RESEARCH at ABERTAY UNIVERSITY

Collaborative research and interdisciplinary innovation for impact

Abertay University®

DUNDEE, SCOTLAND

THE TIMES THE SUNDAY TIMES GOOD UNIVERSITY GUIDE 2021 UNIVERSITY OF THE YEAR FOR TEACHING QUALITY

** The Times & Sunday Times Good University Guide 2021*

FOREWORD

by the Dean of Research and Graduate School

Abertay is a compact and focused University with an established reputation for working effectively across traditional research boundaries, as well as within new and emerging disciplines and sectors. We are committed to high quality research and innovation that addresses real-world challenges and delivers impact for society and the economy.

From environmental research into sustainable businesses and food production, to using computer games as creative and critical tools to understand the behaviours and structures that drive and influence individuals in the societies in which they exist, our researchers are solving complex problems to fuel innovation-led growth and sustainable development.

Society faces unprecedented socio-economic and environmental challenges, the continual emergence of sector disruptors, and the problems as well as benefits afforded by global connectivity and competition – these are truly wicked, complex challenges often requiring mixed discipline approaches.

The solutions to these challenges require the application of excellent fundamental research and creative cross- and inter-disciplinary approaches that consider the interplay amongst a mix of social, economic, environmental and technological concerns.

Our Research and Knowledge Exchange Strategy integrates our research into a single University-wide initiative where discipline expertise from a range of subject areas is integrated and used to support discovery, innovation and applied research within and across traditional disciplinary boundaries. We have drawn on our industry-facing heritage and effective interdisciplinary practice, to enhance our existing expertise and internationally recognised successes; our research culture is inculcated into everything we do as a University.

Our structure is designed to promote collaborative and interdisciplinary working, to break away from traditional academic models, to address real-world challenges. Our academics and research staff focus and build excellence within diverse **Research Groups**, interact and innovate to build strength in our ways of working within **Pooled Excellence** areas, and collaborate with other discipline experts through our **Challenge Spaces** to deliver impact for society and the economy.

Professor Nia A White

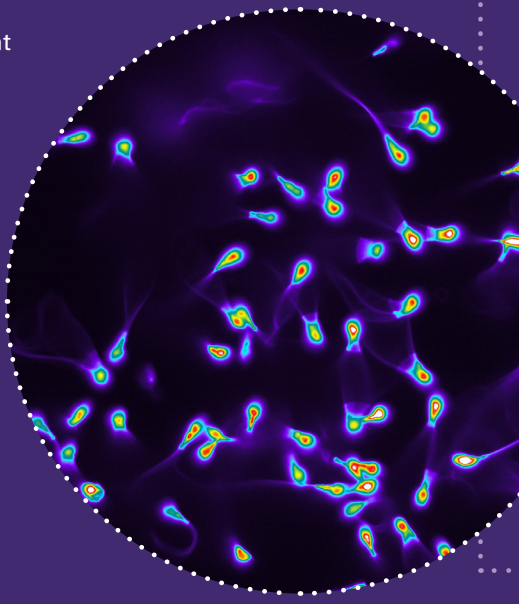
RESEARCH GRO

in the School of Applied Sciences

The **School of Applied Sciences (SAS)** focuses on impact-led research that address real-world challenges. SAS is equipped with cutting-edge laboratory and innovation facilities. Our research spans Engineering, Food Science, Health Sciences, Psychology, Forensic Sciences, Sport and Exercise Sciences.

Engineering and Food Science researchers aim to find solutions to some of the current, emerging and future problems regarding the natural and built environment, as well as food and drink. Our reputation for collaborating with industry in these areas are exceptional, particularly through the work of the Urban Water Technology Centre (wastewater and environmental management), our Food & Drink Innovation and Sensory & Consumer Science facilities. Specialist areas are:

- Environmental technologies
- Sustainable assessment and enhancement
- Structural and geotechnical engineering
- Food science and technology
- Nutrition and public health
- Sensory and consumer science
- Yeast and fermentation alcohol research



Health Sciences research is responding to the growing needs within society concerning health-related challenges. Current research includes workforce resilience, working with children and young people, clinical practice, bioethics, and understanding the impact of environment and lifestyle on fertility, health and disease evolution. Specialist areas are:

- Mental health nursing
- Counselling
- Biomedical sciences

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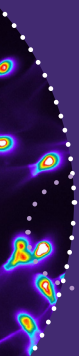
Psychology and Forensic Sciences researchers are a highly collaborative group of scholars invested in inter-disciplinary research. We are innovative in the use of creative technology, and actively involved in local, national and international projects in:

- Toxicology
- Finger printing and trace evidence
- Psychology of policing and the criminal justice system
- Vision science in biology and technology
- Evolutional and biological approaches to behaviour
- Socio-cognitive development, learning and language

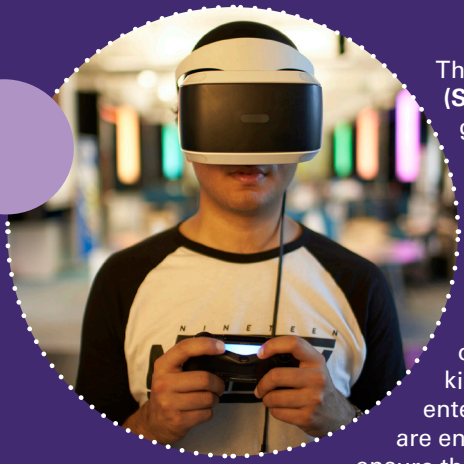
Sport and Exercise Sciences research explores sports coaching and performance, exercise and physical activity for healthy ageing, and equality in sport. Our researchers across the following specialist areas employ a range of methods for data gathering and analysis explicitly designed to maximise impact in society:

- Biomechanics and physiology
- Social science of physical activity, sport and exercise



RESEARCH GRO

in the School of Design and Informatics



The **School of Design and Informatics (SDI)** has world-firsts in computer games and cybersecurity education. Our research focuses on computer games design and development, cybersecurity and the emerging technologies that underpin these areas.

SDI research explores the capabilities of digital technologies to provide new kinds of interactive experiences, in entertainment and serious contexts, that are engaging and effective. We also seek to ensure that technology is usable and secure in the face of increasing online threats.

Our research base is highly interdisciplinary, spanning art, music, design, physics, mathematics, usability and computer science. We combine disciplines to explore challenges in our core areas of games and cybersecurity together with those found in the social and natural sciences.

SDI, in partnership with the Universities of Dundee and St Andrews, leads InGAME (AHRC and SFC funded), the UK Creative Cluster for Computer Games and InGAME International (AHRC). InGAME works at the interface between industry and academia to grow the scale and value of the Dundee games cluster and R&D programme with national and international partnerships.

Games Design and Development encompasses digital art and performance, game design and game studies, and sound and music production. Our research leads to the creation and evaluation of new and experimental forms of play, from curated digital performances to applied games. Much of our activity is practice-based research. Specialist areas are:

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- Play and performance
- Applied games
- Arts research
- Games studies
- Games, history and collective memory

Game Technology and Mathematics research explores augmented and virtual realities, underpinned by expertise in animation algorithms, graphics, parallel computing, mathematics and artificial intelligence. We use these technologies in both entertainment contexts and to unravel the complexities of complex systems. Specialist areas are:

- Real-time animation
- 3D graphics and visualisation
- VR and AR
- AI and analytics
- Systems modelling

Our **Cybersecurity** research recognises that preserving system and personal security requires managing an interplay among technical and socio-organisational factors. Risks exist on the attack surface of a network, the online behaviour of users, and the engineering of software. To address these risks, we have developed research links with government, Police and industry in:

- Human centred security
- Secure system coding
- Digital forensics
- Securing the Internet of Things

Abertay is home to the cyberQuarter, a new £11.7m cybersecurity research and development centre and academic-industrial partnership designed to establish the Tay Cities region as a centre of best practise in applied R&D and knowledge exchange in cybersecurity. It exploits our distinctive ethical hacking and offensive cybersecurity expertise and excellent industry links.

RESEARCH GRO

in the School of Business, Law and Social Science

The **School of Business, Law and Social Science (BLS)** fosters multi-disciplinary research by sharing, translating and exchanging knowledge across subject areas in order to realise real world impacts. BLS research draws on subject expertise in the areas of Business, Human Resource Management, Accounting and Finance, Law, Criminology and Sociology.

Energy, Environmental Sustainability and Management researchers seek to develop solutions to challenges posed by the transition from conventional to renewable energy, and the responsible management of environment and organisational sustainability. Our work includes a multinational project that explores the use and planned development of the Balanced Scorecard (BSC) in several organisations across different national contexts. This Research Group draws on our expertise in:

- Organisational Sustainability
- Oil and Gas Accounting
- Social and Environmental Accounting
- Green criminology

Digital Business and Social Transformation researchers are helping to re-shape business and social innovation stimulated by the 'fourth industrial revolution'. Our work includes digital social innovation with international partners in EU-funded research projects on innovative reputation systems for online communities, the e-participation of young people in environmental

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policy-making, and the co-design of an open platform enabling the public to register the Ethical Behaviour of Companies. This Research Group draws on our expertise in:

- AI and Human Resource Organization
- Social innovation
- Social Media Marketing
- Leadership and the Agile Organization
- Secure digital technologies

Transnational security, law and social justice researchers address urgent problems of transnational jurisdictions, human rights, poverty, equality, information security, insolvency and addiction. Our work includes people trafficking in Europe and the social and organisational aspects of cybersecurity in companies, schools, police, and public administration. This Research Group draws on our expertise in:

- Transnational human rights law
- Medical law and bioethics
- Criminal justice systems and violence reduction
- Employment law
- Policy and governance

POOLED EXCELLEN

Emerging from the academic strengths of our Research Groups are Abertay's Pools of Excellence, where researchers come together through shared methodologies and approaches. Our Pooled Excellence is thus complementary to our discipline-based Research Groups.

Pools comprise researchers from across Abertay, and allow us to integrate our expertise in order to advance the core methodologies that drive our research and knowledge exchange forward.

We recognise that complex real-world problems cannot be solved by single disciplines alone. Our Pooled Excellence embodies characteristic ways of working that transcend problem spaces and serve as a mechanism to integrate disparate disciplines into a coherent whole.

We can, therefore, draw on our Pooled Excellence to work with our discipline-based Research Groups to support discovery, innovation and applied research within and across traditional disciplinary boundaries.

Our Research Groups collaborate and enrich our Pooled Excellence practice in:

Co-creation and external engagement

working with stakeholders collaboratively from the outset to define and develop solutions to problems

Experimentation and systems modelling

investigating complex systems through systematic experimental design and predictive modelling

Digital transformation and emerging technologies

ensuring efficient and effective interactions with and among processes, products and technologies modelling

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Human interaction and user experience

investigating learning, and sharing expertise with students, staff, and the wider research and education community

Effective learning and pedagogy

using existing and emerging digital technologies to create new social and economic processes and products

Social identity and human behaviour

examining the relationship of individuals and groups to socio-economic and technical change

CHALLENGE SPAC

Creative Industries and Cultural Vitality

Creative Industries and Cultural Vitality, exploring the creative use of interactive and immersive technologies in entertainment and non-entertainment spaces alike, and how they shape our everyday living, leisure and work cultures and practices.

CASE STUDY 1: InGAME

InGAME: Innovation for Games and Media Enterprise is an £11.5m Arts and Humanities Research Council (AHRC) and Scottish Funding Council (SFC) funded research and innovation centre based in the heart of the Dundee videogames cluster.

Led by Abertay University, in partnership with the University of Dundee, the University of St Andrews and a network of industry partners, including 4J Studios, Beano Studios, Microsoft, Outplay Entertainment and Sony Interactive Entertainment Europe.

InGAME is to drive innovation and growth within the cluster via:

- **Experimentation:** Creating teams from industry and academia to test new models of collaborative R&D and de-risk creative experimentation through rapid jamming and prototyping.
- **Intensification:** Developing new ideas that locate organisational design, product-market strategy and business model innovation at the heart of independent game development.
- **Diversification:** Incubating innovations that apply game design and immersive technologies to solve real-world problems, increase enterprise productivity and create positive change.
- **Innovation:** Accelerating the R&D of emerging technology innovations and imagine experimental responses to some of the industry's biggest challenges and opportunities.

Games industry freelancers, startups and SMEs access world-class research expertise, state-of-the-art facilities, emerging technology testbeds and postgraduate talent to work on early-stage R&D collaborations that show clear potential for growth and innovation. https://www.innovationforgames.com

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CASE STUDY 2: Games and Tactical Media

Professor Joseph DeLappe's collaborative research creatively expands the possibilities of digital art, video gaming and activism. Joseph collaborated with the Biome Collective in Dundee developing *Killbox*, a BAFTA nominated game that critically explores the nature of drone warfare, its complexities and consequences through a two-person interactive experience of simulated play. In 2017, he was awarded a Guggenheim Fellowship in the Fine Arts and AHRC Immersive Practices funding which facilitated the development of *Elegy: GTA USA Gun Homicides*, 2018-19, an online work to modify an existing game to function as a data visualization system and memorial to gun homicide victims in the USA, also developed in collaboration with members of the Biome Collective. Elegy was recognized in 2019 as a Webby Award, NetArt Honoree. These ground-breaking works have reached large audiences being freely accessible online and shown at numerous international festivals, gallery and museum exhibitions.

CHALLENGE SPAC

Health and Care Across the Lifespan

Health and Care Across the Lifespan, considering challenges of adversity, mental and physical health, wellbeing, education, performance and social care and the roles that science, sport and physical activity have in addressing those challenges.

CASE STUDY 1: Improving Learning

Understanding how psychological processes can improve learning across the lifespan: Abertay psychology researchers have a number of projects exploring how psychological processes influence learning across the lifespan.

One project led by Professor Vera Kempe examines the effects of local dialect exposure on literacy. Using online training in a new language, this Leverhulme Trust funded work shows that exposure to dialect does not impair overall literacy, and may even push learners to actively deciphering words from letters rather than trying to remember what a word sounds like. This work is now being applied to children, to determine the effects of dialect in early reading and spelling acquisition.

In a separate project, Professor Sheila Cunningham's group is leading work on "self-referencing", a technique that enhance attention and memory by activating people's self-concept while they process information. This research explores self-processing biases in children and adults, and shows how the self-referencing technique can be harnessed to support learning and education. A Leverhulme-Trust funded project is exploring the development of self-processes biases in memory in children aged 3-10, and their relationship with other aspects of development. An Economic and Social Research Council funded research project is also testing the effectiveness of adapting educational materials for children in the classroom to include self-referencing, and is being used to shape training for educators across Scotland.

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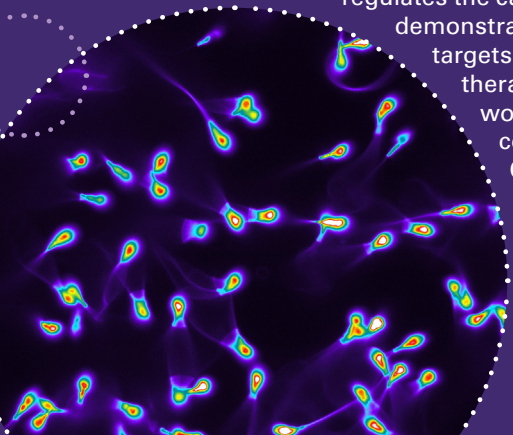
CASE STUDY 2: Duty of Care in Sport and Exercise

The most important part of sport is the people involved, whether they are taking part, coaching, refereeing, volunteering or involved in some other capacity. However, questions continue to be raised about whether the wellbeing and welfare of people are being put at the centre of what sport does and delivers. Working directly with stakeholders who aspire to provide the highest standards of duty of care, our inter-disciplinary research led by Professor David Lavallee focuses on developing innovative tools and solutions to help sport organisations improve recruitment, retention and sustainability outcomes. Our research in this area, which is helping shape the future sporting landscape in positive ways, has been featured in Forbes magazine and commended in the House of Commons Debate on Sport in the UK.

CASE STUDY 3: Mechanisms Underlying Male Infertility

Dr Sean Brown leads a cross-disciplinary group interested in elucidating causes of unexplained male infertility, particularly why sperm fails to fertilise naturally or in vitro. His recent work has focussed on the regulation and role of ion channels for fertilisation competence. He has reported the first description of a very rare genetic mutation that causes loss of function of the sperm calcium channel and therefore total failed fertilisation. He was also first to demonstrate that loss of the sperm potassium channel function causes infertility and low in vitro fertilisation rate. He is currently examining the mechanism by which the female hormone progesterone regulates the calcium ion channel function. This work demonstrates that these ion channels are suitable targets for development of novel diagnostics, therapeutics and male contraceptives. Sean's work has been in collaboration with clinical colleagues at Ninewells Hospital Assisted Conception Unit and leading academics at Dundee University, UC Berkeley, Universities of Münster, Birmingham and Copenhagen and is possible due to support from Abertay and grants from the MRC and the Chief Scientist Office.



CHALLENGE SPAC

Security, Equality and Social Justice

Security, Equality & Social Justice, fostering personal, societal and organisational security and resilience in a time of increasing local, national and transnational threats and socio-technical disruption together with growing economic and health inequality.

CASE STUDY 1: Criminology in Practice

Criminological and legal perspectives are applied to a range of projects concerned with criminal justice professionals, crime reduction, and legal principles and practices in different national jurisdictions.

Professor Denise Martin and Dr William Graham draw on research expertise in police leadership and professional development, bridging between law enforcement and public health professionals, the rehabilitation of ex-offenders through work experience, and mitigating the damaging effect of organised crime on local communities. This work influences policy in government and policing, for example, by supporting police and other agencies to develop new public health initiatives for interacting more effectively with vulnerable drug users in the north east of Scotland.

Professor Annelize McKay is internationally recognised for her work on the law and ethics in relation to clinical research in Africa and is regularly consulted by the pharmaceutical industry. She works on issues such as informed consent by children and mentally-ill individuals to research participation in an African context, and on related issues in the field of bioethics, such as the export and use of human biological specimens from African countries for future research. Her work is supported by being embedded in strong international networks with academics working on medical law and bioethics in South Africa, Australia and the UK.

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CASE STUDY 2: Cybersecurity – a constant arms race

Dr Lynsay Shepherd and Professor Stefano De Paoli are collaborating on an interdisciplinary EU FORESIGHT project by contributing their expertise in human-computer interaction and the sociological implications of secure digital technologies. The project aims to develop a federated cyber-range solution to enhance the preparedness of cybersecurity professionals at all levels and advance their skills towards preventing, detecting, reacting and mitigating sophisticated cyber-attacks. The proposed platform will extend the capabilities of existing cyber-ranges and will allow the creation of complex cross-domain/hybrid scenarios to be built jointly with the Internet of Things (IoT) domain. A consortium of 22 European public and private partners are working together to deliver an ecosystem of networked realistic training and simulation platforms that collaboratively bring unique cyber-security aspects from the aviation, smart grid and naval domains.

CHALLENGE SPAC

Sustainable Development and Inclusive Living

Sustainable Development and Inclusive Living, managing responsibly the natural resource requirements (and energy-food-water nexus) of inclusive living and business infrastructures and safeguard their transmission to future generations.

CASE STUDY 1: Resilient Systems

Our research portfolio in **modelling natural systems to support sustainable development** has attracted funding from UK Research and Innovation (UKRI), Engineering and Physical Sciences Research Council (EPSRC), Natural Environment Research Council (NERC), EU and Innovate UK. Projects focusing on developing tools for sustainable agriculture, whole systems modelling of water, energy & food systems and transforming food production are contributing to the Industrial Strategy's ambition of net zero productive systems by 2040. Working closely with stakeholders and end users we connect research and practice when developing solutions to social and environmental challenges. We embrace innovation in addressing problems faced by national and local government, charities, farmers and veterinary services. Our toolset draws from computational modelling, including AI/ML, game technologies and systems approaches.

The project **Eco-grief and community resilience to changing water practices in Malawi,** Dave Namusanya, our RLINCS PhD student from Malawi, Dr Dan Gilmour and Dr Ashley Rogers are working with one of the world's most densely populated and least developed nations faced with increasing difficulties in accessing clean, safe water. Communities are under pressure to become more resilient to climate change effects. We are assessing environmental and human factors causing strain on communities, in order to uncover adaptive capacities in the face of unreliable access to water under the frameworks of climate justice and social justice. This project follows policy-impacting research funded by Scottish Government to enhance the integration of water resource management across disciplines and stakeholders.

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CASE STUDY 2: New Sustainable Foods for Health

Professor Alberto Fiore has extensive experience in developing food products for sustainable living. Dr Sarah Cottin has pursued her research understanding the role of various food compounds (e.g. omega-3, micronutrients, polyphenols) in health and disease at different stages of life. Combining their experience in food science and nutritional interventions, they strive to design new foods that are beneficial for both the planet and people's health, aiming to tackle the spread of Non Communicable Diseases in the UK and worldwide. They were recently awarded £1m by the Biotechnology and Biological Sciences Research Council (BBSRC) for an international and multidisciplinary Global Challenges Research Fund project aiming to optimise and upscale edible insect-based food, to improve health and the nutritional status of children in Zimbabwe. This work will involve food scientists, nutritionists and sociologists at Abertay (Dr Athina Tziboula-Clarke, Dr John Grigor, Dr Ashley Rogers), in other UK universities (Sheffield) and in Zimbabwe, and marks the beginning of a strong international collaboration to tackle child malnutrition in Africa, developing food products and processes that are sustainable environmentally and economically for the local population.


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RESEARCH FACILITIES

Abertay is equipped with cutting-edge facilities and staff with unrivalled specialist knowledge and practice experience. Our track record for knowledge exchange and working with industry, the private and third sector in outstanding; indeed our partners and collaborators are key to our innovation ecosystem. External collaborators can make use of our specialist equipment and facilities in:

- **Analytical & Biological Sciences**
- **Food & Drink Innovation**
- **Psychology**
- **Civil & Environmental Engineering**
- **Emergent Technology Centre**
- **InGAME**
- **Food & Drink Innovation**
- **Sensory & Consumer Science**
- **Sport & Exercise Sciences**
- **Tayside Centre for Counselling**
- **The Urban Water Technology Centre**

For example, our new £1M Emergent Technology Centre, adds to our strength in the tech sector, providing an environment for digital innovation, cyber education and emerging technologies. The Centre includes a development studio, virtual design studio, user research lab, extended reality XR lab and 5G/IoT testbed.

Our £3.5 million food and drink facilities are the only ones of their type in Scotland and feature a world-leading climate controlled consumer science laboratory as well as an advanced analytical chemistry lab and a fully food standard production plant.

We work with research collaborators, policy makers, businesses and the third sector and can help take your business to the next level.

To discuss collaboration opportunities please contact us at

business@abertay.ac.uk

POSTGRADUATE STUDENTS

Our Postgraduate Students are central to our research community.

Research Postgraduate students work alongside experts from a range of disciplines to pose new questions and find creative solutions to the problems facing society. Our current research degree opportunities include study at PhD, MPhil and Masters by Research. Research students are supported by expert supervision within a vibrant pan-University Graduate School which encourages interdisciplinary working in our next generation of researchers. Abertay offers a unique postgraduate experience within an environment of discovery, creativity and innovation.

Our Taught Postgraduate programmes are focussed in areas of particular strength and are informed by strong industry and/or research links. Our programmes have Professional Body accreditation or recognition, offer flexibility and choice, and provide excellent opportunities to gain sector experience through real-world industry projects, either on campus or out on placement. Current programmes include:

- MSc/PGDip Accounting and Finance
- MSc/PGDip Computer Games Technology
- MSc/PGDip Counselling
- MSc/PGDip Ethical Hacking and Cyber Security
- MProf in Games Development

CONTACTS

For more information about or research or to discuss collaboration please email or visit our web pages:

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https://www.abertay.ac.uk/research-overview/

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