sustainable Mobility
- Smart Agriculture

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MOCHAS

Modelling & Computation for Health And Society

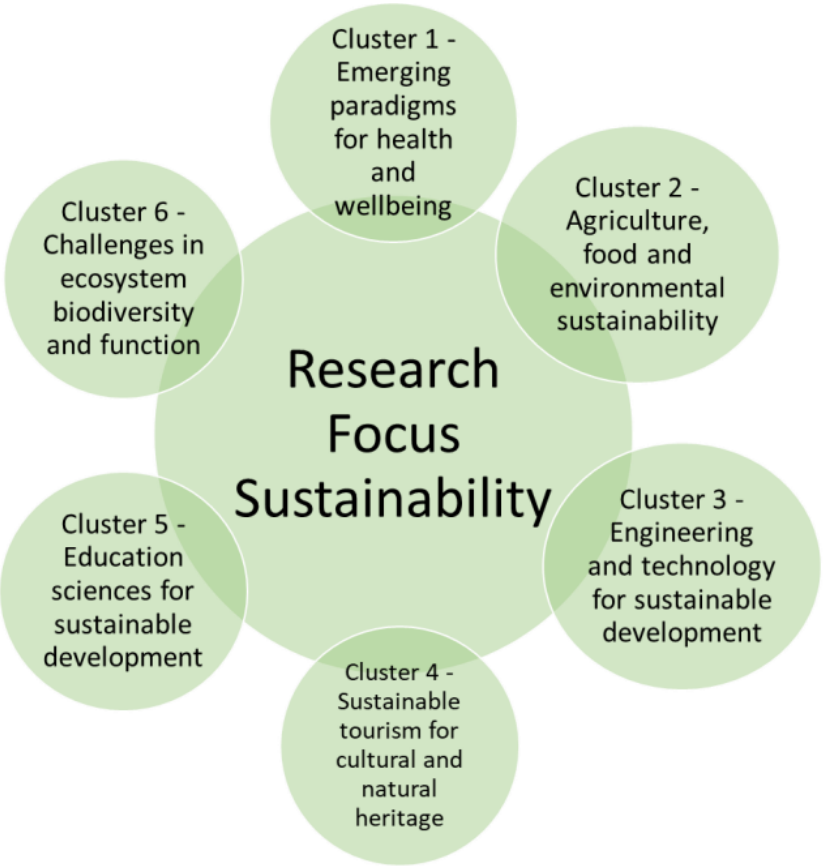
ATU's Postgraduate Research Training Programme (PRTP)

15 PhD Students
3 Campuses
32 ATU Principal Investigators
34 External Partners
- 9 Public Enterprises
- 11 Private Enterprises
- 14 National and International Research Partners

11 Regional Stakeholders

Develop highly skilled research graduates, able to advance cutting-edge modelling and computational tools for addressing societal challenges

Atlantic Technological University


Cluster 1 - Emerging paradigms for health and wellbeing
Cluster 2 - Agriculture, food and environmental sustainability
Cluster 3 - Engineering and technology for sustainable development
Cluster 4 - Sustainable tourism for cultural and natural heritage
Cluster 5 - Education sciences for sustainable development
Cluster 6 - Challenges in ecosystem biodiversity and function
Research Focus Sustainability

Horizon calls

Cluster 1 - Health

HORIZON-HLTH-2024-STAYHLTH-01-05-two-stage: Personalised prevention of noncommunicable diseases - addressing areas of unmet needs using multiple data sources	September 19, 2023 - April 24, 2024	Development and validation in cohort studies of new, personalized methods of early diagnosis, prevention and treatment of non-communicable diseases; the development of these methods with the inclusion of prognostic modeling of the individual course of the disease; development of a multidisciplinary approach to diagnosis and treatment of persons from the risk group and patients with NCDs. To use the possibilities of cohort research and processing of its results using Data Science and Machine Learning methods for 1) formation of lists of effective markers for diagnosing and controlling the course of NCDs and 2) development of personalized approaches to the prevention and treatment of atherosclerosis by correcting epigenetic factors that determine the human lifestyle. New tools of the methodological plan will be created, in particular, 1) a marker method for early identification of risk factors for the occurrence and development of NCDs; 2) a new type of markers – personalized markers; 3) Data-Science-methodology of detection and ranking based on primary data of a cohort study of new markers; 4) non-drug correction of the intestinal microbiome (with the help of personalized nutrition with the use of pro- and prebiotics) for the prevention and treatment of NCDs; 5) machine learning models for prognostic modeling of the individual development of NCDs.

Cluster 1 - Health

HORIZON-HLTH-2024-STAYHLTH-01-02-two-stage: Towards a holistic support to children and adolescents' health and care provisions in an increasingly digital society	March 30, 2023 - 1st stage September 19, 2023 Stage 2 on April 11, 2014	Develop and advance person-centred, evidence-based and coordinated disease prevention intervention solutions to support children and adolescents' health and care in an increasingly digital society. Main players – Health authorities, ministries, universities, health care institutions, other organizations via 1) monitoring, 2) intervention, short-term trainings, cycles of thematic improvement, workshops, master classes on socially significant issues in the field of health care and social services; a new approach to the prevention and treatment of NCDs of children and adolescents, which consists in creating unique food products for medical purposes taking into account the microbiome and using molecular modeling and taking into account the assessment of the level of risk of NCDs development. Developing of easy working motivation life style changing tools for the behavior adaptation and "new game rules" perception.

HORIZON -HLTH-2024-DISEASE-03-13-two-stage: Validation of fluid-derived biomarkers for the prediction and prevention of brain disorders	April 26 - 1 stage 19.09 2 stage 11.04	• The scientific and clinical communities make effective use of state-of-the-art information, data, technologies, tools and best practices to underpin the development of the diagnostics, and as such can also facilitate the development of effective therapeutics and/or preventive strategies. • The scientific and clinical communities advance the field through a better understanding of mechanisms underlying brain disorders at the molecular, cellular and systemic level. • The scientific and clinical community make wide use of newly established and where relevant open access databases and/or integrate them with existing infrastructures for storage and sharing of collected data according to FAIR[1] principles, thereby encouraging further use of the data. • Policymakers, funders, scientific and clinical communities, patient organisations, regulators and other relevant bodies are informed of the research advances made, while health professionals envisage use of the biomarker tests for early detection of the disorder and for guiding patients in the selection of personalised treatments/interventions. • Patients and caregivers are sufficiently engaged with the research, which also caters for their needs.

HORIZON-HLTH-2024-TOOL-05-06-two-stage Innovative non-animal human-based tools and strategies for biomedical research	September 19- 1 stage 2 stage 11.04	Researchers utilise tools and strategies that are more relevant to the human situation as compared to the currently used animal models. Fewer live animals are used in biomedical research. Strengthened EU leadership in non-animal based biomedical research that is socially accepted and sustainable. Healthcare providers and patients will benefit from innovative tools or strategies opening up novel biomedical concepts enabling improved disease prediction, prevention and treatment. • The innovative tools and strategies should approaches such as –omics and other high-throughput procedures, human-derived cell-based material, organoids, micro-physiological systems, and in-silico models. • Prospects and avenues for dissemination, knowledge sharing, uptake or translation into health policies of the proposed tools and strategies within the EU should be provided. • Aspects such as harm and cost-benefit assessment as well as ease of production with respect to current practices should also be considered. • Criteria for model qualification and standardisation should be developed in well-justified use-case contexts to demonstrate their translational values.

HORIZON-CL6-2024-CircBio-01-5 Programmed biodegradation capability of bio-based materials and products, validated in specific environments	22 February 2024	Select applications for biodegradable non-single-use/single-use bio-based materials and products. Such applications should include materials and products which are biodegradable in open environments.. • Develop manufacturing technologies of such bio-based materials and products with targeted performances: i) decreased carbon footprint and environmental impacts of the production processes; ii) improved circular life extension through predictive maintenance, suitability to be safely re-used and re-manufactured, iii) safe biodegradation in the specific environments • Use innovative and adapt existing AI-based and other digital solutions to optimise the circular lifecycle of products and make it more environmentally and economically sustainable; • Validate tests of biodegradability of bio-based materials designed for specific applications both in controlled and in open environments, e.g. soil and water, under ranges of physical/chemical conditions including extreme conditions. The tests should include the monitoring of the time-frame of partial up to full biodegradation and the environmental impacts in case of biodegradation in open environments, including eco-toxicity and any impacts on biodiversity.

HORIZON-CL4-2024-TWIN-TRANSITION-01-35 Turning CO2 emissions from the process industry to feedstock	7th Feb 2024	• Process significant amounts of CO/CO2 containing emissions from energy intensive process industries; • Demonstrate process and cost efficient environmentally friendly technologies for: capture[2] and purification • Demonstrate the cost efficient environmentally friendly conversion of CO/CO_2 into chemicals and and if relevant downstream products; • Evaluate the energy efficiency for the overall CCU process and where relevant flexibility considerations for the efficient use of renewable energy for capture and conversion; • Encompass the use of advanced monitoring and control techniques and integration of advanced digital technologies, which enable optimisation of the overall system; • Contribute to an integration effort to realize fully integrated capture and utilization systems, including the optimization of materials, process interfaces, and ultimately device architectures and to promote maximum energy efficiency; • Include techno-economic analysis, including social and environmental impact.

HORIZON-CL4-2024-TWIN-TRANSITION-01-05 Technologies/solutions to support circularity for manufacturing (Made in Europe Partnership) (RIA)	7th Feb 2024	• Assessing the environmental impact of their products, including the flow of products after their use to reduce product and raw material waste with the support of digital technologies; • Achieving a considerable net reduction of the environmental impact through the use of innovative modelling and simulation software that allows transport and manufacture monitoring, ultimately driving the decarbonisation of the manufacturing industry; • Facilitating the development and uptake of digital tools/platforms such as the EU Digital Product Passport, to increase traceability and characterisation of materials and products (e.g. at analytical research infrastructures), including environmental footprint and quality; • Removing barriers in the uptake of the digital tools from the market will be addressed and the workforce will be empowered through new skills.

What skills do we need to develop in our Early Stage Researchers in relation to modelling/data/AI?

MOCHAS

Modelling & Computation
for Health And Society

Atlantic Technological University

Data Analytics and Statistics

Mathematical and Computational Modelling

Machine Learning and AI

MOCHAS

Environmental Monitoring and Modelling

Materials Modelling and Discovery

Medical diagnostics and Medical Devices

Sustainable Mobility

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SLIGO
COUNTY COUNCIL
COMHAIRLE CHONTAE SHLIGIGH


Ashland
always solving


Microsoft


NEW PARK
care centre


Saolta
Grúpa Oiliscoile Cúram Sláinte
University Health Care Group


axial3D


ELEMENTAL
SOFTWARE


Comhairle Contae
Dhún na nGall
Donegal County Council


ST. VINCENT'S
UNIVERSITY HOSPITAL
Elm Park


NEXALUS


mbi


Valeo


Errigal


BLACKROCK
HEALTH
GALWAY CLINIC


OrganOx
living organs for life

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

WAGENINGEN
UNIVERSITY & RESEARCH

University College Dublin
An Coláiste Ollscoile, Baile Átha Cliath

TU DUBLIN
OLLSCOIL TEICNEOLAÍOCHTA BHAILE ÁTHA CLIATH
TECHNOLOGICAL UNIVERSITY DUBLIN

TECHNICAL UNIVERSITY OF LIBEREC
www.tul.cz

NUFFIELD DEPARTMENT OF SURGICAL SCIENCES
Medical Sciences Division

UNIVERSITÀ DI PISA

UNIVERSITY OF LIMERICK
OLLSCOIL LUIMNIGH

WALTON
Institute for Information and
Communication Systems Science

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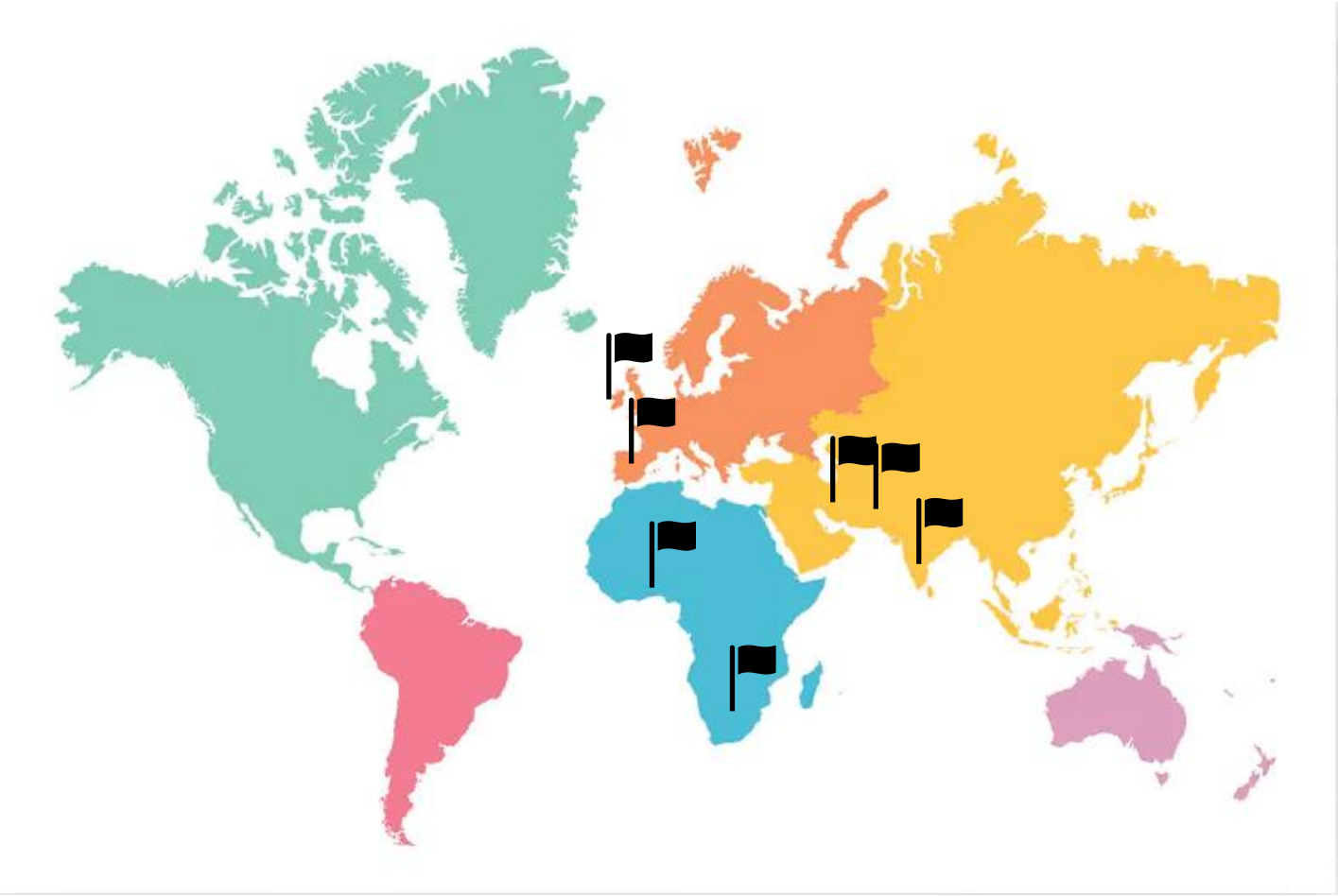

MOCHAS

Our Students

Ireland
Spain
Botswana
Iran
Nigeria
Pakistan

Atlantic Technological University

MOCHAS

Modelling & Computation for Health And Society

Mathematics

Computer Science

Life Science

Materials Science

Engineering

Physics

Economics

Environmental Science

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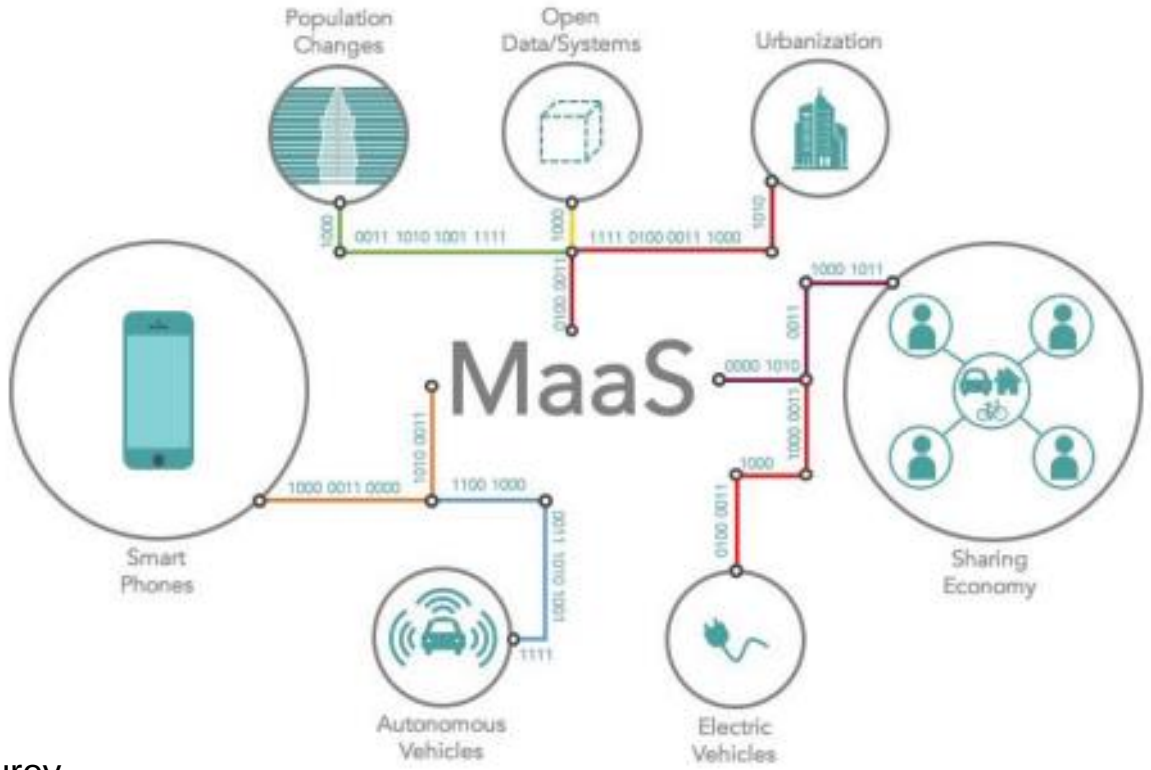
Modelling Mobility as a Service for optimised transport provision in non-urban areas

MOCHAS



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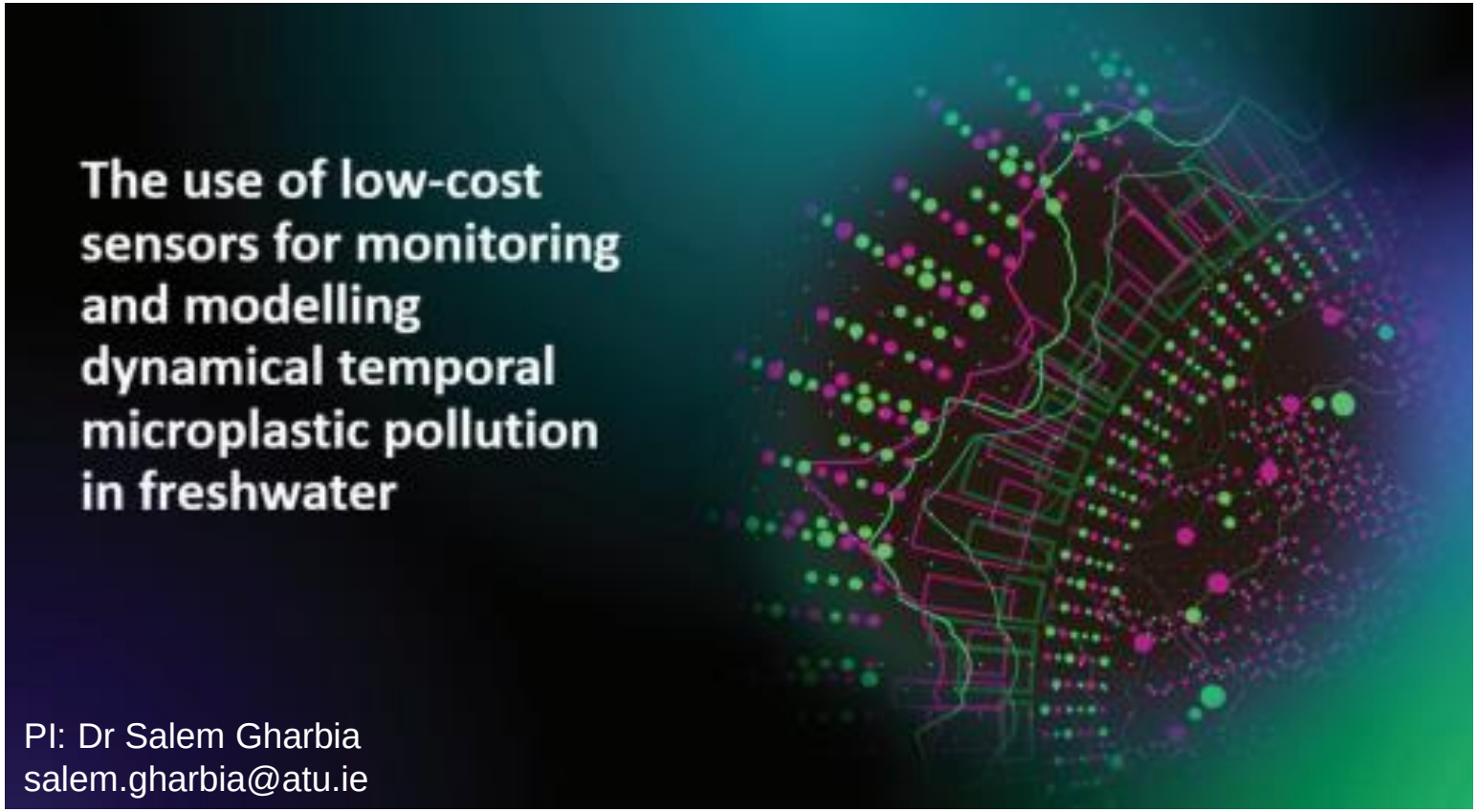

PI: Dr Salem Gharbia
salem.gharbia@atu.ie

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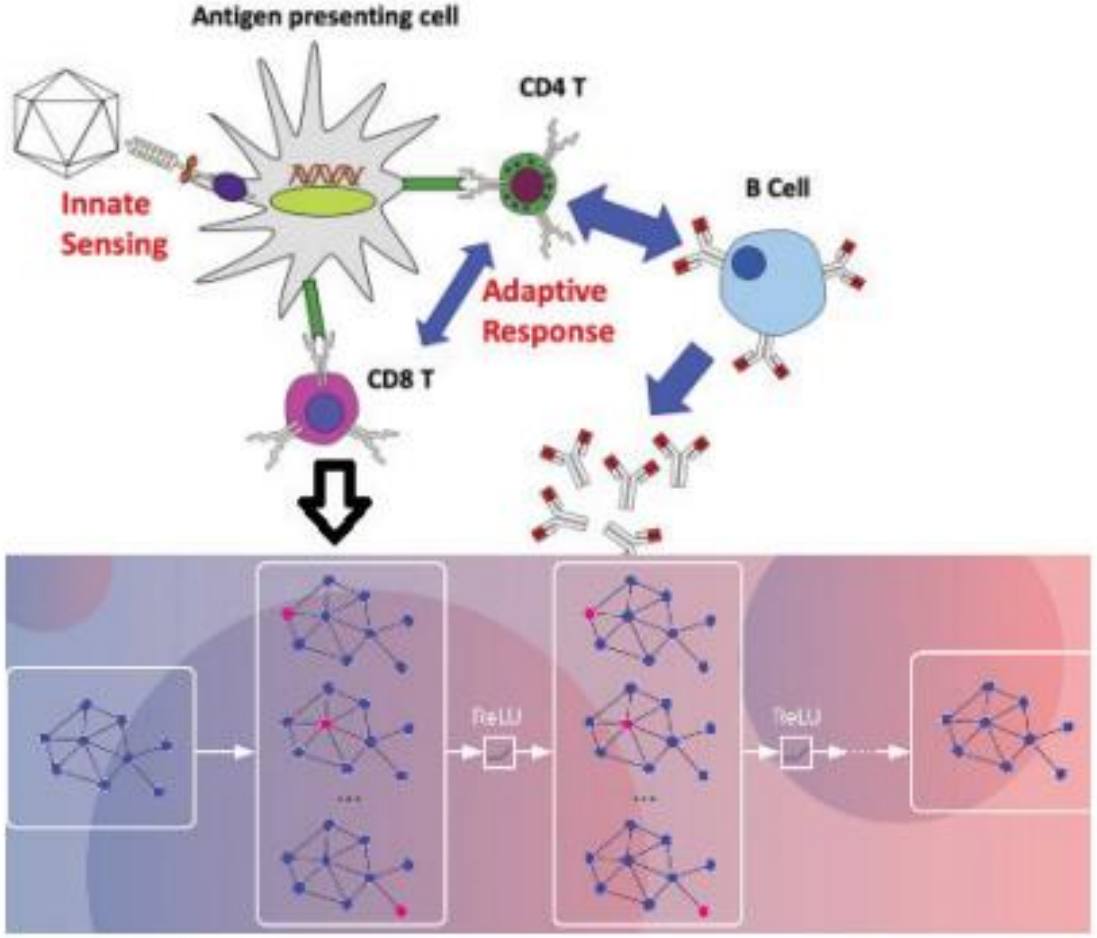
Human innate immune response modelling using self-supervised graph-based deep learning



PI: Dr Shagufta Henna
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Applying mathematical models to predict mechanical and biological properties of polymeric tissue engineered constructs

PI: Dr Liam Morris
liam.morris@atu.ie

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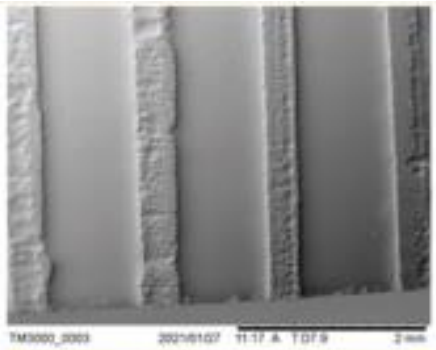
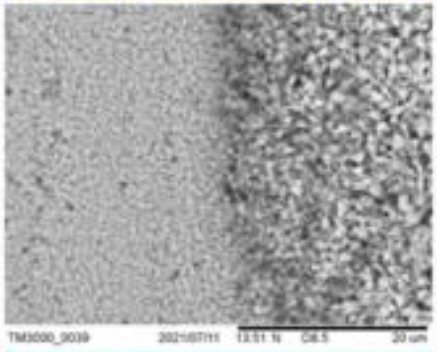
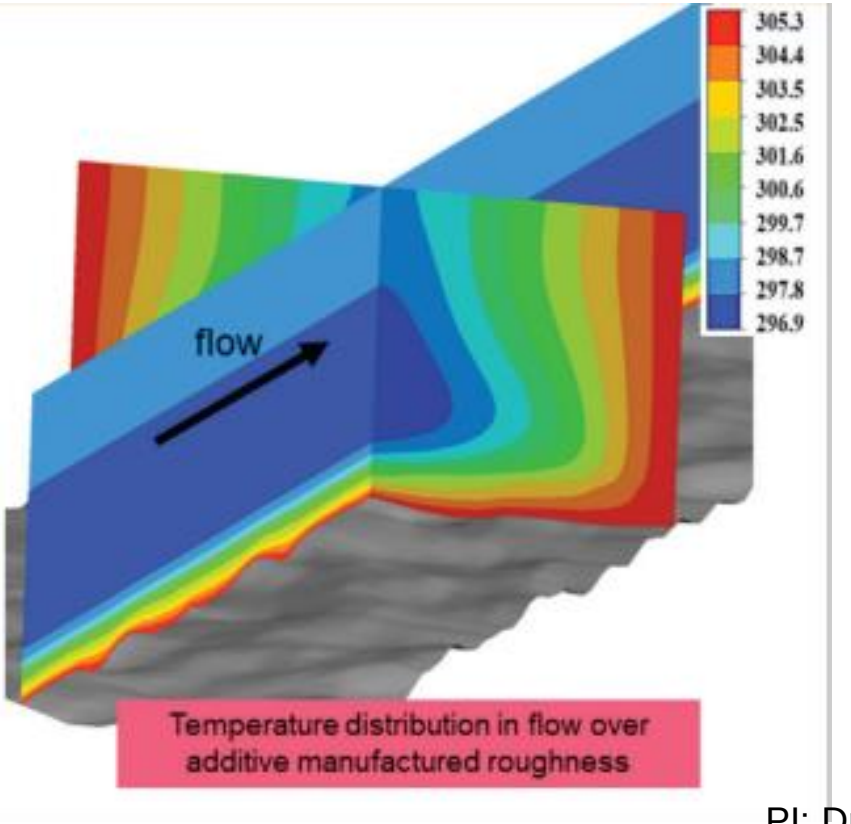
Design, modelling and optimisation of sustainable next generation Heat Transfer devices



Etched channels on Cu



Cu with differing μ roughness



Temperature distribution in flow over additive manufactured roughness

PI: Dr Gerard McGranaghan
gerard.mcgranaghan@atu.ie

Atlantic Technological University

Autonomous network communication models for emergency communication

PI: Dr Saim Ghafoor
saim.ghafoor@atu.ie

Atlantic Technological University

Modelling innovation in the health technology assessment of medical devices

PI: Dr Richeal Burns
Richeal.burns@atu.ie

Atlantic Technological University

Optimising skin graft meshing techniques to improve after-burn care

PI: Dr Cormac Flynn
cormac.flynn@atu.ie

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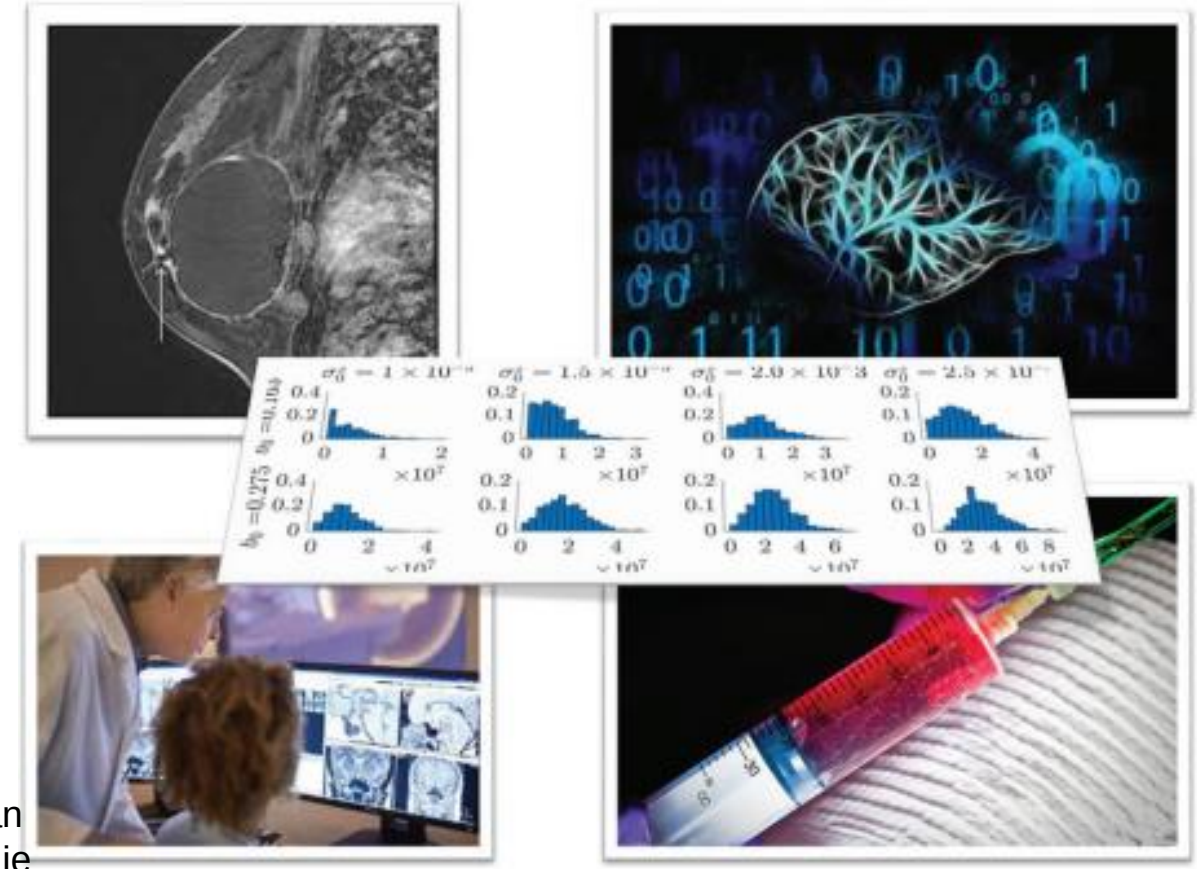
Medical Image Analysis for breast cancer screening using Artificial Intelligence (AI)



PI: Dr Saritha Unnikrishnan
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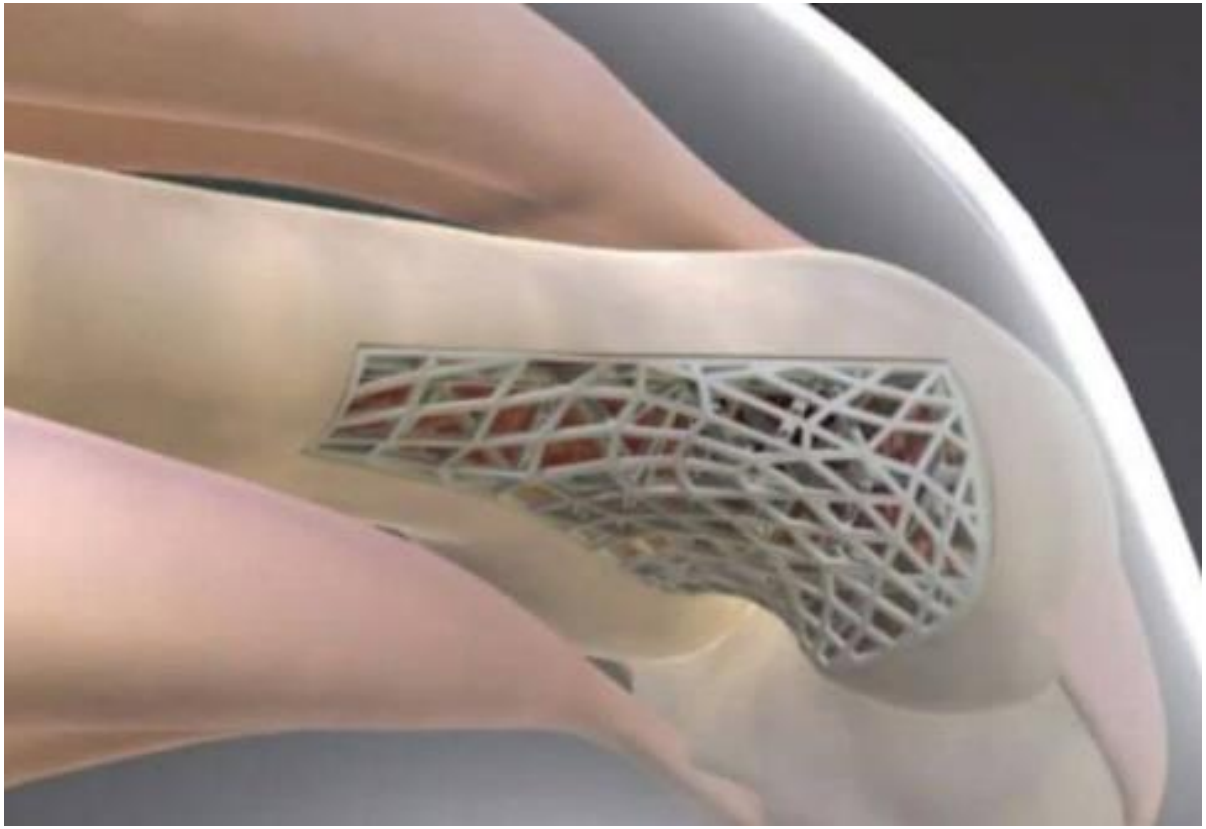
Mathematical & computational modelling for 3D-printed bioresorbable orthopaedic implants



PI: Dr Marion McAfee
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- PRTP Launch ATU Galway, Sep 2022
- 10 ECTS L9 Module – Mathematical and Computational Modelling, Oct-Dec 2022
  - Co-delivered by 10 ATU academics
- Autumn School, ATU Sligo Nov 2022
- Symposium ATU Galway, Jan 2023
  - 38 ATU Research Projects presented
- Summer School, ATU Donegal, June 2023

MOCHAS
Modelling & Computation for Health And Society

Annual Summer Schools and Winter Symposia to rotate between campuses for next three years

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MOCHAS Postgraduate Research Training Program

Year One	Research Project			
	Induction	Autumn School	Winter Colloquium	
	Structured Modules & Seminar Series			
Year Two	Research Project			
	Placement *	Summer School	Winter Colloquium	
	Structured Modules & Seminar Series			
Year Three	Research Project			
		Summer School	Winter Colloquium	
	Structured Modules & Seminar Series			
Year Four	Research Project			
		Summer School	Final Conference	

* Indicative - exact timing and duration will be project specific

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Modelling & Computation for Health And Society

MISHE
Mathematical Modelling and Intelligent Systems for Health and Environment

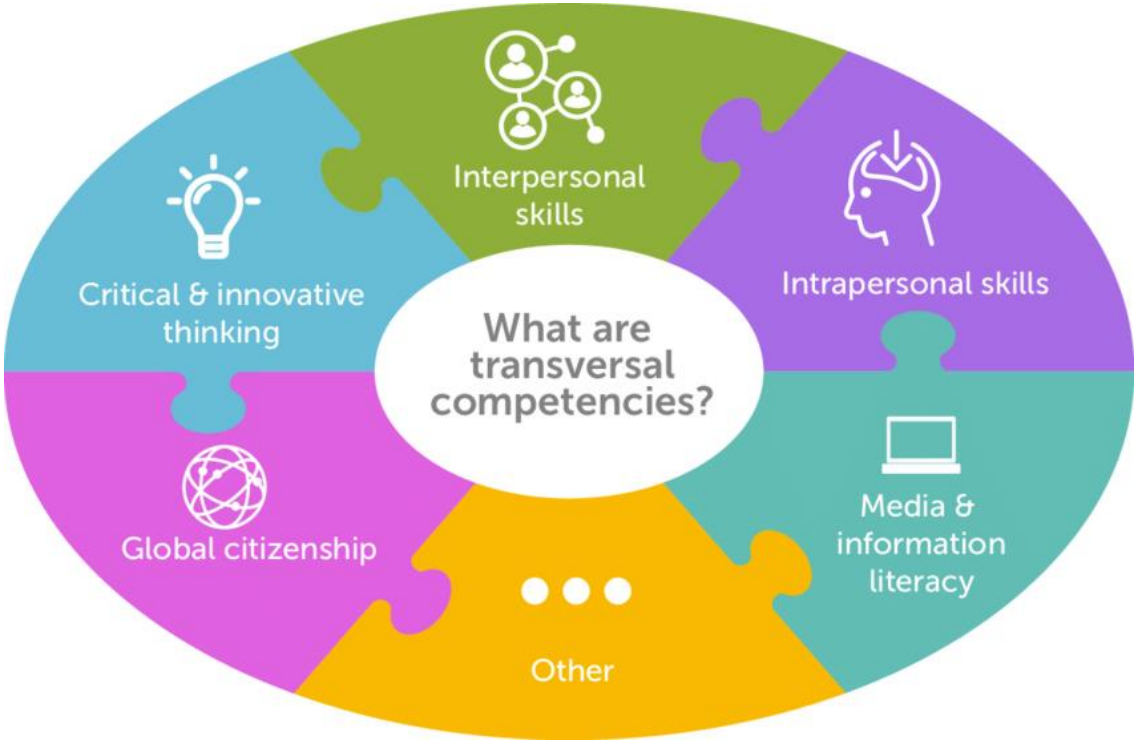
ATU Symposium

on Modelling and Computation for Health and Society 2023

Atlantic Technological University

Transversal Skills

Transversal skills are skills that can be used in a wide variety of situations in life and in work. The term 'transversal' refers to the way these skills cut across different tasks and job roles.


What are transversal competencies?
Interpersonal skills
Intrapersonal skills
Media & information literacy
Other
Global citizenship
Critical & innovative thinking

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Modelling & Computation for Health And Society

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Modelling & Computation for Health And Society

ATU's Postgraduate Research Training Programme (PRTP)

Research Summer School

6th-9th June 2023

ATU Donegal

ATU
Ollscoil Teicneolaiochta an Atlantaigh
Atlantic Technological University

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Day 1 - Tuesday 6th June (Half-Day)

Time	Event	Speaker	Location
1.00-2.00	**Registration**		Main Foyer
1.00-2.00	**Lunch**		Blasta
2.00-2.15	**Summer School Opening**	Dr Eoghan Furey -- *MOCHAS Leader ATU Donegal*	1104
2.15-3.00	**Work-Life Balance**	Sharon Ferguson - *Mental Health & Wellbeing Officer ATU Donegal*	1104
3.10-4.00	**Achieving High Level Success**	Patsy McGonagle -- *Former Irish Olympic Team Manager*	1104
4.10-5.00	**Research Integrity**	Dr Tara Doherty -- *Research Officer ATU Donegal*	1104
5.00-6.00	**Dinner**		Main Canteen
6.00-7.30	**Summer School Quiz**		1104

Day 2 - Wednesday 7th June

Time	Event	Speaker	Location
9.30-10.00	**Tea/Coffee**		Blasta
10.00-10.50	**Entrepreneurial Research**	Dr Padraig Gallagher – *Head of Research & Innovation ATU Donegal*	1104
11.00-1.00	**Stakeholder Engagement Workshop**	Dr Yvonne Lang -- *Lecturer ATU Sligo*	2271
1.00-2.00	**Lunch**		Main Canteen
2.00-6.30	**Summer School Excursion**	Historic Inis Eoghain Peninsula -- *Fort Dunree & Grianan of Aileach*	Meet outside front door ATU
6.30-7.30	**Dinner**		Main Canteen

Day 3 - Thursday 8th June

Time	Event	Speaker	Location
9.30-10.00	**Tea/Coffee**		Blasta
10.00-12.30	**Communicating for Influence Part 1**	Camilla Long -- *Bespoke Communications*	Blasta
12.30-1.30	**Lunch**		Main Canteen
1.30-4.30	**Communicating for Influence Part 2**	Camilla Long -- *Bespoke Communications*	Blasta
4.30-5.30	**MOCHAS Supervisors Meeting**	Supervisors only	
7.30	**MOCHAS Dinner***	*MOCHAS Registered Students & Staff only	Yellow Pepper Restaurant, Main Street Letterkenny

Day 4 - Friday 9th June (Half-Day)

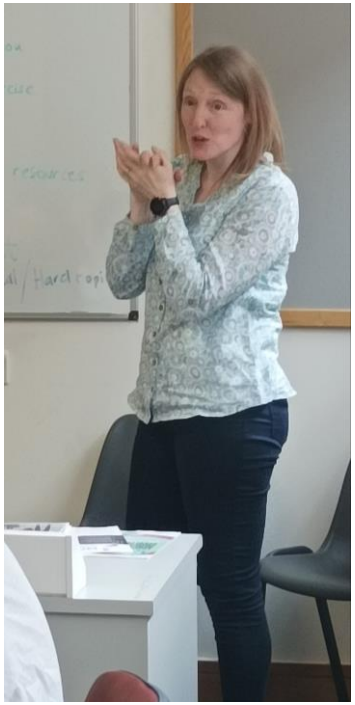
Time	Event	Speaker	Location
9.00-9.30	**Tea/Coffee**		Main Canteen
9.30-1.30	**'Writing, it ain't that Bad'** – Writing Masterclass	Dr Sarah Hass -- *Ghent University, Belgium*	1104
1.30-1.45	**Summer School Closing**		1104
1.45	**Farewell Lunch**		Main Canteen


MOCHAS
Modelling & Computation for Health And Society
ATU's Postgraduate Research Training Programme (PRTP)
15 PhD Researchers
3 Campuses
32 ATU Principal Investigators
34 External Partners
11 Regional Stakeholders
Donegal, Sligo & Galway-Mayo, Ireland
ATU

Work Life Balance

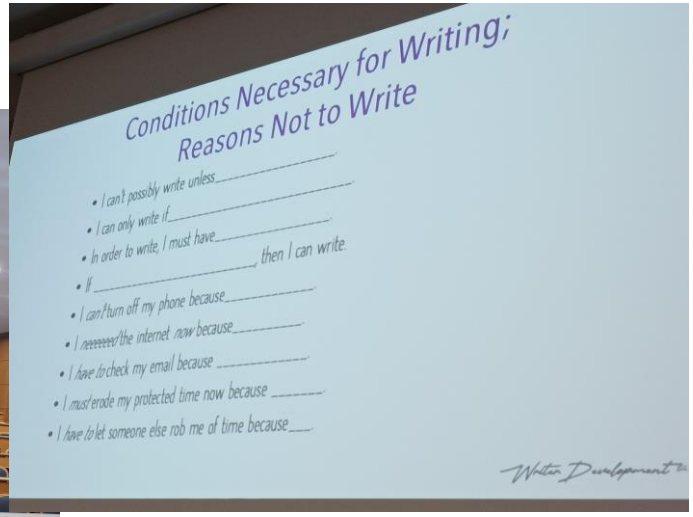
Achieving High Level Success
Olympic Team Manager

Stake Holder Engagement



Communicating for Influence

Writing: it ain't that bad!



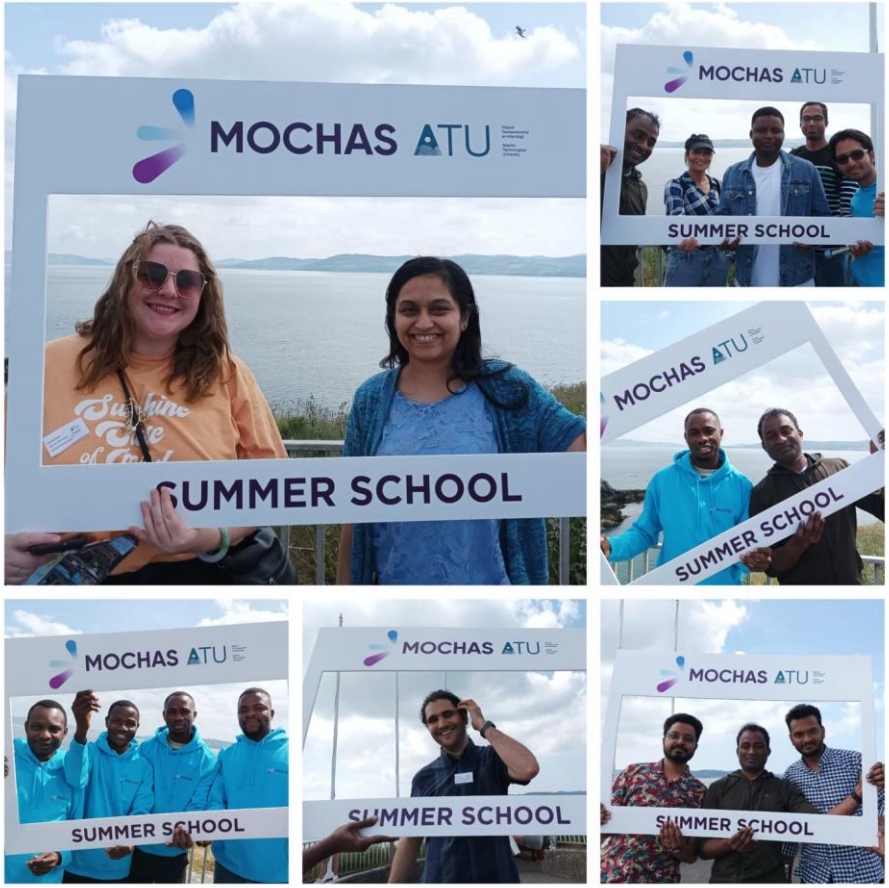
The Entrepreneurial Researcher

COMMERCIALISATION FUND RESEARCH

- Offers third level researchers financial and soft supports, to translate their research into innovative and commercially viable products, services and companies

  institutes
- **Feasibility Grant** - Researchers can access a grant of €15,000 to procure an independent industry expert consultant to conduct a market opportunity assessment and explore potential routes to commercialisation for their technology.
- **Full Award** - This fund provides researchers with the resources required to develop and refine their technology for market.

Social Events


MOCHAS ATU
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MOCHAS Postgraduate Research Training Programme

Centre for Mathematical Modelling and Intelligent Systems for Health and Environment

Medical and Engineering Technologies Research Centre

Actions from Workshop for EU GREEN

- EU Green Researchers (PIs and PhD students) are invited to participate in the Symposium in Modelling & Computation for Health and Society in Sligo in January 2024
- We will develop a collaborative EU Green BiP (Blended Intensive Programme) in Modelling and Computation for application in research addressing Sustainable Development Goals. This will be a great way to share expertise to enhance doctoral training for all our students - and to develop research collaborations in the longer term.
- We will examine potential for funding an EU Green doctoral network under the same theme – potentially MSCA/interreg etc...

- Please email marion.mcafee@atu.ie if you are interested to be involved in any of these activities

Daniel Petterson (HiG)
Tiberiu Vesselenyi (UO)
Marion McAfee (ATU)
Luis Rato (UE)
Cesaltina Pires (UE)
Salvador Abreu (UE)
Matthias Cehlin (HiG)
Eoghan Furey (ATU)

Missing from Photo:
Leo Creedon (ATU)
Liam Morris (ATU)