Research in Life Sciences Directory 2024

UKRI BBSRC EastBio Doctoral Training Partnership

Biotechnology and Biological Sciences Research Council

eastBIO
East of Scotland Bioscience Doctoral Training Partnership

Introduction

Since its first inception, in 2012, the UKRI BBSRC-funded EastBio DTP has been delivering excellence in bioscience research provision via a comprehensive and forward-thinking training programme across our nine partners - the universities of Aberdeen, Dundee, Edinburgh, St Andrews, Stirling, SRUC, James Hutton Institute, Moredun Research Institute, IBioIC, as well as associated partners SULSA and Cool Farm Alliance - and five intakes of approximately 60 students per annum. In its current instalment, funded for a third consecutive time by BBSRC, we have continued to develop our programme thanks to our collaborative governance approach that is based on co-creation, transparency, critical evaluation and input by students, supervisors, partner institutions and the funder.

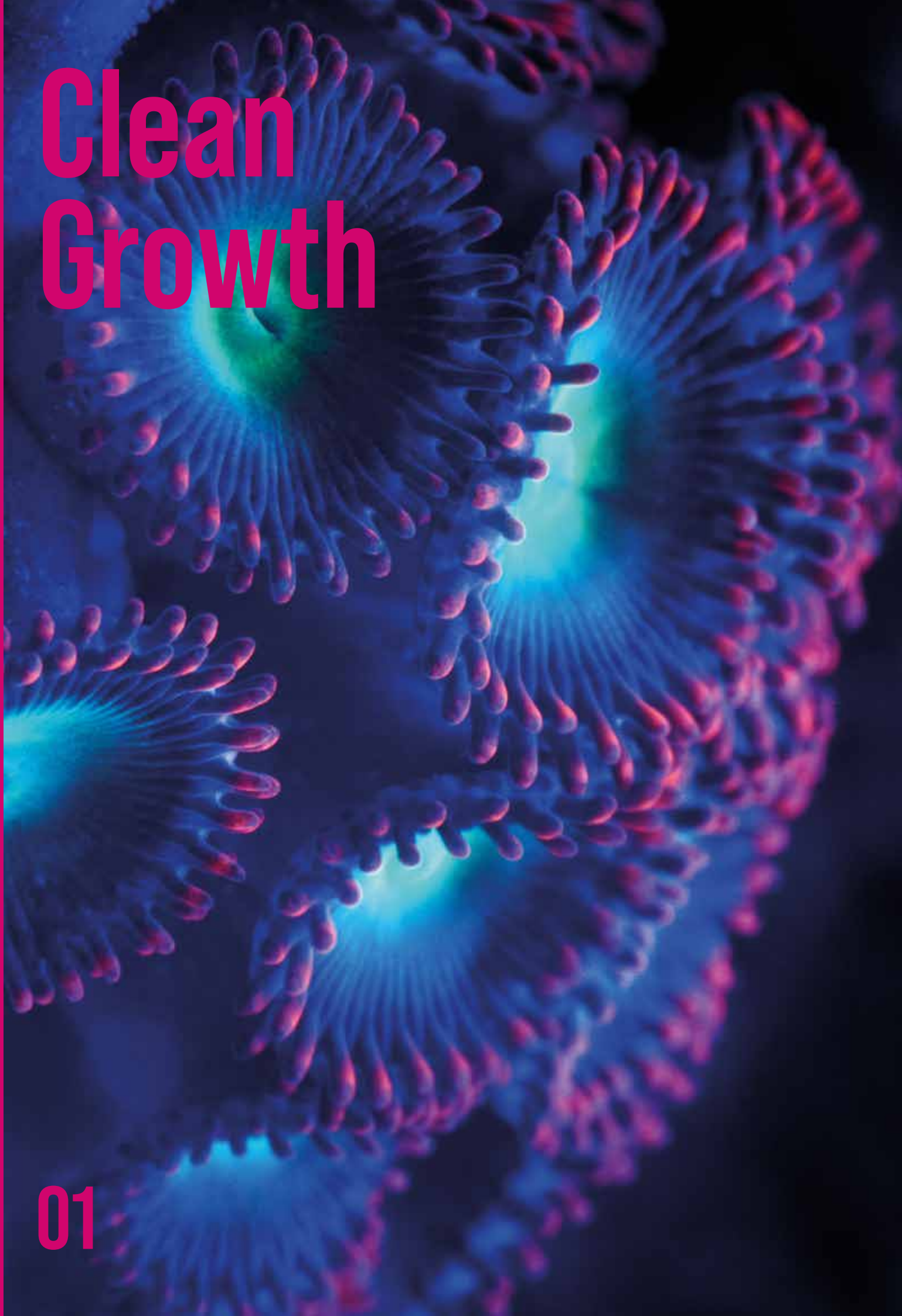
In this context, we have produced this Research Brochure featuring profiles contributed by our supervisors; the brochure is aimed to serve as a dynamic resource for the use and benefit of both our supervisors, current or prospective, and industrial shareholders, to facilitate efficient, creative and open networking and enable the shaping of research connections and relationship across the partnership. The initiative came out of input the Management Group received from current supervisors and is corroborated by formal and anecdotal input on our programme from supervisors and students alike. We are committed to principles of excellent practice in research provision and support underpinned by our Equality, Diversity and Inclusion vision and we hope that this evolving resource will benefit especially early career researchers to establish networks of collaborators and allies and assist, alongside other forms of support provided by the partnership, in the removal of barriers to their professional development.

The EastBio Research Brochure will be publicised in the summer of 2024 on the occasion of the EastBio Annual Symposium (St Andrews, 3-4 June) and, from then onwards, will be maintained as a digital resource published on the new EastBio website **https://www.ed.ac.uk/biology/eastbio**.

We structured individual academic profiles according to the BBSRC strategic areas of Clean Growth, Crops and Soil, Health, Livestock/Aquaculture, Rules of Life and Transformative Technologies. We hope that you will find the brochure both helpful and enjoyable!

EastBio DTP Management Group

Clean Growth



01

Jamie Gilman

MiAlgae

industrial biotechnology; circular economy; fermentation

MiAlgae applies leading advances in science and technology to improve food security and reduce the impact of humanity on the planet. We aim to eliminate reliance on wild-caught fish as a source of Omega-3 by harnessing the potential of microalgae as a sustainable and rich alternative source. Our circular economy approach uses co-products from the Scottish whisky industry as a feedstock to ferment omega-3 rich algae. The resulting biomass is the basis of our NaturAlgae product, which is targeted at the pet food and aquaculture markets. Research at MiAlgae focuses on optimisation and scaling of precision fermentation techniques, downstream processing, product stability, product analysis and new product development.

www.mialgae.com

Louise Horsfall

University of Edinburgh

sustainable biotechnology; engineering biology; microbes

Metals have a finite supply, thus metal scarcity and supply security have become worldwide issues. We have to ensure that we do not drain important resources by prioritising the desires of the present over the needs of the future. To solve such a global challenge, we need to move to a circular, more sustainable economy where we use the resources we have more wisely. One of the founding principles of a circular economy is that waste is an unused feedstock, that organic and inorganic components can be engineered to fit within a materials cycle by the design, engineering and re-purposing of waste streams.

Certain bacteria have the ability to reduce metal cations and form precipitates of zero-valence, pure metals, as part of their survival mechanism to defend against toxic levels of metal cations. Using Synthetic Biology tools and techniques, alongside iterative design, build and test cycles we aim to enhance, manipulate and standardise the bio-manufacture of these nanosize precipitates as high value products. Ultimately producing engineered microbes with the ability to upcycle critical metal ions from waste streams into high value nanoparticles with a range of exciting applications.

https://horsfall.bio.ed.ac.uk

Marcel Jaspars

University of Aberdeen

health and wellbeing; microbes; technologies and methodological development; molecules

The Marine Biodiscovery Centre aims to discover new natural compounds to treat cancer, infection, inflammation, central nervous system and parasitic diseases from a range of biodiversity obtained from coral reefs, deep oceans and deserts. Once discovered, we harness nature's own methods to obtain analogues and provide sustainable supplies of these compounds. We also work to protect deep-sea biodiversity by providing advice to UN and EU policy makers.

www.abdn.ac.uk/ncs/profiles/m.jaspars/

Caroline Kirk

University of Edinburgh

energy storage; materials for energy applications; advanced materials; changing the environment

Caroline Kirk is a Senior Lecturer in Materials Chemistry in the School of Chemistry at the University of Edinburgh. Research in her group spans the areas of solid state materials chemistry and mineral chemistry and she continues to pursue collaborative and interdisciplinary research.

Her research involves targeting natural systems and carrying out careful and controlled laboratory studies to investigate formation processes of mineral phases and monitor their stability at either elevated temperatures or under different conditions of pH. This research can be applied in the design of high value materials in the fields of environmental remediation and energy storage.

Current projects in the Kirk group include: "Novel, sustainable and low-cost remediation strategies for solid waste streams that contain potentially toxic elements (PTES)", "Use of cement minerals for remediation materials", "Using Mn-Co containing compounds formed through biological processes as precursors for development of electrode materials for energy storage applications" and "Development of Phase-Change Materials for Heat-Storage and Heat Protection Applications". Recent collaborative work has involved academic partners at The Natural History Museum, London, University of Manchester, the Diamond Light Source, Federal University of Paraiba, Brazil, China and industrial partners including Brazilian Nickel, Elisabeth cements, Brazil and Sunamp Ltd.

www.chem.ed.ac.uk/staff/academic-staff/dr-caroline-kirk

Megan McKerchar

Cool Farm

sustainable; agriculture; carbon; greenhouse gases; biodiversity

The Cool Farm Alliance is a science-led, not-for-profit community interest company that brings together the agriculture supply-chain network on a global scale. It occupies the space where the three nodes of agriculture, commerce, and knowledge converge. The growing Cool Farm Alliance membership includes many of the world's leading food and beverage companies, NGOs, academic institutions, farmer groups and agronomists. Cool Farm Alliance members share the need for a respected, consistent, standardised, independent calculation engine and have joined the Alliance to ensure the Cool Farm Tool meets this need, now and in the future. Building connections, as well as leveraging and sharing knowledge, is key to this platform.

https://coolfarm.org/

Attila Molnar

University of Edinburgh

plants; food and sustainability; industrial biotechnology; technologies and methodological development

Our mission is to increase global food security through the development and integration of cutting-edge research with technological advances to improve crops. Understanding the principles of gene regulation and genome editing is paramount for the field of Engineering Biology. In my laboratory, we specialize in studying epigenetics - a mechanism that controls gene activity without altering the DNA sequence, as well as in DNA repair. We focus on both land plants and microalgae, utilizing and advancing genome editing tools and technologies. This knowledge underpins our efforts in crop improvement, spanning the creation of virus resistance in plants to the production of high-value compounds in microalgae.

https://molnar.bio.ed.ac.uk/

Eulyn Pagaling

James Hutton Institute

microbes; antimicrobial resistance; pathogens; microplastics; environment

I am a Senior Environmental Microbiologist in the Environmental and Biochemical Sciences Department at the James Hutton Institute. My research focuses on environmental contaminants, particularly on the antimicrobial resistance-pathogens-

microplastics nexus, using molecular approaches to tackle these challenges. This research includes determining sources and transmission pathways, understanding mechanisms involved in transmission and persistence, and understanding how contaminants can impact the environment. I am currently co-leading a project for the Scottish Government's (RESAS) Strategic Research Programme (2022-2027) on the flow of antimicrobial resistance and pathogens from the environment to the food chain. I am WP lead on another project investigating the vulnerabilities of private water supplies and I am Hutton lead on a further project focused on Johne's disease. I have co-authored 22 peer-reviewed papers and 17 technical reports. My research has appeared in several national media outlets, including newspaper articles and an interview for BBC Reporting Scotland. I currently supervise four PhD students and one postdoctoral scientist.

www.hutton.ac.uk/staff/eulyn-pagaling

Joanna Sadler

University of Edinburgh

industrial biotechnology; plastic degradation; plastic upcycling; sustainable synthesis

Research in the Sadler Lab focusses on development of biotechnological tools to enable a more sustainable, circular economy for chemicals synthesis. Engineering biological systems to first degrade waste feedstocks (e.g. plastic) and then upcycle them into high value chemicals will not only tackle waste pollution and re-enter end-of-life carbon back into the economy, but further provide sustainable alternative manufacturing routes to industrial chemicals currently produced from oil.

http://sadlerlab.github.io

Uma Shankar Sagaram

CyanoCapture Ltd.

microalgae and cyanobacteria physiology and scaleup; food and sustainability; industrial biotechnology

I am the Chief Scientific Officer at CyanoCapture with over 20 years of research experience, leading multiple projects in industry-academic consortia. Currently (2022-present), I am leading the R&D at CyanoCapture in developing a scalable cyanobacteria-based technology for industry scale CO2 capture. My research work - PhD (2003-07 from Texas A&M) and postdoctoral (2007-12) - mainly focused on elucidating the molecular interactions of bacteria and fungi with plants and environment. Since 2012, my interests have been on leading innovation-driven R&D in developing bio-based solutions for sustainable energy and materials production. My specific interests are in developing microalgae/cyanobacteria as a scalable platform and evaluating their techno-economic feasibility for commercialisation. I trained >20 PhD & MS scientists in industry and 4 PhD students as part of industry-academic collaborative PhD programs.

www.cyanocapture.com

Nicola Stanley-Wall

University of Dundee

microbes; biofilms; sustainable agriculture; Bacillus subtilis

The ability of unicellular bacteria to co-ordinate responses and to act as a multicellular population is proposed to provide an advantage to the bacterial population as a whole. A mechanism whereby bacteria can function as a multicellular population is to form a biofilm, a community of bacterial cells that is adherent to a surface, interface or to each other and encased in a self-produced polymeric matrix. Bacteria living in biofilms

have increased resistance to various antimicrobial agents and are better adapted to survive periods of environmental stress. Therefore, biofilms have a significant impact in clinical settings, where they are the causative agent of the majority of chronic infections, and in industrial settings where they cause significant damage due to corrosion and bio fouling. On the other hand, microbial biofilms can also result in beneficial processes such as bio-remediation and bio-control that cannot be accomplished by bacteria that are dispersed in the environment.

https://www.dundee.ac.uk/people/nicola-stanley-wall

Jolanda van Munster

SRUC

mycology; microbial interactions; lignocellulose degradation; biotechnology

Our team aims to understand how fungi degrade plant biomass, and to use this knowledge to help build a more sustainable society. To achieve this, we work on the interface of mycology and glycobiology. Our focus is on the activities of anaerobic fungi in the gut environment of ruminants such as cows and sheep. We investigate responses of these fungi to plant cell walls, the fungal degradative mechanisms and how their activity results in changes in composition and structure of plant material itself. We are also interested in a functional understanding of the interactions that fungi have with other microorganisms. EastBio DTP-funded researchers have made a large contribution to our team's progress. Their work resulted in isolation of new rumen microbes, and has set important steps in understanding the molecular mechanisms behind the distinct roles of two fungal species during plant biomass digestion. The training and network opportunities provided by EASTBIO have expanded our team's collaborations and expertise.

https://sites.google.com/view/glycomycology

Stephen Wallace

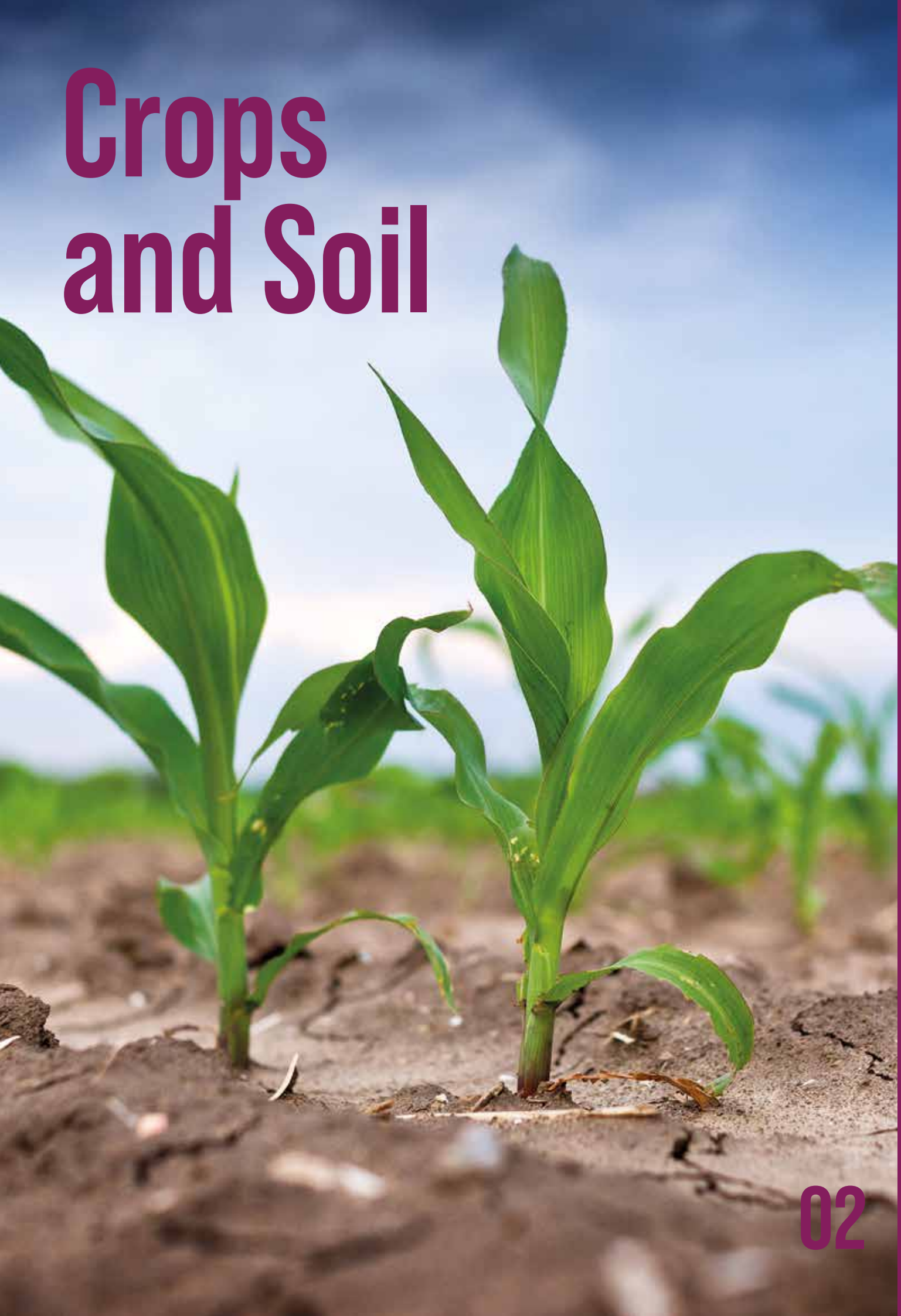
University of Edinburgh

chemical biotechnology; circular economy; sustainability

My lab engineers microorganisms to create new sustainable bioprocesses to industrial chemicals that are currently manufactured from fossil fuels.

https://wallacelab.bio.ed.ac.uk

Crops and Soil



02

Vera Eory

SRUC

agriculture; sustainability; greenhouse gas emissions; policy analysis; farmers' behaviour

I am interested in the socio-economic aspects of sustainable agriculture and work with interdisciplinary methods to understand better how to reduce the environmental effects of agricultural production. My research spans across topics, including the cost-effectiveness of mitigation practices, environmental co-effects, farmers' perceptions and the assessment of policy instruments. Besides developing and leading research projects, I supervise PhD projects and work with a range of stakeholders, especially policy makers.

https://pure.sruc.ac.uk/en/persons/vera-eory

Andrew Hudson

University of Edinburgh

sustainable agriculture; high-value compounds; plant development; genomics; trichomes

My research group examines how the form of plants is controlled and has evolved and how this knowledge can be used in crop improvement. We use snapdragons (Antirrhinum species) because these are adapted to diverse environments - from mountains to deserts - but form fertile hybrids in which we can map and identify the genes responsible for their differences. We are particularly interested in the development of epidermal hairs (trichomes), which are assumed to protect plants against pests and environmental stresses, such as UV or drought, and are the source of many high-value compounds, including pharmaceuticals and flavours. Consequently, there is interest in being able to increase trichome density to improve resistance or compound yields, either through genome editing or assisted breeding. The barrier is identifying the underlying genes. Antirrhinum species differ in the pattern and types of hairs that they produce (secreting glandular or simple non-secretory) and we have identified some of the genes involved in variation of these traits and for differences in the biochemistry of their secretions. We have recently begun using tomato to test whether the functions of the genes identified in snapdragons are conserved in this crop and to test whether increasing trichome density can improve resistance or compound yield without penalizing other aspects of plant performance. We also use natural populations of snapdragons in Spain and Portugal to examine the costs and benefits of being hairy in different environments.

https://hudson.bio.ed.ac.uk/

Nick Littlewood

SRUC

biodiversity; conservation; land management

I am an Ecologist with a wide-ranging interest in wildlife conservation and, especially, in the impact of management on species and habitats. My work spans plant, invertebrate, bird and mammal assemblages and the interactions between these. I also carry out work on individual species, including rare or threatened taxa. I work closely with conservation practitioners, land managers, NGOs and agencies to produce outputs that have conservation policy and management relevance. An example of such work has been providing policy and practical advice for responding to the threat from tree diseases, including Ash Dieback and Chronic Oak Decline. I maintain links with the Conservation Evidence group at the University of Cambridge and promote adoption of evidence-based practices in conservation.

https://pure.sruc.ac.uk/en/persons/nick-littlewood

Pete Smith

University of Aberdeen

food and sustainability; soil systems; climate change; computer modelling

My work is mainly in the fields of food systems, land use, greenhouse gas (GHG) emissions, climate change, soil systems, ecosystem modelling, biogeochemistry, global change, bioenergy, and nature-based solutions. I like making cutting-edge science useful by developing decision support tools for practitioners to use in real world applications.

www.abdn.ac.uk/people/pete.smith/

Runxuan Zhang

James Hutton Institute

plants; food and sustainability; technologies and methodological development

My group focuses on the development of novel, cutting-edge computational methods for high throughput data including accurate and fast transcript quantification for alternative splicing analysis using sequencing data, improvement of protein and splice junction coverage in shotgun proteomics, microRNA identification, quantification and characterization, as well as gene regulatory network inference.

The method we developed to construct reference transcript datasets to enable extreme fast and accurate transcript/gene quantification using RNA-seq data in Arabidopsis is now translated into barley and potato and other 10 species, which improves the quality of the analysis results, reduces the analysis time. It provides great benefits for all the scientists working on molecular biology across the globe. Our "3D RNA-seq" attracted over 20K users globally since it was released in June 2019. It also won Best Innovation in Innovator of the Year Award at UoD School of Life Sciences Review 2018 and cited by over 70 papers published in high impact journals, such as Nature, Nature Comms, The Plant Cell.

www.hutton.ac.uk/staff/runxuan-zhang

Health

03

Simon Arthur

University of Dundee

immunology; infection; cell signalling; autoimmunity; fibrosis

The mammalian immune system plays critical roles in tissue homeostasis and the host response to pathogens. Dysregulation of immunity can result in autoimmunity and chronic inflammation. We are interested in deciphering the intracellular signalling processes that allow immune cells to integrate multiple incoming signals, either from pathogens or other immune cells, in order to produce an appropriate response. By understanding these mechanisms, and identifying the points at which they go wrong in disease, we hope to identify potential new targets for therapeutic development. Currently we are using high resolution proteomics to study signalling and metabolic control, primarily in B cells, mast cells and macrophages, in response to agonists that act Myd88 dependent and G-protein coupled receptors.

www.dundee.ac.uk/people/simon-arthur

Mark Bronsvoort

University of Edinburgh

animal health; diagnostics; epidemiology; infectious disease; phylogeography

I am based at the Epidemiology, Economics and Risk Assessment (EERA) group at the Roslin Institute, part of the University of Edinburgh's Royal (Dick) School of Veterinary Studies (R(D)SVS). The group has a wide range of research interests in livestock and companion animal diseases, the environmental and genetic factors associated with disease and how to improve animal and human health through data-driven evidence for policy.

The group is a multidisciplinary team including veterinarians, statisticians, clinicians, geographers, ecologists, molecular biologists, geneticists, data scientists and mathematical modellers. We pride ourselves in being able to develop and support data pipelines from the conception stage, to field studies, data management and analysis all the way to policy briefs and impact monitoring. We answer questions as simple as 'Is the population diseased?' to as complex problems such as long time-scale exotic disease import risk predictions.

Our ethos includes:

- To generate high quality datasets to answer applied research questions
- To make datasets open and available where possible for others
- To develop and support education and training courses from undergraduate to postdoctoral level
- To use data driven evidence to improve the livelihoods of animal keepers and the health and welfare of their animals

What we do:

- Infectious diseases of livestock in Africa
- Understanding zoonotic diseases at the human livestock wildlife interface
- Design and implementation of animal disease surveillance
- Wildlife disease epidemiology at the livestock interface
- Drivers of antimicrobial resistance (AMR) at the animal human interface
- Statistical and mathematic modelling approaches in veterinary epidemiology
- Application of machine learning to improve veterinary decision making
- Animal health economics for vaccination and control strategies

www.ed.ac.uk/roslin/eeragroup/research

Megan Davey

University of Edinburgh

animal developmental biology; cell signalling

I am a developmental biologist using limb development as a platform to explore embryonic patterning, the constraints of evolution on development and to pioneer the field of embryonic tempo. I specialise in avian models of vertebrate development employing innovative transgenic and bio-imaging approaches with the aim of improving human and animal health and answering the global challenge of climate change.

www.research.ed.ac.uk/en/persons/megan-davey

Elaine Emmerson

University of Edinburgh

healthy ageing across the life course; technologies and methodological development; molecules; cells and industrial biotechnology

Therapeutic radiation is a life-saving treatment for those with head and neck cancer. However, tissues that lie in the radiation field also receive high doses of radiation, leading to cellular damage and irreversible organ dysfunction. The salivary glands (SGs) are often inadvertently irradiated, leading to significant oral health problems, and difficulties in speaking, eating and sleeping, which together severely affect quality-of-life. Patients rely solely on short-term solutions which alleviate the symptoms, and while considerable effort has been invested in understanding the side effects of radiation injury on the SGs, there is no permanent cure for this debilitating condition. While the SGs go through an initial period of regeneration, this ultimately fails over time and the tissue degenerates. However, why this occurs and which cells are involved is unknown. Our research aims to characterise the cellular response to radiation injury, understand the kinetics of crucial ligand-cell interactions, and ultimately test whether regeneration can be rescued by replacing injured cells or restoring cell-niche crosstalk. A regenerative approach could eliminate the need for lifelong salivary replacements for people experiencing xerostomia (chronic dry mouth). This has the potential to save over £1 billion/year within the UK, and to lead to vast improvements in patient quality of life after cancer treatment.

www.ed.ac.uk/profile/elaine-emmerso

Greg Findlay

University of Dundee

health and wellbeing; developmental disorders; stem cells; signal transduction; post-translational modifications

Our lab applies cutting-edge chemical, genetic, proteomic and transcriptomic technologies to investigate signalling mechanisms that regulate pluripotent stem cell biology. Using these approaches, we have uncovered a series of exciting new stem cell signalling pathways, providing key insights into regulation of stem cell maintenance and differentiation. More recently, we have begun exploring how disruptions to stem cell signalling networks lead to human developmental disorders, particularly intellectual disability. Our approaches have pinpointed novel signalling components that are mutated in intellectual disability syndromes, and elucidated the molecular mechanisms underpinning the development of these disorders in patients.

www.ppu.mrc.ac.uk/research/principal-investigator/greg-findlay

Danielle Gunn-Moore

SRUC

mycobacterial infections; feline dementia; Feline Infectious Peritonitis

My major research focuses are mycobacterial infections in cats (and dogs), feline gerontology, and Feline Infectious Peritonitis (FIP). Since returning to the R(D) SVS 25 years ago, I have been involved in the supervision of >40 post-graduates (especially clinical residencies), seven PhDs, >15 MSc, and >100 clinical research projects. Raised ~2M in research funds. My students' research led to >180 peer-reviewed papers, >170 invited reviews, book chapters, editorials and published letters, and >150 research abstracts and presentations. Thanks to this my H-value is 42, with >5000 citations: **https://www.ed.ac.uk/profile/prof-danielle-gunn-moore**.

I established the Companion Animal Mycobacterial Infections Helpline over 20 years ago, we are the global lead for tuberculosis in cats and dogs, developed clinically significant and commercially available assays for mycobacterial infections in companion animals, and investigating two large tuberculosis outbreaks drew attention to the risk of tuberculosis from commercial raw cat food, and resulted in a change in the law such that fallen tuberculosis reactor stock cannot be fed to hounds. Our work has improved the prognosis of tuberculosis in cats from 40% to >80%.

I am one of few people investigating feline dementia (aka feline cognitive dysfunction syndrome) globally. Over 18 years we have described its predominant clinical signs, developed the mnemonic to describe it, defining its immuno-histological changes, its major triggers and management strategies, resulting in >25 papers and reviews.

www.roslin.ed.ac.uk/danielle-gunn-moore/

Fiona Houston

University of Edinburgh

prion; brain; sheep; infectious disease

The research in my group focuses on mechanisms that contribute to the pathogenesis and transmission of prion diseases in ruminants. We pioneered the use of sheep as a model to study transmission of prions by blood transfusion, and are currently using the extensive archive of blood samples from these studies to develop and test diagnostic assays, including novel biomarkers. Another area of interest is mechanisms underlying long term persistence of infection in individuals in the absence of signs of disease (subclinical infection), potentially representing a reservoir for future transmission. We are also investigating the effect of prion protein (PrP) genetic variation in modulating pathogenesis and susceptibility to chronic wasting disease (CWD) in European deer/cervid species, following the emergence of the disease in Norway in 2016. In addition to our work on prion diseases, we study the comparative neuropathology of aging in ruminants and other domesticated animals.

www.ed.ac.uk/profile/fiona-houston

Marcus Lee

University of Dundee

Malaria; drug resistance; CRISPR

We are interested in the molecular basis of drug resistance in the human malaria parasite Plasmodium falciparum, and in developing molecular genetics approaches to interrogate gene function.

One of our longstanding research interests has been to understand the mechanisms available to the parasite to develop resistance, which often comes at a cost in terms of fitness in the absence of drug pressure. We use in vitro evolution of resistance, genome sequencing and CRISPR-based engineering to understand drug mode-of-action and parasite adaption.

www.dundee.ac.uk/people/marcus-lee

Neil Mabbott

University of Edinburgh

immunology; infectious diseases; host-pathogen interactions; transcriptomics; aging

Research summary: Host-pathogen interactions in the mucosal immune system.

Current research interests: My research aims to understand the pathogenesis of infectious diseases within the immune system. Particular interests include understanding host-pathogen interactions within the mucosal immune system, especially prion diseases and other gastrointestinal pathogens such as Salmonella and nematodes. Studies are also focused on the effects of host age on the function of the immune system and how this influences susceptibility to gastrointestinal pathogens. A systems biology approach is also being used to compare the transcriptomic profiles of distinct immune cell populations in the steady-state, and also during ageing. This research benefits greatly from the availability of precisely defined mouse prion pathogenesis models, unique transgenic and immunodeficient mice and state-of-the-art bio-imaging and bioinformatics expertise.

www.ed.ac.uk/profile/neil-mabbott

Chiara Maniaci

University of Dundee

health and wellbeing

The major goal of our research is to discover the fundamental principles of how cells expand the complexity of their proteome as consequences of protein post-translational modifications events. We focus on the "cleave-to-modify" mechanism which involves the processing of Ubiquitin-like-domain containing proteins to enable their further modification as a means to regulate protein biological function. In our research we use a multidisciplinary approach with techniques ranging from biochemistry, cell biology, organic chemistry and proteomics to studies in model organisms to gain mechanistic and functional understanding of protein processing and modification and, consequently, reveal new targets for pharmacological intervention to treat disease.

https://chiaramaniaci0.wixsite.com/maniaci-lab

Samantha Pitt

University of St Andrews

health and wellbeing; cardiovascular; electrophysiology

In healthy individuals, the controlled release of calcium causes the heart to beat strongly. Calcium is released through specialised gates called ryanodine receptors (RyR2). In patients with heart failure and fatal arrhythmias the release of calcium becomes erratic leading to weakened contraction of heart muscle and cell death. Using a combination of low noise electrophysiological recordings in combination with molecular and biochemical methods, and live cell imaging, my group investigates intracellular calcium dynamics and the molecular function of RyR2 and other Ca2+-channels that are present on intracellular organelles. The aim of our research is to try to understand what happens to channel function under pathophysiological conditions. By exploring new mechanisms involved in regulating intracellular calcium release in cardiac tissue my group strives to uncover potential new drug targets in the fight against heart failure to improve patient outcomes.

https://metalion.wp.st-andrews.ac.uk/

Daniel Price

Moredun Research Institute

vaccinology; host-parasite interactions

I started my MRI fellowship in April 2019. The aim of my fellowship is to develop novel control approaches for ectoparasites of veterinary importance. Throughout my research career to date I have used functional genomic approaches to better understand mechanisms of host/parasite interactions. Using these tools my overall aim is to better understand parasite biology, in particular how parasites are able to exploit their host. With a better understanding of host-to-parasite interactions, my aim is to develop novel interventions or vaccines to protect livestock of veterinary importance against parasites.

https://moredun.org.uk/people/staff-directory/dan-price

Dewei Yi

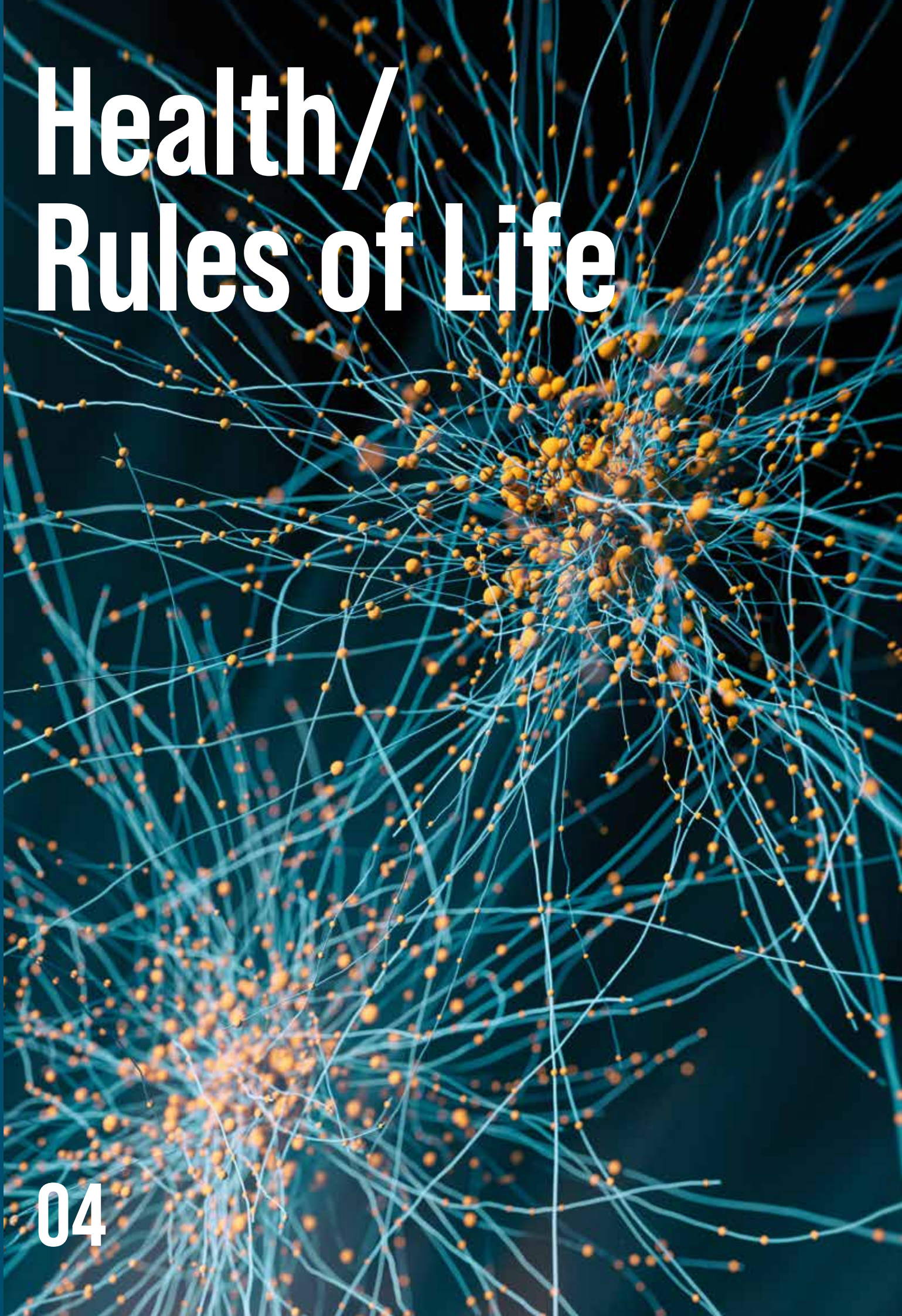
University of Aberdeen

health and wellbeing; technologies and methodological development

There have been widely recognised social determinants that influence brain functions and health. The social self (e.g. a feeling of connections to others) is a key indicator of these characteristics since it determines how people see, think, feel, and interact with the environment. Although maintenance of the self is crucial for resilience and adaptation to biological and cognitive changes associated with ageing, little is known about the fundamental mechanisms underpinning the social self, as represented in the ageing brain. With recent advances in virtual reality (VR) techniques and the integration of electroencephalography (EEG) and transcranial magnetic stimulation (TMS) technology, this project seeks to understand the necessary neural substrates that process experiences of self-other connections in natural social settings in older adults.

www.abdn.ac.uk/people/dewei.yi/

Health/ Rules of Life



04

Jelena Baranovic

University of Edinburgh

neuroscience; health and wellbeing; technologies and methodological development

We think, learn, memorise and forget because our neurons communicate in a certain way. Many proteins mediate this communication and AMPA-type glutamate receptors are among the most important ones. Their activity is one of the first signs to a neuron that another, neighbouring neuron is trying to communicate.

To understand what happens in our neurons when we learn, form memories and forget, we need to know how AMPA receptors work and how their activity is regulated.

Our group uses a range of biophysical and molecular biology techniques (including patch clamp electrophysiology, protein purification and super-resolution fluorescence microscopy) to study function and regulation of AMPA receptors.

www.ed.ac.uk/biology/groups/baranovic

Tim Czopka

University of Edinburgh

animal systems; health and wellbeing; technologies and methodological development

I work in the field of developmental and cellular neurosciences where my group investigates principles that govern the assembly and remodelling of neural circuits. We have a particular interest in understanding how non-neuronal support cells (called glial cells which comprise about half of all brain cells) interact and communicate with surrounding neurons to tune their form and function.

For our work we use zebrafish as model organism. Young zebrafish are small in size, genetically tractable, and develop functional circuits capable to execute sophisticated behaviours whilst being optically nearly transparent. This allows us to study glial regulation of circuit development at unprecedented resolution using a wide range of complementary methods, including high-resolution optical microscopy of live cell reporters and biomolecular sensors, cellular and (opto)genetic manipulations, as well as behavioural analysis.

www.czopka-lab.com/

Laura McCulloch

University of Edinburgh

neuroimmunology; stroke; B cells; mucosal immunology; infection

We are primarily interested on the impact of stroke on the immune system and how post-stroke immune changes lead to complications of recovery, such as bacterial pneumonias. We aim to find novel immunomodulatory strategies to prevent infection in the context of stroke.

To understand the mechanisms that underpin these effects, we also study communication between the central nervous system and immune system in health and disease.

www.ed.ac.uk/inflammation-research/people/principal-investigators/dr-laura-mcculloch

Livestock/ Aquaculture

05

Annette Boerlage

SRUC

aquaculture; aquatic epidemiology; veterinary epidemiology; gill health; salmon; statistics

I am an applied aquatic epidemiologist based in Inverness Scotland with Scotland's Rural College (SRUC), where I am involved in research and teaching. I use statistical and mathematical models to obtain insight into the interactions between environment, host and pathogen in aquaculture systems and industries to improve economic, environmental and biologic sustainability. My research fits under the umbrella of the blue economy. My main area of expertise is gill health of Atlantic salmon, but I have expertise with other salmonid and warm-water fish species and their diseases and disorders. I am publication officer of the European My of Fish Pathologists.

My research goals are to deliver evidence-based information that can improve health management on aquaculture farms, mitigate disease, production loss, and mortality of aquaculture stock, and improve sustainability of the aquaculture industry. My work is applied and has impacts at many levels including stakeholders local and internationally, health and welfare of salmon, sustainability of salmon producers, informing regulators, and capacity building for academia and professionals.

https://pure.sruc.ac.uk/en/persons/annette-boerlage

James Bron

University of Stirling

aquatic animal health; parasitology; host-pathogen interactions; sea lice; parasite control

I have been a researcher and lecturer at the Institute of Aquaculture, University of Stirling for >35 years, working on a range of key parasite, viral and bacterial pathogens of cultured finfish. I have particular interest in host-parasite interactions, especially for ectoparasites including sea lice and the causative agent of amoebic gill disease (AGD). My background is highly multi-disciplinary, and my areas of interest and research have included aquatic parasitology, finfish health and welfare, image analysis, light, fluorescence, confocal, SEM and TEM microscopy, modelling of disease, zoonotic disease, functional feeds, vaccine development, development of novel medicinal and non-medicinal treatments, investigating engineering solutions to disease, and selection for genetic resistance to disease. Key impacts relate to the improved control of parasites in aquaculture and to the provision of research and advice that assists planning and policy.

www.stir.ac.uk/people/255712

Rick D'Eath

SRUC

animal welfare; animal behaviour; precision livestock farming; pigs; poultry

My research uses animal behaviour as a way to measure animal welfare, or to understand and solve animal welfare problems which involve behaviour.

- Behaviour-related welfare problems in pigs: social aggression, tail biting and mounting, and genetics of animal temperament in relation to these problems.
- Hunger in ration-fed animals (dry sows and broiler breeder chickens). Using behaviour, motivation, neurophysiology and gut physiology to understand, measure and ameliorate the problem.
- Precision livestock farming- collaborating to develop and validate agri-technology such as machine vision cameras and other sensors to monitor behaviour, health and welfare on farm.
- Analysis of how wider drivers and issues impact animal welfare and policy (including trade, regulations, economics and climate change)

https://pure.sruc.ac.uk/en/persons/rick-death

Xavier Donadeu

University of Edinburgh

cellular agriculture; adipose tissue biology; stem cells; livestock; development

My research interests lie in the areas of Stem Cell biology and Reproductive Biology in large animal species. I am interested in these species both from a veterinary perspective and as disease models. I lead a research group working in the areas of Stem Cell biology and Reproductive Biology in large animal species. Work in my laboratory spans from hypothesis-led studies to understand basic cell, organ and whole animal biology and physiology, all the way through to translational studies with industry to develop novel molecular diagnostics and cell-based tools to address specific key challenges faced by the livestock (cattle and pigs) industry and companion animal sectors, in addition to applications for cellular agriculture. My laboratory is best known for pioneering work on, first, the use of miRNAs as novel diagnostic biomarkers for cattle, and secondly, the characterization and application of stem cells (iPSCs and MSCs) in farm species (horse, cattle, pigs).

www.research.ed.ac.uk/en/persons/xavier-donadeu

Adam Hayward

Moredun Research Institute

host-parasite interactions; ecology and evolution; helminths; defence against infection; animal production

Animals in any population, wild or domesticated, vary enormously in their responses to infection. Some mount effective immune responses that clear the infection (resistance), some appear to continue to thrive in spite of infection (tolerance), others deal poorly with the infection and succumb to its effects (susceptible). My interest is in asking how much individuals vary, how this variation comes about, and working out how we can exploit this variation to devise strategies for the management of disease, including breeding and management of the environment.

My main focus is on helminth parasites of sheep (gastro-intestinal nematodes) and cattle (liver fluke), and I collaborate with colleagues who are experts in immunology and parasitology and producers and commercial companies with more knowledge of animal production. I mainly use data collected from large-scale field trials but also use data from abattoirs and I have worked on a wild population of Soay sheep for over 15 years. I also use meta-analysis to make sense of the results of past studies on important topics in livestock disease.

https://moredun.org.uk/people/staff-directory/adam-hayward

Dan Macqueen

University of Edinburgh

genomics; aquaculture; evolution; animal health; fish and shellfish

My research is focussed on farmed fish species, though my group works across a range of animal taxa and their pathogens. We leverage the latest omics technologies to understand the genetic, genomic and cellular basis for traits of relevance to sustainable and profitable aquaculture, while further aiming to advance methods to reduce disease on fish farms and promote fish welfare. Additionally, my group is very interested in fundamental genome biology and genome evolution. For instance we are investigating the role played by whole genome duplication (i.e. polyploidy) events in shaping genomic and functional diversity during evolution.

www.macqueenresearchgroup.com/

Simone Meddle

University of Edinburgh

animal systems; animal welfare

Simone is a Group Leader at the Roslin Institute. She leads a research group funded by the BBSRC, that investigates how environmental and social cues can trigger functionally important behaviours such as response to stress, food intake, reproduction, photoperiodism and aggression by examining the neuroendocrine system in birds. Simone is also investigating the neurobiology of positive welfare (environmental enrichment) and behaviour.

www.ed.ac.uk/profile/simone-meddle

Luke Rendell

University of St Andrews

animal systems; evolution of behaviour; behavioural ecology; learning; communication

I have broad research interests, largely centred around the evolution of learning, behaviour and communication, with a special focus on marine mammals and interest in interdisciplinary collaboration.

https://research-portal.st-andrews.ac.uk/en/persons/luke-edward-rendell

Diego Robledo

University of Edinburgh

genetics; genomics; disease resistance; fish

Infectious diseases are currently the main threat to aquaculture sustainability. The main interest of our research group is to understand responses to pathogens in aquaculture species, and in particular differences in resistance / susceptibility. We use various genetic technologies and functional genomics approaches to understand the genomic makeup of successful immune responses and link them to the underpinning genetic variation. The final goal is to exploit this knowledge to produce disease resistant animals through genome editing and genomic selection, improving animal welfare and the sustainability of aquaculture.

www.ed.ac.uk/roslin/aquaculture/people/diego-robledo

Lida Zoupi

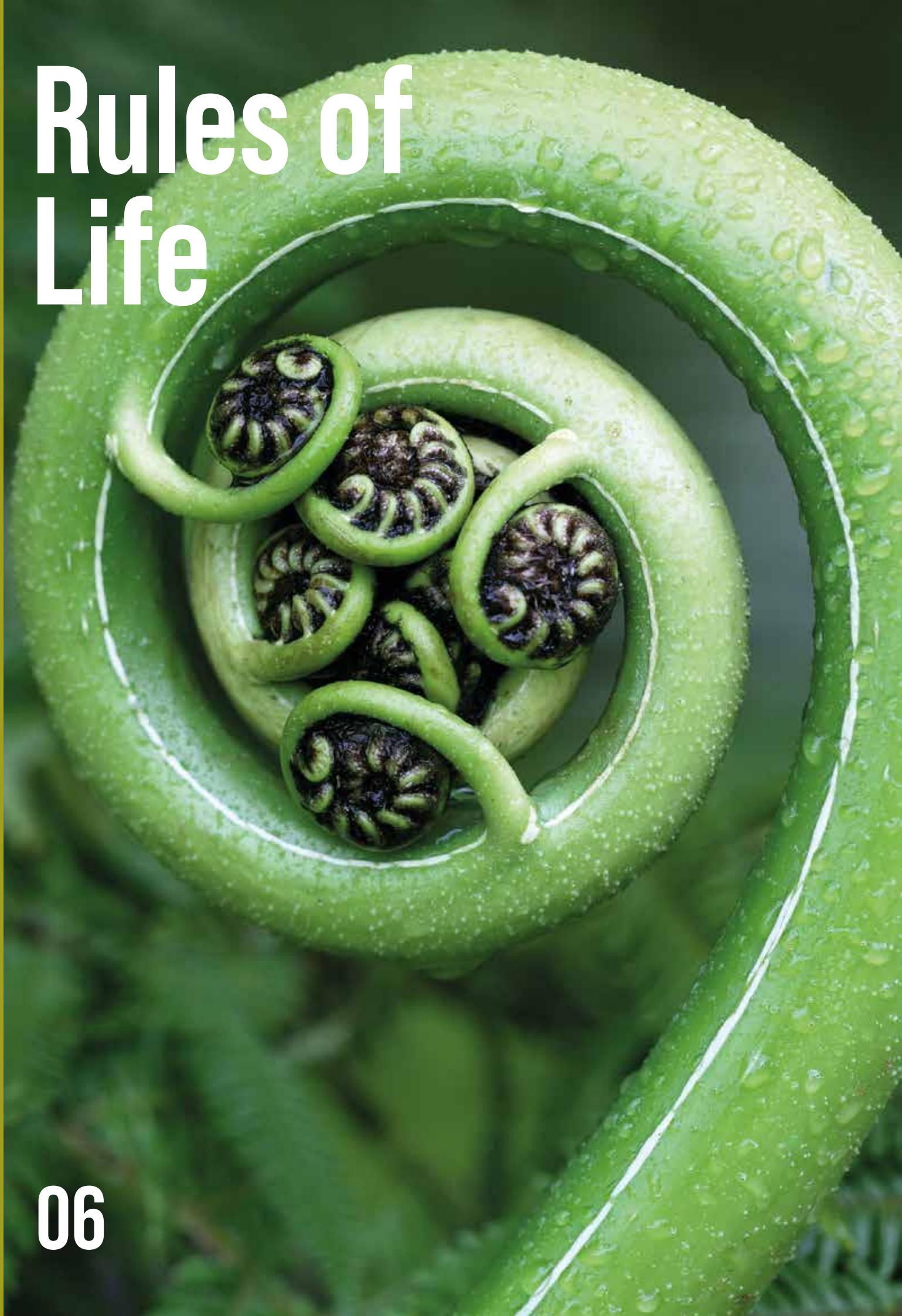
University of Edinburgh

animal systems; health and wellbeing

We are interested in the fundamental cellular mechanisms that underly the establishment and regulation of neuronal networks in the brain during typical development and in the context of neurodevelopmental disorders. We focus on the communication between neurons and oligodendrocytes, a type of glia cell in the brain that wraps neurons with myelin, a specialised membrane that insulates the axons of neurons enabling fast and efficient signal transmission. We use genetic, environmental and pharmacological approaches to manipulate myelination during postnatal development and we study the effect on neuronal function. The nature and the outcomes of our work provide new conceptual insights into how myelinated neuronal networks regulate signal transmission and by extension influence information processing in the brain. In addition, we establish versatile and cutting-edge genetic approaches, protocols and analysis pipelines that we openly share with the broader scientific community to be used a wide range of researchers within the life sciences.

https://zoupilab.com/

Rules of Life



06

James Ainge

University of St Andrews

cognition; behaviour; memory; hippocampus;

The focus of the lab is to try and understand the neural mechanisms that support our ability to remember the things that have happened to us – episodic memory. Most of our work takes a systems neuroscience approach to examine how networks within the hippocampus and entorhinal cortex process memory information. We use in vivo electrophysiology to examine firing patterns of individual neurons as lab rats carry out memory tasks. We also use molecular and genetic tools to manipulate the network and understand the cellular mechanisms underlying episodic memory.

Complementing the neuroscientific approach, other lines of research in the lab examine the cognitive mechanisms underlying episodic memory in both human adults and children. Ultimately, we aim to apply this work by using our knowledge of mammalian memory networks to help test therapeutic strategies for disorders of memory such as Alzheimer's disease.

https://aingelab.wp.st-andrews.ac.uk/

Helen Alexander

University of Edinburgh

bacteria; antimicrobial resistance; evolutionary biology; mathematical modelling

My research group studies bacterial evolution using mathematical models, in vitro experiments, and statistical inference. Our main areas of interest include:

(1) Mutagenesis: What are the evolutionary consequences of realistic cell-level mechanisms of mutagenesis, particularly heterogeneities amongst cells and over time? How can we accurately estimate mutation rates from simple experiments?

(2) Antibiotic tolerance and resistance: How does the environment (both abiotic and biotic factors) impact a bacterial population's response to antibiotic treatment? How does it impact evolution of resistance, especially emergence from de novo mutants?

We are interested in these questions both from a fundamental evolutionary biology perspective and to gain insights into antibiotic treatment strategies that could better balance short-term efficacy with robustness against resistance evolution.

www.ed.ac.uk/biology/groups/alexander

Davide Bulgarelli

University of Dundee

plants; microbes; food and sustainability

I am a scientist and a team leader interested in deciphering the molecular interactions between plants and their associated microbial communities (collectively referred to as the plant microbiome). Similar to the microbiome defined by the digestive tract of humans, the plant microbiome modulates the growth, development and health of its host organisms. Therefore, the study of the plant microbiome represents a research field with great potential for discovery both in basic and applied science. To study the plant microbiome, my research group uses an innovative research approach encompassing plant genetics, microbial ecology and computational biology. Capitalising on the collaborations we established with academia and agricultural stakeholders, we aim at deploying the knowledge we generate to sustainably enhance global food security.

www.dundee.ac.uk/people/davide-bulgarelli

Alessio Ciulli

University of Dundee

chemical biology; targeted protein degradation; structural biology; molecular mechanisms; protein-protein interactions

The Ciulli Laboratory develops novel small molecules inducing targeted protein degradation and modulating protein-protein interactions. We do research on fundamental chemical biology and translate it via collaboration partnership with the biopharma industry and by creation of spin-out companies.

Pioneering discoveries from the Laboratory and others over the past decade have contributed to the advent of a new modality of chemical intervention to study biology and drugs to cure disease. Instead of blocking a target protein as conventionally done with inhibitors, we are designing "tailored" bifunctional molecules that bring a target protein to an E3 ubiquitin ligase for targeted protein degradation. We have illuminated important understanding of how this new class of molecules work that is beginning to define the rules and principles of how to design and study them.

Our research in this area takes a multidisciplinary approach including organic and medicinal chemistry and computational tools to design and achieve desired molecules, structural biology and biophysics to study binary and ternary complexes in solution and reveal their structural and dynamic interactions, and chemical biology, biochemistry, proteomics and cell biology to study the cellular impact of our small molecules into relevant cellular systems and disease models, in collaboration with biologists and medics.

www.lifesci.dundee.ac.uk/groups/alessio-ciulli//

Rafael Guimaraes da Silva

University of St Andrews

enzymology; antibiotic resistance; cancer biochemistry; kinetic isotope effects; enzyme catalysis

Enzymes catalyse virtually all chemical reactions in living organisms, making their rates compatible with life. These proteins have evolved to utilize a range of strategies to achieve incredible rate enhancements in comparison with the corresponding non-catalysed reactions. The study of enzymatic mechanisms is fundamental to elucidate how enzymes work in physical and chemical terms, and how their activity is regulated.

In the da Silva Lab, we apply techniques of molecular biology, biochemistry, structural biology and physical organic chemistry to unravel the mechanisms of enzymatic reactions catalysed by multi-protein allosteric complexes, tRNA methyltranferases, ketoreductases, and hydrolases. Particular attention is given to transition-state structure, inhibitor design, and fast protein dynamics. The results inform our drug design efforts to combat bacterial infections and cancer. Furthermore, we use enzymes in the design of biocatalytic routes to synthesize chemicals useful for biotechnology and research, but which are hard to make with traditional synthetic chemistry.

https://dasilva.wp.st-andrews.ac.uk/

Cristina Esteves

SRUC

AMR; MSC; stem cells; regenerative and antimicrobial therapies; alternative protein

My group studies animal Stem cells relevant for translational applications. One area of research investigates Mesenchymal Stem/Stromal cells (MSCs) and their secretome as novel tools against antimicrobial resistance (AMR) and towards the reduction of antibiotic usage in infection.

Strategies being developed involve both direct targeting of bacteria and indirect stimulation of natural body defences by modulation of epithelial and immune responses against infection. In addition, we are generating induced pluripotent stem cells (iPSC) from different species, as a long-lasting source of MSCs.

Another area of our research involves the establishment of mesenchymal-derived cell lines for cellular agriculture and alternative protein production, focusing on in vitro meat applications.

This research involving dairy cattle, pigs, dogs and horses is funded by BBSRC, UKRI-Innovate UK, Dogs Trust, HBLB, Petplan Charitable Trust, The Hong Kong JC Equine Welfare Research Foundation.

www.ed.ac.uk/profile/dr-cristina-esteves

Sander Granneman

University of Edinburgh

RNA; bioinformatics; protein-RNA interactions; biochemistry; structural biology

My group is studying the role of riboregulators and RNA binding proteins in regulation of gene expression during adaptive responses. Many microorganisms, in particular human pathogens, have evolved clever mechanisms to be able to very rapidly adapt to stress caused by environmental changes, such as changes in host temperature and nutrient availability. This enables them to efficiently maintain cellular homeostasis even in hostile environments. Our goal is to gain mechanistic insights into regulatory strategies used by these organisms to adapt to stress.

Our research focusses on riboregulators and RNA-binding proteins that play a key role in stress adaptation. In collaboration with Jay Tree (University of Sydney), David Gally (Roslin Institute) and Ross Fitzgerald (Roslin Institute) we are currently working on a number of bacterial pathogens to unravel the role of these factors in the post-transcriptional regulation of gene expression (for example, see Tree et al 2014, van Nues et al 2017, Iosub et al 2019 and Chu et al, 2022).

https://sandergranneman.bio.ed.ac.uk

Julie Harris

University of St Andrews

vision; psychology; perception; animal systems; neuroscience

We study vision at the interface between neuroscience, psychology and computer vision. Our research starts from the idea that vision is a dynamic process, linking an organism to its environment, and the group studies a number of aspects of vision in the environment. In my Lab, experiments with human observers (using behavioural and eye movement measures) are used to explore the basic processes underlying our perception of, and interaction with our world. We also use computational techniques to model visual systems and visual environments. Our main areas of interest are binocular vision and the perception of objects and layout, we are also interested in vision for driving and the perception of camouflage and animal patterning. Our work is closely allied to Human Computer Interaction and has application in the areas of autonomous control, virtual reality, ubiquitous computing, computational biology and behavioural ecology.

https://julieharrislab.wp.st-andrews.ac.uk/julie-harris/

Matthias Hennig

University of Edinburgh

systems neuroscience; computational neuroscience; motor systems; neural networks; vision system

My research is in computational neuroscience, which uses methods from computer science and mathematics

to understand brain function. A main focus is on neural data analysis, on computational and machine learning models in neuroscience and on open-source scientific software development. Much of this work is done in close collaboration with experimental neuroscience labs and aims to develop and test hypotheses that are well-grounded in theory, and to provide tools for scientific discovery in neuroscience.

https://homepages.inf.ed.ac.uk/mhennig/

Ines Jentzsch

University of St Andrews

biological underpinnings of human behaviour; health and wellbeing

I am a cognitive neuroscientist and a classically trained pianist, studying different aspects of attention and performance in humans. I am specifically interested in the processes that underlie our ability to plan and control our thoughts and actions, using both behavioural and electrophysiological approaches. I am also interested in how these processes change as a function of expertise (e.g., in groups with high levels of motor skills such as instrumental musicians), normal aging and psychological illness.

www.st-andrews.ac.uk/psychology-neuroscience/people/ij7

Catherine Kidner

University of Edinburgh

plant genetics; evolution; speciation; genome diversity; tropical diversity

We are interested in the application of large-scale comparative sequence analysis to understanding patterns of diversity. We use NGS to produce transcriptomes, genomes and phylogenies to explore the diversity of tropical plants. We use the resources of the living collections at RBGE for expression analysis and are using Hyb-Seq to mine genetic data from herbarium samples. Begonia is one of the largest angiosperm genera and well represented in flora across the tropics. Understanding the drivers and the results of speciation patterns in Begonia will help us understand tropical diversity. We have produced a genetic map, several transcriptomes, a reference genome and several draft genomes for the group and are using these to identify the genetics underlying species-level diversity patterns. Inga is a group of about 300 species of leguminous trees of the neotropics. It is cultivated as a shade tree in agro-forestry. We have been using Hyb-Seq to produce a well resolved phylogeny for the genus and are using comparative transcriptomics to identify traits associated with species-level variation, particularly in herbivore defence. We are interested in all aspects of comparative genetics and genomics in underexplored plants.

www.ed.ac.uk/profile/kidner-group

Stuart MacNeill

University of St Andrews

molecular microbiology; functional genomics; cell cycle; genome biology; biochemistry

Research in the MacNeill lab has primarily focused on dissecting the enzymes and mechanisms of DNA replication and genome stability using two contrasting genetically-tractable model systems, the eukaryotic fission yeast Schizosaccharomyces pombe and the halophilic euryarchaeon Haloferax volcanii. In addition to this, we also study the molecular biology of T5-like bacteriophages, the activity of the highly diverged DNA ligase enzymes encoded by crAss-like bacteriophages and various eukaryotic viruses, such as Cedratvirus kamchatka, and the function of selected carbohydrate-active enzymes (CAZymes) in Haloarcula hispanica, Haloferax volcanii and related haloarchaea. We use a variety of methods to address questions of protein

structure and function, including genetics, genome engineering, cell and molecular biology, biochemistry, structural biology and bioinformatics.

https://macneill.wp.st-andrews.ac.uk

Adele Marston

University of Edinburgh

meiosis; mitosis; oocytes; yeast; chromosomes

The goal of our group is to discover the molecular basis of the adaptations that sort chromosomes into gametes during meiosis and to understand how they contribute to female infertility in humans. We exploit the tractability of yeast as a discovery tool and combine this with work in frog, mouse and human oocytes. Our approach is guided by the research question, employing and developing a wide range of cell biological, genomic, proteomic and biochemical assays.

www.ed.ac.uk/biology/wcb/research/research-group-leaders/adele-marston

Peter McCaffery

University of Aberdeen

communication and signalling; receptors; biomedical neuroscience; medical science and disease; biochemistry and physiology

Our research is focused on the function of the retinoic acid receptors (RARs) in the brain. The work initially explored the role of RARs to guide development of the CNS, demonstrating their capacity to regulate patterning of neurons in eye, spinal cord and brain. This work has extended to the adult CNS, developing the idea of RARs control of CNS development to their role in regulating neuronal plasticity. These studies point to the action of RARs to control adult neurogenesis in the hippocampus where they influence learning and memory and also how RARs control hypothalamic homeostatic functions and seasonal plasticity in the neural stem cells present in the hypothalamus. With collaborators at Durham University we have demonstrated the neuroprotective actions of RARs in neuronal cell lines and cultured primary neurons and that the actions of the RAR ligands to promote both genomic and non-genomic activity is vital to this protective action. This collaboration has resulted in novel approaches to develop these ligands into therapeutics for neurodegenerative disease and led to the start-up company at Durham, Nevrargenics Ltd.

www.abdn.ac.uk/ims/profiles/peter.mccaffery

Alistair McCormick

University of Edinburgh

engineering biology; photosynthesis; plants; algae; cyanobacteria

Photosynthesis is nature's principal means of solar energy and carbon capture, and is one of the most essential biological processes for sustaining life on earth. Our group studies the fascinating world of photosynthetic organisms using an Engineering Biology approach, the next evolution of the field of Synthetic Biology that uses engineering principles to design and construct biological parts that can be readily incorporated into living organisms. Our current work is focused on improving photosynthetic efficiencies in land plants and micro-algae and developing molecular tools for exploiting micro-algae for the production of high value compounds.

https://mccormick.bio.ed.ac.uk/

Dies Meijer

University of Edinburgh

cell biology; genetics and development; animal science; neurodevelopment; protein-protein interactions

We aim to understand the molecular and cellular mechanisms that drive Shaker-type voltage-gated potassium channels (KCNA) to accumulate at specific axonal membrane domains during developmental and regenerative myelination, and how these domains are dynamically maintained during adult life. Such an understanding is not only of biological but also of medical interest, as disruption of these cellular and molecular interactions cause devastating neurological diseases such as epilepsy, ataxia, cognitive disorders, and demyelinating diseases. Our research focuses on the role of the secreted LGI1-4 proteins and their transmembrane receptors ADAM11, ADAM22 and ADAM23 in these processes. Using mouse genetics, histological, biochemical and cell biological techniques we have demonstrated that while LGI4-ADAM22 interactions are crucially important for axonal myelination, LGI3-ADAM23 and LGI2-ADAM11 interactions drive the accumulation of KCNA1 and KCNA2 channels at the juxtaparanodal domain of myelinated axons and at the cerebellar pinceau respectively. How these different combinations of LGI-ADAM molecules drive KCNA1 biology to affect neuronal excitability is the focus of our continuing research.

https://discovery-brain-sciences.ed.ac.uk/our-staff/research-groups/dies-meijer

Berndt Muller

University of Aberdeen

gene action and regulation; biochemistry and physiology; multiprotein complexes; animal diseases

Spliced leader trans-splicing is an RNA splicing mechanism used by many eukaryotic groups (including many important human and animal parasites) to generate the 5' ends of their mRNAs. The mechanistic details of this process are not well understood, and we are using the model animal C. elegans to gain insight into the key molecules involved. Better understanding of spliced leader trans-splicing has the potential to facilitate the development of new drugs to treat parasitic infections.

www.abdn.ac.uk/people/b.mueller

Darren Obbard

University of Edinburgh

genomics; metagenomics; viruses; evolution; drosophila

We study the evolutionary genomics of hosts and pathogens, primarily using Drosophilidae and their viruses as a model system. We also work on other pathogens of Drosophila, and on the viruses of other invertebrate hosts, and we have a particular interest in the evolution of RNA interference pathways. We predominantly apply computational population genomic, phylogenetic, and metagenomic methods based to our own field collections and to public data (70%), but we also do experimental studies in Drosophila (30%). We are interested in such questions as "Do hosts and viruses engage in a coevolutionary 'arms race'?", "How much of evolution is driven by host-pathogen interaction?", "What determines the host range of pathogens, and what determines the pathogen community of viruses?".

https://obbard.bio.ed.ac.uk/

David O'Hagan

University of St Andrews

organofluorine; chemical biology; organic synthesis; enzymology

Our research has a strong focus on organo-fluorine chemistry, and particularly organo-fluorine chemistry focused on bioorganic and chemical biology research. We are

interested in the influence of the fluorine atom on the behaviour of biomolecules. We also have a strong interest in enzymatic fluorination (the fluorinase) and how that can be applied to biotechnological solutions, through molecular biology, towards the production of organisms that can produce organofluorine compounds by fermentation (eg. antibiotics).

https://davidohagangroup.wp.st-andrews.ac.uk/

Achim Schnaufer

University of Edinburgh

parasitology; mitochondrial biology

Our lab aims to understand mitochondrial biogenesis, metabolism and RNA processing in trypanosomatid protozoa, which are important parasites of man and livestock, and to utilize that knowledge to inform drug development.

https://schnauferlab.bio.ed.ac.uk

Manon Schweinfurth

University of St Andrews

evolution; cognition; animal welfare; cooperation; behavioural experiments

Together with my team, I investigate the evolutionary and psychological origins of cooperation. In particular, I am interested in why and how individuals cooperate with others instead of being selfish. To investigate these questions, I mostly study chimpanzees and rats besides humans. Most of my studies are based on predictions derived from game theoretical models that I test experimentally in both lab and field settings. My research provides important insights into the social life of rodents and primates, which I use to inform and improve animal welfare and conservation efforts.

https://manon-schweinfurth.jimdofree.com/

Jie Sui

University of Aberdeen

self; social brain; cognition and emotion; health and wellbeing; technologies and methodological development

Our group is interested in understanding relationships between human brain functions and social cultural experiences and their influence on adaptive behaviour. This is underpinned by a methodological interest in scientifically measuring aspects of the human self in different populations including younger and older adults, neurodivergent people, and individuals with mental health issues. A unifying topic in our research is the close fusion of experiments (e.g., psychophysics, virtual reality), state-of-the-art neuroscientific techniques (e.g., EEG/ERP, MRI/fMRI, TMS), and computational analyses of human behaviour to discover new approaches to understand the nature of the self in mind and brain, and how we can use that to improve human cognitive and health conditions and society.

www.abdn.ac.uk/psychology/people/profiles/jie.sui/

Clare Sutherland

University of Aberdeen

wellbeing; human behaviour; human neuroscience; social neuroscience

Our research looks at human social behaviour. We are interested in psychological, biological and brain mechanisms of social perception, particularly how people interpret social cues from faces and bodies. For example, what makes a face or a body look healthy or attractive? Why do people trust strangers at first glance? We are also interested in AI face technology and in human face identification.

www.abdn.ac.uk/psychology/people/profiles/clare.sutherland/

Jens Tilsner

University of St Andrews

plant cell biology; virus; plasmodesmata; microscopy; RNA imaging

Our research is focused on host-pathogen ans, interactions of plant-infecting viruses and in particular, how their replicating RNA genomes are transported between cells through plant cell junctions (plasmodesmata), which are unique membrane nano-channels with no direct equivalent in animal systems. We also investigate the structure, function and regulation of the plasmodesmata in the normal physiological context of uninfected plants. We employ a wide variety of experimental approaches, including imaging (confocal, super-resolution, electron microscopy, live-cell visualisation of RNA), molecular biology, protein biochemistry and structural biology and genetic modification of both plants and viruses.

www.st-andrews.ac.uk/biology/people/jt58

Neil Vargesson

University of Aberdeen

animal systems; health and wellbeing; limb development; embryonic development; teratogens

Work in the lab focuses on normal and abnormal limb development, in particular the role the blood vessels play in controlling limb development. Previously shown how Thalidomide caused limb malformations, through targeting blood vessels. Currently interested in how limb outgrowth and length is controlled so all the limbs are the same relative size. This will shed light on how limb reductions come about.

www.abdn.ac.uk/ims/profiles/n.vargesson

Craig Watkins

Moredun Research Institute

mycobacteria; microbiome; molecular microbiology; immunology and genetics

My interests have been in applying molecular approaches to the understanding of host immune responses to disease and bacterial genomics, with respect to Mycobacterium avium subspecies paratuberculosis (MAP) – the infectious agent responsible for Johne's disease. Recently my research interests have extended to studying the microbiota of the intestine of ruminants infected with MAP and environmental transmission of MAP.

Previous & current Research Interests include:

- Functional studies of MAP genes, using gene knockout technology for vaccine development.
- Fluorescent microscopy of in-vitro MAP infected immune cells, including macrophages
- Immune responses in the host species, including RNA-seq (in collaboration with Roslin Institute)
- SNPs in transcription factors and their receptors of immune genes in sheep (in collaboration with Roslin Institute, Edinburgh)
- Co-infection studies using MiSeq sequencing of 16S rDNA to assess intestinal microbiomes in sheep under different environmental and health status conditions. (in collaboration with the School of Biological Sciences, University of Edinburgh)
- MAP transmission and contamination in the environment to establish infection control strategies on farm.

I have supervised a number of post-graduate students and I am also closely involved in preparing and presenting science to the public through the STEM (Science, Technology, Engineering and Mathematics) network and the

Communications team at the Moredun Research Institute.

https://moredun.org.uk/people/staff-directory/craig-watkins

Mike Webster

University of St Andrews

animal behaviour; behavioural ecology; social; learning; grouping

My research focusses on the function, underlying mechanisms and evolution of group-living in animals. My group uses both laboratory experiments and field studies to understand how and why animals form groups, taking in research into recognition, competition, social organisation, social learning, predator-prey interactions and responses to environmental change. My research philosophy promotes reproducibility, and I advocate for clearer reporting and mitigation of sampling biases. I am co-author of the STRANGE reporting guidelines that introduce a framework for the declaration and discussion of biases in published research.

www.st-andrews.ac.uk/biology/people/mmw1/

Kees Weijer

University of Dundee

development; live imaging; cell-cell signalling; tissue morphogenesis; mathematical modelling

My group investigates the interactions between cell-cell signalling and critical cell behaviours that organise large-scale tissue dynamics and morphogenesis. We study this during multicellular morphogenesis of the social amoebae Dictyostelium discoideum and gastrulation in the chick embryos. We use molecular genetic and physico-chemical perturbations, live imaging and biophysical modelling to elucidate critical cellular properties and behaviours controlling emergent tissue dynamics and morphogenesis.

www.dundee.ac.uk/people/kees-weijer

Ewelina Wojcik

Proteon Pharmaceuticals

bacteriophages; bacterial resistance; bioprocess

Proteon Pharmaceuticals has a platform to develop and commercialize phage-based products for the animal and human health industries, with centres of excellence and know-how to deliver research to the marketplace, reducing the risks of antimicrobial resistance and improving sustainability of livestock farming. Proteon Pharmaceuticals has a modern research and scientific infrastructure and employs scientists and young bioscience. This interdisciplinary group combines broad competences: from the ability to isolate bacteriophages, their molecular and genetic characteristics, to use of modern tools based on artificial intelligence to analyze biological data, to the optimization of biofermentation processes carried out on an industrial scale.

www.proteonpharma.com

Emma Wood

University of Edinburgh

memory; recognition; spatial cognition; neurophysiology; rats

A primary focus of our research is on the neural systems and circuits mediating spatial navigation and episodic memory; specifically, the ability to know where we are and how to get to where we want to go, and the ability to remember specific events from our lives. We research how networks of spatially modulated cells (such as place cells and head direction cells) located in the hippocampus, parahippocampal cortices, and subcortical structures, work and interact to underpin these cognitive functions, and the developmental trajectory of these circuits and cognitive abilities from juveniles to adulthood.

We use an integrated approach combining behavioural analysis with in vivo high

density electrophysiological recording in freely moving rodents, together with manipulations of the circuits using a variety of techniques including lesions, pharmacology, and molecular-genetic cell type-specific targeting tools.

This basic research guides our translational and collaborative research within the Simons Initiative for the Developing Brain investigating the circuitry underlying altered cognitive function in rodent models of neurodevelopmental conditions such as intellectual disability and autisms.

https://discovery-brain-sciences.ed.ac.uk/our-staff/research-groups/dr-emma-wood
https://sidb.org.uk/emma-wood/

Transformative Technologies

07

Ruth Andrew

University of Edinburgh

mass spectrometry; chromatography; steroid; glucocorticoid; metabolism

Ruth Andrew's research group studies the role of steroid hormones in metabolic disease using a series of biochemical flux and mass spectrometric (MS) approaches. Her team has revealed the role of the enzymes, 5alpha-reductases, in regulating metabolic health in translational studies from mice to man and also population cohorts. She actively pursues innovations in MS to offer new opportunities in steroid measurements and currently is studying application of mass spectrometry imaging in lipidomics.

https://search.ed.ac.uk/?q=ruth+andrew+research+group

Paolo Annibale

University of St Andrews

biophysics; fluorescence microscopy; superresolution Imaging; single molecule; cell signaling

I am a biophysicist with ten years of experience as a research microscopist, first using scanning probe methods, then fluorescence fluctuations and super-resolution techniques. This expertise builds on top of a training in solid state physics, molecular electronics and semiconducting thin films matured working in Italy, Switzerland the US, Germany and now the UK. I am currently researching fundamental molecular mechanisms modulating cellular signaling and the underlying pharmacology using quantitative spatiotemporal imaging approaches.

www.st-andrews.ac.uk/physics-astronomy/people/pa53/

David Clarke

University of Edinburgh

technologies and methodological development; Health and wellbeing; bioanalytical chemistry

The core research theme of our group is the application of modern techniques in mass spectrometry (MS) for the functional and structural characterisation of biological systems. Our research utilises a range of MS-based techniques including: top-down and middle-down fragmentation, ion-mobility mass spectrometry, native mass spectrometry, and hydrogen/deuterium exchange. These MS-based studies are supported by complementary biochemical analysis, chemical biology techniques and structural biology approaches.

www.clarkelab.co.uk

Scott Cockroft

University of Edinburgh

molecules; industrial biotechnology

Research in the Cockroft group spans organic chemistry and bionanotechnology. We combine molecules of synthetic and biological origins to examine the physical organic chemistry underpinning molecular interactions and the operation of molecular machines. We are developing new bioconjugation methods for chemically modifying biomolecules, including transmembrane protein nanopores and nucleic acids. We also study compounds capable of forming channels or disrupting lipid membranes.

www.cockroft.chem.ed.ac.uk/

Helge Dorfmueller

University of Dundee

technologies and methodological development; cells and industrial biotechnology

The research focus from the HD laboratory is on the biosynthesis pathway of the Group A Carbohydrate. In order to reveal details into the biosynthesis of this Streptococcus pyogenes virulence factor, we are applying a range of disciplines ranging from molecular biology, synthetic biology, biochemistry, mass-spectrometry and structural biology. The fundamental insights into the pathway are translated into drug discovery and vaccine development projects. We have recently developed a vaccine production platform that allows the production of recombinant streptococcal vaccine candidates that combine pathogen specific protein antigens with pathogen specific carbohydrates.

www.dundee.ac.uk/people/helge-dorfmueller

Alison Hulme

University of Edinburgh

chemical biology; protein labelling; biomolecular imaging; Raman microscopy; drug discovery

Hulme Group research integrates synthetic methodology development with chemical biology to provide molecular level insight to challenges in biology and medicine. Current research is focused on the development of new tools to probe protein-protein interactions, from stapled peptides, PROTACs, DUBTACs and molecular glues, to the synthesis of bespoke time-resolved proximity labelling probes. With colleagues at the Edinburgh Cancer Research UK Centre, I have also pioneered the application of stimulated Raman scattering (SRS) microscopy to the life sciences and medicine (ChemSci 2017, JMedChem 2020), and I was awarded for my work the 2021 RSC Bader Award for her work on label-free Raman imaging in cells.

https://hulmegroup.wordpress.com/

Jeremy Graham

Cairn Research Ltd

microscopy; fluorescence; optogenetics; imaging; bioscience

Our collaborations with academic researchers and students through the EastBio Doctoral Training Program has proved invaluable within several areas of our business. In particular it has allowed us to validate certain products using direct interaction with students and supervisors at St Andrews. We have also been involved in building a custom microscope for high-speed imaging. We have engaged in significant collaborative development of both hardware and software for a variety of imaging applications. This collaboration continues with plans for the secondment of a student over the course of 2024.

www.cairn-research.co.uk

Tom MacGillivray

University of Edinburgh

health; imaging; analysis; data; brain

My research utilises the eye as a window to diseases affecting the human vascular and nervous systems. I aim to harness tools and technologies in image analysis and AI to devise novel strategies for reducing disease susceptibility and increasing resilience in the aging eye, body, and brain. This enables the development of better methods for more precisely targeting and personalising ways to reduce the risk of disease progression in tandem with the repair and restoration of lost function.

www.ed.ac.uk/profile/dr-tom-macgillivray

Julien Michel

University of Edinburgh

technologies and methodological development ; molecules; cells and industrial biotechnology ; health and wellbeing

My group researches new computer simulation methodologies to model interactions between pharmaceuticals and biomolecules. The software and methodologies we develop are used to support the rational design of small molecules and proteins for drug discovery and biotechnological applications in academia and industry. Group members come from a variety of backgrounds in Chemistry, Biochemistry, Physics, Engineering, and are united by a passion for applying quantitative modelling and chemical methods to advance healthcare.

www.julienmichel.net/lab/

Diego Oyarzun

University of Edinburgh

engineering biology; artificial intelligence; computational sciences; biotechnology; biomedicine

We develop computational tools to engineer biological systems for applications in biotechnology and biomedicine.

https://homepages.inf.ed.ac.uk/doyarzun/

James Prendergast

University of Edinburgh

bioinformatics; genetics; genomics

My research is focused on using quantitative techniques to understand how the genome and regulome shape important mammalian phenotypes. My lab takes a holistic, cross-discipline approach to this. From generating improved genomics resources such as graph genomes, through generating novel functional datasets such as the first genome-wide massively parallel reporter assays in cattle, to applying machine learning approaches to use novel omics data to identify functional regulatory variants, all the way to generating novel ways of presenting, analysing and sharing these resources via novel software, bioinformatics workflows and genome browsers.

www.research.ed.ac.uk/en/persons/james-prendergast

Marius Wenzel

University of Aberdeen

bioinformatics; genomics; epigenetics; evolution; molecules

I am an evolutionary biologist with broad interests in fundamental questions regarding the evolution of phenotypes, physiology, behaviour, ecology and biodiversity, spanning all levels of biological organisation from cells to ecosystems. The main themes of my research include phylogenomics, comparative genomics, transcriptomics, epigenomics and conservation genetics. I am particularly interested in genome evolution and the role of epigenetics in the evolution of functional phenotypic diversity.

My research emphasises the use of high-throughput sequencing to characterise genomes, transcriptomes and epigenomes in wild and laboratory systems, and involves a large amount of bioinformatics data mining. A large component of my computational interest is the utility of long-read sequencing using Oxford NanoPore and PacBio technology for characterising environmental samples, obtaining full-length transcript repertoires and assembling complex eukaryotic genomes.

www.abdn.ac.uk/people/marius.wenzel

Maarten Zwart

University of St Andrews

neuroscience

We are interested in the neuroscience of how animals move to meet their needs. We explore the mechanisms that underlie the generation of movements using a combination of multi-disciplinary approaches that include imaging, electrophysiology, and connectomics. We are also a maker lab, building custom microscopes and other setups to help us do the experiments we want to do.

We use the zebrafish and fruit fly larva model organisms to see how the nervous systems of these diverse animals have evolved to move around in their environment.

www.zwartlab.com

Dr Jacob Francis and Dr Stefan Pulver - EastBio Symposium, Edinburgh, 12 June 2023
image credit: @Mark Reynolds

Design: Graphic Design Service, LTW, ISG, The University of Edinburgh

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