PN
Physiology News

Issue 133 / Spring 2024

Poisoned hearts:
Exploring the harmful effects of toxic environments

The Physiological Society

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Physiology News

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Welcome to the Spring 2024 edition of *Physiology News*

Introduction

News and Views

Features

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New eras: The excitement, trepidation and fortunes of change

Alanna Orpen

Media and Communications Officer, The Physiological Society

How do our stories begin and what fills the chapters along the way? In this Spring Issue of *Physiology News* magazine, our members, journal authors and community of physiologists around the world share their passions, and show us how their experiences propelled their varied careers; from treating patients living with mental health conditions to tackling environmental threats, we discover what drives each of them and how physiology is perfectly positioned to tackle big societal challenges.

Firstly, news from our community. *Physiology News* will be entering its own period of change. This will be the last print issue of *Physiology News* as the magazine will be re-launched this autumn as an online-only magazine. Professor Lucy Green, Trustee and Chair of Communities Committee, explains what you can expect from a new, online member magazine (p.7).

Last year, *Experimental Physiology* transitioned from being a subscription journal to a Gold Open Access journal. On p.12, Lucinda Periac-Arnold, Head of Publishing at The Society, looks back at *Experimental Physiology*'s first year as a Gold Open Access journal, sharing the opportunities and challenges of this new and exciting landscape for our authors and the physiological community.

Also, in the field of publishing, preprints could be a game changer for physiology research. Dr Sandra Franco-Iborra and authors from ASAPbio, US, wish to raise awareness of this innovation and encourage the community to embrace the open platform, explaining how preprints could amplify the impact of your research (pp.14-15).

Are we at a pivotal moment for helping those living with addiction? Professor Anders Fink-Jensen (Psychiatric Center Copenhagen, Denmark), a clinical psychiatrist working on treating and researching mental health conditions, has advanced the research into a particular group of compounds, called GLP-1 receptor agonists. In his interview on pp.24–27, he talks about how these compounds could offer a new hope for the development of anti-addiction drugs.

When it comes to matters of the heart, Dr Jennifer Reed (University of Ottawa Heart Institute, Canada) is concerned about the lack of programmes designed to meet women's needs to reduce their risk of cardiovascular disease, a principal cause of premature death. On pp.16-19, meet the women working in exercise science and cardiovascular rehabilitation to prevent and treat cardiovascular disease in women.

How our hearts and bodies respond to different training regimens set Dr Aurel Leuchtmann (University of Basel, Switzerland) on a path to understand the molecular mechanisms behind the benefits of exercise. The search resulted in Aurel and his co-authors winning *Physiological Report*'s Paper of the Year 2023 (pp.28–31).

For our 2023 Rob Clarke Award winner, Anupa Sara Paulose (University College Dublin, Ireland), improving the outcomes of patients living with dementia is an issue that is close to her heart. In her article on p.41, she talks about how this personal connection with the disease fuels her ambition to join the global research efforts to combat the illness. Read our interview with Anupa to learn more about her undergraduate research project for the award.

On pp.20–23, read our interview with Fellow Member, Professor Holly Shiels (University of Manchester, UK) as she warns of the damaging effect of fossil-fuel pollution on human hearts. Holly's comparative physiology work on extreme environments has meant that a vulnerable link to pollutants shared by fish and human hearts led to quick action, calling for changes to public health guidelines.

Another warning call for action is the 'Red Alert' article by Shania Pande, Policy Officer at The Society (pp.10–11). Learn more about the policy team's climate and health project and their report calling for a national heat resilience strategy, a multidisciplinary approach rooted in physiological understanding to tackle extreme heat and protect vulnerable groups.

To increase the visibility of physiology and The Society, Dariel Burdass, Chief Execuitve of The Society, informs us of The Society's Royal Charter application (pp.8–9). Find out more about the steps to gaining this accolade and how it can enhance public trust in The Society and elevate members' profiles, to name but a few of the benefits.

For those new to lecturing, help is at hand in the form of a series of video resources on our Training Hub. Professor Matthew Mason (University of Cambridge, UK) shares the topics and concepts covered by experts in the current set of videos to help you teach important and challenging areas (pp.38–39).

If you are looking for a grant, then turn to p.40 as Julia Attias, Membership Programmes Manager at The Society, tells you how to use our new Physiology Grants Directory. We hope it will be your 'go-to' place for finding physiology-related opportunities.

This issue of *Physiology News* demonstrates all of the fantastic ways in which physiology is improving human health, and what better way to celebrate this than through our annual celebration 'Physiology Week'. This ran in November last year and you can find out more about the global events that took place on pp.44–45. Continuing the theme of celebration, on p.42 we hear about the innovative, life-saving physiological research of the Extreme Environments Group at the University of Portsmouth. Their research has influenced global practices and policies, improving both athlete and occupational safety in extreme environments, for which they were presented with the inaugural Excellence in Physiology Award.

Catch-up with our events on pp.34–37, browse the meeting previews to gather with your community for those all-important networking and collaboration opportunities. Then the remarkable achievements of world-renowned leader in science, Professor David Brown, are honoured in a tribute written by Professor Mala Shah (University College London, UK).

Without further ado, enjoy the issue, beginning with Professor David Attwell and his review of events past, present and future in his President's View on p.6.

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My second year of presidency

Reviewing our activities and looking ahead at things to come

Professor David Attwell

President, The Physiological Society

Now, in the second year of my presidency, it is a good time to review events within The Society since I last wrote in August 2023, and outline what is coming up in the near future.

Climate Change and The Physiological Society

Life as we know it, and specifically physiology, may be on the brink of serious change. It was just announced that, for the first time on record, global warming has exceeded 1.5°C over the last 12 months, the Greenland ice sheet lost nearly 200 billion tons of ice last year, and water flow in the so-called Atlantic meridional overturning circulation (which includes the Gulf Stream that keeps the UK warmer than it would be otherwise) may be on the threshold of breaking down. It is thus with impeccable timing that The Society has (with the Faculty of Public Health) recently presented a report to Parliament on Climate Change and Physiology (including useful guidance on the best way to stay cool when the thermometer hits 40°C). The report is available here: www.physoc.org/heatresilience.

In mid-February, we held an online meeting with Wellcome on the link between extreme heat and mental health, and work on physiology in extreme environments (as we may experience in future!) has been recognised by The Society awarding its first Excellence in Physiology award to the Extreme Environments Laboratory at the University of Portsmouth (www.physoc.org/about-us/excellence-in-physiology/excellence-in-physiology-award/).

Awareness of the link between human activity and climate change is pushing many organisations, including The Physiological Society, to revise their arrangements for committee meetings in order to become more environmentally sustainable by reducing travel and unnecessary CO_2 emissions.

Publications

In line with our environmental sustainability policy, and to reduce costs, the Board of Trustees have decided that *Physiology News* will move to purely online publication. Its structure will also be reorganised to give members an enhanced experience (see News and Views section for more information).

Experimental Physiology has now flipped to completely Open Access publication, and we are anticipating an increase in submissions after an initial dip, which we are told always accompanies such a flip.

For *The Journal of Physiology*, the major event on the horizon is the re-negotiation of our publishing contract with Wiley for the period after 2026. Given that this journal serves as the primary income stream for The Society, the pivotal decision of whether to continue with Wiley or explore alternative publishers hinges largely on the potential profitability we can secure through negotiation.

Raising awareness of Physiology

In November 2023, we celebrated Physiology Week, coordinating events involving hundreds of people all over the world. See www.physoc.org/physiologyweek/ and watch our video www.youtube.com/watch?v=jpxkxuhgqQU to see a few highlights of the events.

We also unveiled the latest in our series of Blue Plaques that commemorate important physiologists, with the aim of bringing them to the attention of the local population. In September 2023, we visited Newcastle University to unveil a blue plaque that commemorates Francis Arthur Bainbridge who demonstrated how the amount of blood flowing into the heart controls the heart rate.

Training events

The Society unveiled a new online Training Hub (www.physoc.org/training-hub/) as a benefit for members, with videos and resources on a number of topics that are essential for teaching physiology. I was impressed to learn some novel concepts in cardiovascular physiology from the first video I looked at, so I encourage you all to check out what is available there.

The Training Hub also presented events on The Application of Stable Isotope Tracer Techniques in Human Physiological Research (at the University of Nottingham), an Introduction to Innovation and Intellectual Property (online), and two Research Project Management courses (online).

We have recently held two training events: Navigating your Career after a Postdoc (29 February, online); and Best Practice in *in vivo* Research (26 March, at the University of Bristol). The next one is our Physiology Education meeting in May at the University of Salford.

Scientific Meetings

The Society has had a series of successful meetings since last August**.** These included two-day meetings on Membrane Transport (University of St Andrews), Cross-Talk of Cells in the Heart (University of Liverpool), Regenerating the Cardiovascular System (University of Oxford), and Drowning Prevention and Treatment (online). Our annual Member Forum at the Royal Society gave members the chance to ask The Society's Trustees questions about the way The Society and its journals are being run, and included a fascinating Presidential Lecture and question-and-answer session by Sir Jeremy Farrar (now Chief Scientist of the World Health Organization, and previously Director of the Wellcome Trust) on the practical politics of influencing science funding and government policy.

Across 2024, we have our largest ever programme of two-day meetings. The first of these on Dietary Manipulations for Health and Disease was held in March at Manchester Metropolitan University. We are looking forward to the next ones: Neuroplasticity in Brain Health and Disease (April, Newcastle University) and Regulation of Smooth Muscle Function (June, Dundalk Institute of Technology, Ireland). For a full list of events across the year please visit www.physoc.org/events.

The highlight of the year will be our Annual Meeting with the Scandinavian Physiological Society, at Northumbria University in Newcastle on 2–4 July, for which the registration period and abstract submission are now open. With seven plenary and keynote lectures, and a broad range of symposia, and oral and poster sessions, the programme looks outstanding. I hope to meet as many of you there as possible!

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Physiology News is changing

Professor Lucy Green

Trustee and Chair of Communities Committee

I always look forward to reading *Physiology News (PN)* magazine. From the scientific feature articles to the stories about the achievements of our members, the magazine embodies the sense of community that makes The Physiological Society feel like a family.

The magazine has been through several periods of change over its lifetime and we are now entering another. Later this year *PN* will be re-launched as a new, online magazine.

Why are we going online?

In an era where digital transformation shapes every facet of our lives, our new magazine marks a significant stride towards meeting the needs of our global community of physiologists. Over the last few years, there has been a huge increase in members reading our news features online. We know that, particularly as working patterns have shifted post pandemic, members value the flexibility of being able to access the magazine from anywhere around the globe.

Sustainability is another key motivator. Reducing the carbon footprint associated with physical print production and distribution is a responsible step forward. The new magazine will eliminate the need for paper, ink, and physical delivery, aligning with our drive to reduce our impact on the environment and support efforts to tackle climate change. It also allows us to reduce the costs associated with printing and delivery, which enables us to focus our resources on supporting our members.

What to expect

The new *PN* will launch from a brand new online media platform on our website, which provides a broader range of content types and incorporates interactive features to enrich the reader's experience.

The magazine will provide a clear voice for our members, highlighting achievements and supporting the community. We will feature interviews with physiologists from across the world, highlighting their engaging science as well as their experiences and stories. Each issue will be themed around a topic, broad enough to allow us to explore it from a wide range of physiological perspectives. We will also be able to link these to other Society activity, such as our conference programme and our journals.

The relaunched *PN* will be released three times a year and members will have exclusive access to the latest issue using our member area on our website. The existing *PN* archive is remaining in place, so you will always be able to access our back catalogue of issues.

Member-led

As a membership Society, everything we do is to support physiologists and to advance the discipline of physiology. Our new magazine will put members right at the heart in generating scientific and news content. The *PN* Advisory Group, made up of members, has a wealth of experience and expertise to shape the magazine and we are always looking for members to engage with us directly.

Looking ahead

The first issue of our new *PN* will launch in the autumn. I know that, for some, there will be a degree of trepidation about these changes, particularly the move to online only. This speaks to the important role The Society plays in the lives of our members: you care about The Society's future direction and value *PN* as part of this. I share this view and, as a Trustee, I am determined to ensure the new *PN* meets the needs of the moment. That requires us to be more environmentally and financially sustainable while embracing new forms of media to deliver a magazine that engages readers and speaks for our community. I look forward to hearing your views later in the year.

I would like to finish by thanking all those who have been part of *PN* so far. Over the last few years the magazine has been steered by Keith Siew as Scientific Editor, and his enthusiasm and commitment to *PN* has driven it forward. From our many authors and contributors, to the dedicated Editorial Board, it is truly a team effort.

Most of all, thank you to our members who make *PN* so much more than just a magazine. It's at the heart of our community, and I can't wait for you to see the next chapter.

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Building on strong foundations and celebrating our future

Dariel Burdass

Chief Executive,
The Physiological Society

At the 2023 Member Forum, The Society shared the exciting news that it had applied for a Royal Charter during the CEO's annual report to members.

Further information about what this would mean for The Society and next steps are outlined below.

Background

In 2020, during Professor Bridget Lumb's tenure as President, the Board of Trustees approved the recommendation to pursue a Royal Charter for The Society, and seek approval for Royal status, thus enabling a name change to 'Royal Physiological Society'. The Board considered that a future Royal Charter would recognise our organisation's prestigious 140-year heritage and expertise within the field of physiology. It would also acknowledge our pre-eminent work in promoting the academic discipline of physiology: supporting those working in the field by organising world-class conferences, publishing the latest developments in our scientific journals and offering grants to support research and collaboration.

However, along with the honour of receiving a Royal Charter comes a set of responsibilities, particularly regarding The Society's obligation to serve the public benefit[1] through our Purpose, which is *to support and inspire our community to advance the physiological sciences*. One way we do this is through highlighting the pivotal role that physiology research plays in addressing global challenges to a broader audience, including policymakers and funders.

Honorary Fellow of The Society, Professor David Paterson, spearheaded the Royal Charter initiative during his role as President-elect and President (2019–2022), in collaboration with Society staff and legal counsel from The Society's solicitors, BDB Pitmans.

What is a Royal Charter?

A Royal Charter is a formal document, granted by the Monarch, on the advice of the government. It is a legal instrument that bestows independent legal personality upon an organisation, defining its objectives, constitution, and powers to govern its own affairs.

Originally, a Royal Charter was a procedure by which the Crown could grant corporate personality to bodies of persons conducting activities for public or private benefit. The term 'Royal Charter' has since evolved into an honorary distinction. Today, it is bestowed upon eminent professional bodies or charitable organisations with a proven track record and sound financial standing, as assessed by the Privy Council. An institution incorporated by Charter is, subject to the general law, generally self-regulating and not answerable to the Privy Council or the Privy Council Office in relation to the conduct of its internal affairs.

Internationally recognised as a mark of quality, the Royal Charter is now selectively granted to organisations that excel in their respective fields and uphold certain criteria. Since the 1950s one of these criteria has been that the petitioner shall exist not solely to advance the interests of its members but also, and primarily, to advance the public interest.

Past President and Honorary Member David Paterson

'Our Society members have contributed to numerous Nobel Prizes in Physiology or Medicine. A Royal Charter would be a fitting accolade to acknowledge the long legacy of discovery in the physiological sciences. Importantly, the Charter will increase the visibility of physiology and The Society by providing a path for future generations to continue this discovery.'

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Why is The Physiological Society petitioning for a Royal Charter?

There are a number of reasons and some of these are outlined below:

- **Recognition of professional expertise**
  Obtaining a Royal Charter is a prestigious acknowledgment of the high level of expertise and professionalism within the organisation. It serves as validation of The Society's dedication to advancing knowledge and excellence in the field of physiology, thereby enhancing its credibility, and standing among peers, stakeholders, and the broader community.

- **Enhanced public trust and awareness**
  The prestigious status conferred by a Royal Charter can significantly enhance public trust and confidence in The Society and its members. It serves as a mark of quality and excellence, signalling to the public that The Society is a reputable and trustworthy authority in the field of physiology. This increased trust and awareness can lead to greater engagement, support, and participation from the public, stakeholders, and potential collaborators.

- **Elevating the organisation's and members' profiles**
  The use of 'Royal' in The Society's name can elevate its profile and visibility, both nationally and internationally. This heightened recognition can attract attention from key stakeholders, including policymakers, funding bodies, other institutions, researchers and media, thereby enhancing opportunities for collaboration, networking, and advocacy. Additionally, individual members may benefit from the enhanced prestige associated with belonging to a Royal Society, which can facilitate career advancement, networking opportunities, and professional recognition.

- **Strengthening the organisation's brand and fostering aspiration**
  The attainment of a Royal Charter can strengthen The Society's brand identity and positioning within the field of physiology. It communicates a sense of excellence, tradition, and authority, distinguishing The Society from its peers and competitors. This can inspire pride and loyalty among members, as well as attract new members who aspire to be associated with a prestigious and influential organisation. Furthermore, the Royal status can serve as a source of motivation and aspiration for current and future generations of physiologists, encouraging them to strive for excellence and contribute to the advancement of the profession.

Applying for a Royal Charter

The first stage of applying for a Royal Charter – and convincing the Privy Council it is in the public interest – is probably the most difficult part of the process.

The Society was required to demonstrate through an initial Royal Charter Memorandum and letters of support from other Royal Societies[2] the following:

- our public benefit
- our proven track record of stability
- a constitution that ensures our proper governance
- representation of a unique area of professional expertise
- no significant overlap with any other operational Chartered or non-Chartered bodies who participate in physiology (outlining how our members differ significantly in their expertise and area of practice from the members of these bodies).

As noted at the Member Forum in December 2023, The Society's application for a Royal Charter[3] has passed its first stage of approvals. This means that we can now proceed to a formal application to the Privy Council for a Royal Charter.

In preparation for this we have been working with BDB Pitmans to undertake the compulsory governance work of drafting the Constitution, which comprises the Royal Charter and the associated Bye-laws (approved by the Privy Council) and Regulations (approved by the Board).

Application for a Royal Charter – next steps

1. **Coordinate with the Privy Council's Office to ensure approval of the draft constitution:**
   Work through the Privy Council Office to ensure that the draft Constitution meets the requirements of the Privy Council and garners their approval.

2. **Finalise and formalise the draft Royal Charter, bye-laws, and regulations:**
   Once consensus is reached on the content of the draft Royal Charter, Bye-laws, and Regulations, formalise these documents in an agreed-upon format.

The Society's application for a Royal Charter has passed its first stage of approvals. This means that we can now proceed to a formal application to the Privy Council for a Royal Charter

3. **Secure approval from The Society for constitutional documents and petition:**
   Obtain approval from The Society for the finalised constitutional documents and the formal petition to the Privy Council before submission.

4. **Seek approval from The Society's voting membership for Royal Charter status:**
   Present the finalised petition and constitutional documents to The Society's voting membership who would then need to pass a resolution to approve The Society's reorganisation as a Royal Charter, i.e. they would need to approve the petition and constitutional documents. This process is similar to when we updated The Society's Articles of Association in 2019.

5. **Application to use the word 'Royal':**
   Apply to the Cabinet Office for the use of the word Royal in our name (the application is more likely to be successful now that the Privy Council has given its provisional agreement to the Royal Charter application). This will run concurrently with the application for the Royal Charter.

Footnotes

1 The Society as a registered charity currently operates for the public benefit as set out in our charitable objects.

2 These included the Royal Society, the Royal Society of Biology, various funders, and both clinical and academic allied Physiology Societies.

3 A Royal Charter is an instrument of incorporation, granted by The Monarch, which confers independent legal personality on an organisation and defines its objectives, constitution, and powers to govern its own affairs.

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RED ALERT: Why the UK needs a National Heat Resilience Strategy

Shania Pande

Policy Officer, The Physiological Society

2023 was the hottest year on record

The year 2023 was confirmed as the warmest year on record since 1850, with over 200 days having a new daily global temperature record for that time of the year.[1] In the UK especially, the length and frequency of extreme heat episodes are expected to intensify in the years ahead, as are the number of preventable heat-related deaths. Despite this, the UK remains as one of the most underprepared countries in the world to deal with the consequences of extreme heat. A national heat resilience strategy is therefore a crucial step in the effective preparation and implementation of a multidisciplinary approach to tackle this extreme heat.

Extreme heat particularly affects the most vulnerable in society

Heat-related impacts occur mostly among vulnerable groups either due to reduced physiological capacity to cope with extreme temperatures or living and working in environments that are inappropriate for the rising temperatures. These vulnerable groups include older people, people who are pregnant, people with pre-existing health conditions or people who take certain medications, as well as those exposed to higher temperatures at work, or due to lack of shelter (such as people who experience homelessness).

However, we know very little about the underlying physiological mechanisms that make people more vulnerable to heat. It is important that the UK's national strategy is rooted in an understanding of how heat impacts the normal physiology of individuals, particularly these vulnerable groups. As Associate Professor Zoe Saynor from the University of Portsmouth notes, *"We need a much better understanding of how heat affects different individuals, not only their physiology but also the external environment and the relationship between the two.*[2]

Responding to extreme heat requires coordinated action

To support and protect individuals and communities across the country, The Physiological Society partnered with the Faculty of Public Health to produce a report, which makes recommendations for the UK Government and devolved administrations to develop a Heat Resilience Strategy to coordinate action in the following areas:

1. **Research**: Establish a *Heat Adaptation Research Exchange Taskforce* to tackle research gaps and increase the speed of research translation into policy and action. The taskforce should focus efforts on those deemed most vulnerable and where the most significant research gaps remain, including older people, pregnant women and people with pre-existing conditions, and those who take prescription medications.
2. **Built environment:** Form a *Human-Centred Climate Adaption Design and Planning Institute* to accelerate the adaptation of the built environment to higher temperatures, with governments across the UK mandating thermally efficient design principles and promoting the use of green infrastructure.
3. **Businesses:** Employers must develop a physiologically informed and sustainable plan for workers during extreme heat events to protect health, safety, wellbeing and productivity.
4. **Public health**: Improve early warning systems and bring together public health professionals from across the UK and devolved governments, local authorities and charities to deliver a public health campaign focused on improving long-term resilience and preparedness for extreme heat amongst vulnerable groups.

Launch event for the report *Developing a Human-centred Heat Resilience Strategy* in partnership with the Faculty of Public Health in the Houses of Parliament, London.

To support and protect individuals and communities across the country, The Physiological Society partnered with the Faculty of Public Health to produce a report which makes recommendations for the UK Government and devolved administrations to develop a Heat Resilience Strategy

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From left to right: Stephen Benn, Viscount Stansgate; Dr Candice Howarth, Grantham Research Institute on Climate Change, LSE; Professor Elizabeth Robinson, Grantham Research Institute on Climate Change, LSE; Dr Cat Pinho-Gomes, Faculty of Public Health and UCL; Baroness Fiona Twycross, Deputy Mayor of London for Fire and Resilience; Carl Petrokofsky, UK Health Security Agency; Professor Mike Tipton, The Physiological Society and University of Portsmouth

Extreme temperatures not only impact people's physical health, but are also associated with a rise in mental ill health. However, there is a lack of information about the relationship between physiological and cognitive functions that drive poor mental health outcome

Extreme heat exacerbates not only physical but mental ill health

Extreme temperatures not only impact people's physical health, but are also associated with a rise in mental ill health. However, there is a lack of information about the relationship between physiological and cognitive functions that drive poor mental health outcomes as well as increases in hospital admissions from attempts to take one's own life during periods of extreme heat.

To this end, The Society organised an online webinar with the Wellcome Trust in February this year to understand how heat affects mental health and physiology's role in mitigating it. The roundtable was attended by experts in climate science, mental health and physiology from a range of high-income as well as low-and middle-income countries.

As the Chair of the project's Steering Group, Professor Mike Tipton, also from the University of Portsmouth, noted at the report's launch in Parliament, *"Physiology is absolutely critical to doing the right things to adapt and mitigate these challenges of heat, but physiology can't work alone. We have to work in collaboration with architects, public health officials, clinicians, botanists, town planners, and in that way we can get to the optimum solution for the challenges ahead."*

Decision-makers need to pay closer attention to physiologists

Physiological research will be crucial in understanding the impact of extreme heat on human health and developing a sustainable response.

If you would like to be involved in The Society's future projects on Climate & Health, please contact the policy team at policy@physoc.org.

To read our latest report *Developing a Human-centred Heat Resilience Strategy* and look at our past work in the area, please follow this link: physoc.org/policy/climate-change-and-health/.

References

1 Copernicus Climate Change Service. *Copernicus: 2023 is the hottest year on record, with global temperatures close to the 1.5°C limit.* Available at: https://climate.copernicus.eu/copernicus-2023-hottest-year-record

2 The Physiological Society. *Report Launch: Developing a Heat Resilience Strategy.* Available at: https://www.youtube.com/watch?v=EyGca3D3ez4

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The Physiological Society Prize winner announced at STEM for Britain 2024

The Physiological Society Prize was awarded to Grace Meaker (University of Oxford, UK) at STEM for BRITAIN

On Monday 4 March, early-career researcher scientists, politicians and a panel of expert judges attended Parliament for STEM for BRITAIN, a major scientific poster competition and exhibition. The event is organised by the Parliamentary & Scientific Committee to give members of both Houses of Parliament an insight into the outstanding research being carried out at UK universities by early-career researchers.

The Physiological Society Prize was judged by a panel of physiologists, including Chair of The Society's Policy Committee Chair, Professor Mike Tipton, and Chair of Communities Committee, Professor Lucy R Green.

Speaking after presenting the award to Grace, Professor Tipton said:

"The Physiological Society is proud to support STEM for Britain, which gives the opportunity for early career physiologists to talk directly to politicians about their research".

"Every year we award The Physiological Society Prize to an early career researcher in physiology whose research stands out for being novel, robust and important. This year was no different. I was really impressed by the first-class science on display. Awarding Grace The Physiological Society Prize is a testament to her excellent research on stem cells, her colleagues and supervisors, it also shows how critical physiology is for understanding how blood stem cells are regulated and produced, this could lead to the development of new therapies."

Grace was shortlisted from hundreds of applicants to appear in Parliament. Her poster 'Sticky Stem Cells: How PVA promotes blood stem cell production' discusses the novel discoveries made from using PVA (found in the glue) to grow blood stem cells in the lab.

From left to right: Dariel Burdass (CEO The Physiological Society; Professor Mike Tipton (University of Portsmouth/Chair Policy committee, TPS), Grace Meacher (winner of TPS Prize, University of Oxford); Stephen Metcalfe MP; Lord Stansgate.

On winning The Physiological Society Prize, Grace said:

"I am delighted to have been awarded this prize and thank The Physiological Society for my award. It was a great experience to present my research in Parliament and to get feedback and questions from both academics and policy-makers. I would also like to take this opportunity to thank my supervisor Adam Wilkinson for his expertise and support in making this project possible. It is such an exciting time to be in stem cell research and I cannot wait to see how the field develops."

Stephen Metcalfe MP, Chairman of the Parliamentary and Scientific Committee, said:

"This annual competition is an important date in the parliamentary calendar because it gives MPs an opportunity to speak to a wide range of the country's best young researchers.

"These early career engineers, mathematicians and scientists are the architects of our future and STEM for BRITAIN is politicians' best opportunity to meet them and understand their work."

The Parliamentary and Scientific Committee runs the event in collaboration with The Physiological Society and a range of learned and professional societies.

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Experimental Physiology: Reflections on the transition to Gold Open Access

Lucinda Periac-Arnold

Head of Publishing, The Physiological Society

The Physiological Society is committed to the principles of open science. From 1 January 2023 our journal *Experimental Physiology* transitioned from being a subscription journal to being a Gold Open Access (OA) journal. The change diversified our publishing offering, both to our membership and to the wider physiological research community, and marked an exciting evolution in *EP's* 116-year history.

Open Access: One year on

Looking back at the first full year for *EP* as a Gold OA journal, there have been many learning opportunities for The Society at large as well as for the publishing staff behind the scenes and for the Editors involved. Throughout, our commitment to offering authors a first-class publishing experience with high-quality peer review at its heart has remained at the forefront. Our Editor-in-Chief, Professor Damian Bailey of University of South Wales has led that charge with characteristic passion and enthusiasm. Damian, along with our world-class *EP* Editorial Board, continuously support authors through their publishing journey, helping them to develop and hone their manuscripts in preparation for publication. In the move to OA, for the first time in its history (barring an anomalous year during the pandemic), *EP* reached over one million downloads. Those downloads reflect the global reach of our historic and prestigious title, with our readership spanning 220 out of 240 countries across the world[1].

Challenges with Open Access

With the global reach and new audiences that OA brings, it also brings challenges. One particular challenge has been the introduction of an Article Processing Charge (APC). APCs can be paid by the author, the author's institution, or their research funder, and can therefore create an additional barrier to submission for some authors. To address this, we stay in close contact with our publishing partner, Wiley, monitoring their already strong spread of Transitional Agreements globally. Transitional Agreements provide institutions with 'read and publish' access to journals, wherein they are able to access paywalled content, but also have a fund for authors based in the same institution to cover APCs without any cost to themselves[2]. As well as continuously monitoring these agreements, we also advocate for our communities where coverage can be improved and hope to see expansion in the future.

Open, accessible and rigorous

In a recent survey, more than 50% of our members identified OA as a strong reason for selecting a journal to publish in[3]. As the research publishing industry grapples with a rapidly expanding landscape of for-profit OA journals, it can be difficult for authors to know which OA journal to choose when submitting their manuscript. As a Society journal, *EP* prides itself on providing the physiology community with a trusted, high-quality, efficient and rigorous OA journal in which to disseminate their research. In addition, unlike the plentiful for-profit journals, profits from *EP* are reinvested back into the physiological community. By publishing in *EP*, you are supporting the future of physiology through funding The Physiological Society's charitable activities, including training, grants and events.

We look forward to another exciting year ahead for *EP* and remember, as a member of The Society you are entitled to a 10% discount on APCs when submitting to *EP*.

Footnotes

[1] Wiley Journal Insights

[2] Always check with your librarian

[3] Rated OA between 7 and 10 on a scale of importance in selecting a publication to submit to

ERRATUM

There was an error in the article 'Obituary: John Nicholls' published in PN132: Winter Issue. We printed that John Nicholls died in 2013, the correct date is 2023. We apologise for the mistake and the dates have been corrected to 1929-2023 in the online article at physoc.org/magazine-articles/obituary-john-nicholls-1929-2023/.

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Physiology research in the era of preprints

Dr Sandra Franco-Iborra
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Dr Jonathon Alexis Coates
Associate Director, ASAPbio

The authors are working in different disciplines, but all involved with ASAPbio (Accelerating Science and Publication in Biology) in the hope to increase the awareness and adoption of preprints and speed up the delivery of scientific results both within and outside of academia.

In the fast-paced world of scientific discovery, rapid dissemination of research findings is crucial for accelerating progress and knowledge sharing. However, the traditional publishing system hinders this process, leading to delays, increased costs, and limited access. Preprints, preliminary versions of scientific manuscripts that have not undergone formal peer review, have emerged as game-changers, dismantling barriers, and enabling immediate sharing of scientific ideas. The life sciences have gradually embraced this innovation, with bioRxiv and medRxiv gaining popularity. But in the field of physiology, the adoption of preprints lags behind. Unravelling the intricacies behind this slower uptake, we delve into key metrics of the current landscape and propose actionable strategies to bridge this gap and foster greater adoption.

Brief history of preprints

Preprints, originating from informal manuscript sharing, saw a significant shift with the advent of online repositories. ArXiv, established in 1991, accelerated research dissemination in physics. Despite biology's initial slow adoption, the launch of bioRxiv in 2013 marked a turning point, with preprints now constituting about 10% of life sciences publications. While early initiatives, such as the NIH information exchange groups, faced resistance from journals (Cobb, 2017), the landscape has evolved, with preprints gaining acceptance from both journals and funding agencies. Some funders, like ASAP (Aligning Science Across Parkinson's) and the Chan Zuckerberg Initiative, mandate preprint sharing before journal submission.

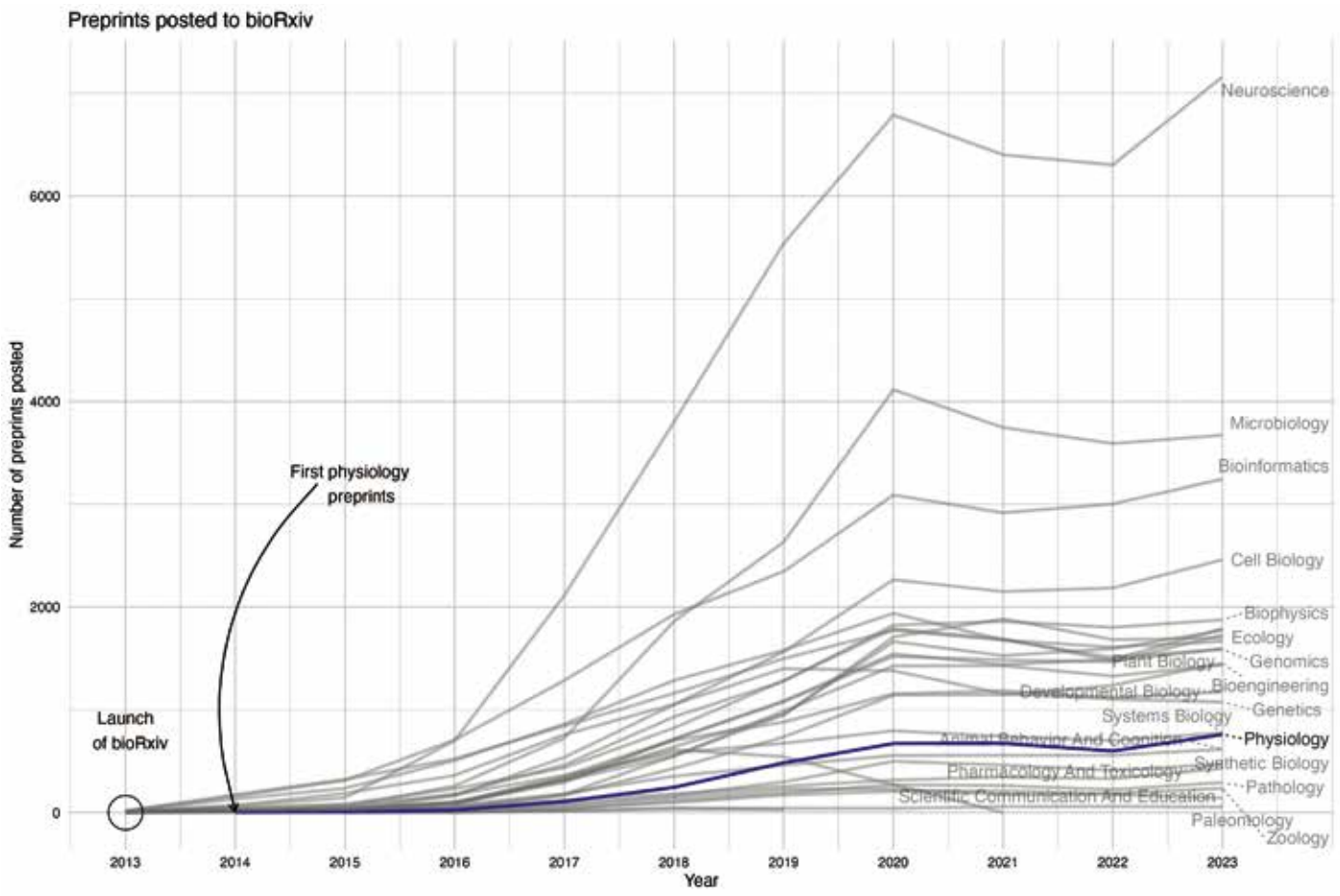

Figure 1. Number of preprints posted to bioRxiv per year and discipline

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Preprints in physiology

While preprints are widely accepted in life sciences, their adoption in physiology has been slower. Compared to other disciplines, physiology remains on the lower end of posted preprints per year on bioRxiv (see Fig.1), with much lower download rates (Abdill and Blekhman, 2019). Even now, while neuroscientists share over 7,000 preprints per year, physiologists contribute hundreds. Additionally, the proportion of physiology preprints that have been published is lower (50.7%) than the global rate on bioRxiv (~70%), with many opting for closed (CC-BY-NC-ND) licences (31%) or no licence at all (39%). Most physiology preprints are posted as a single version (77.6%), missing out on the advantage of updating them. These trends suggest reluctance among physiologists to openly share their research. While the reasons for this slower uptake are complex, the potential of preprints is undeniable. Could this open platform be the key to unlocking even faster advancements in our understanding of the human body? We firmly believe so. But what exactly makes preprints so valuable for the field of physiology?

Unleashing the power of preprints in physiology

Imagine amplifying the impact of your research, reaching wider audiences sooner, and accelerating scientific progress. Preprints offer all these benefits for physiologists, unlocking a world of possibilities. Studies show that preprinted articles attract more citations and attention than those directly published in journals (Fu and Hughey, 2019; Fraser et al., 2020). This increases visibility, particularly valuable for early-career researchers, and can even lead to journal invitations. Preprints shift the power dynamic, empowering authors to share their work when ready and gather valuable feedback before submission. This can spark collaborations and refine manuscripts for stronger publications. Beyond individual benefits, preprints contribute to a more open and efficient scientific ecosystem. During the COVID-19 pandemic, nearly 40% of research (Fraser *et al.*, 2021) was first shared as preprints, accelerating knowledge sharing (Besançon *et al.*, 2021) and potentially saving lives. Compared to traditional publishing timelines that can take months, preprints appear online within days on platforms like bioRxiv, facilitating rapid dissemination. For instance, a 2021 preprint (Ghosh *et al.*, 2021) highlighting a potential link between smoking and increased COVID-19 risk gained media attention six months before traditional publication, and potentially influenced public awareness. The advantages go beyond speed. Preprints decouple the quality of research from metrics like journal impact factor, promoting fairer evaluation. They also provide a platform for early-career researchers to showcase their work and gain recognition, fostering a more inclusive and diverse research landscape. Preprints are now accepted by most journals (including *The Journal of Physiology*, *Experimental Physiology* and *Physiological Reports*), making it easier to share your research in preprint repositories. Platforms like PREreview offer informal peer review before submission, helping refine your work and speed up publication. We recently ran the Crowd Preprint Review initiative, where 50 preprints received valuable feedback. Authors exchanged comments on bioRxiv, and even shifted their research focus based on the comments. Preprints can be also used to flip a traditional journal club and transform it into a preprint club, offering critical feedback directly to authors.

How to get started with preprints?

1. Read a preprint
2. Discuss a preprint at your next journal club or join/create a preprint review journal club
3. Review a preprint
4. Post a preprint when going to conferences or before submitting your next manuscript to a journal (*The Journal of Physiology* is part of the J2B service for direct submission)

Ready to accelerate your research, amplify your voice, and contribute to a more open, impactful physiology community? Don't wait, grab our checklist below and explore the resources available at https://asapbio.org/. Join the preprint movement today!

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Where are the women in cardiac rehabilitation?

Why we need more female scientists dedicated to improving the lives of women at risk of and with cardiovascular disease

Dr Jennifer Reed

University of Ottawa Heart Institute, Canada

I am a Clinician-Scientist (Registered Kinesiologist-Scientist), the Director of the Exercise Physiology and Cardiovascular Health Lab (EPCHL) and was recently appointed as Chair of Cardiac Rehabilitation in the Division of Cardiac Prevention and Rehabilitation at the University of Ottawa Heart Institute (UOHI), which is Canada's largest and foremost heart health centre dedicated to understanding, preventing, and treating cardiovascular disease. I am also an Associate Professor in the School of Epidemiology and Public Health in the Faculty of Medicine, and Adjunct Professor in the School of Human Kinetics in the Faculty of Health Sciences at the University of Ottawa. As I pull open the gleaming glass doors of 40 Ruskin Avenue, where the UOHI is located, I am reminded nearly daily that these roles are an honour and there is much to do when it comes to women's representation in cardiovascular health research.

A world of women focused on women's health

I have enjoyed a life-long passion for exercise and sport. I earned a doctorate in Kinesiology with a specialisation in exercise physiology from the Pennsylvania State University. Working in the world-renowned Noll Lab where Dr Elsworth R 'Buz' Buskirk once walked the halls, I studied clinical exercise physiology and neuroendocrinology in the Women's Health and Exercise Lab. My supervisors (N Williams, MJ De Souza) were women, my lab-mates, those who survived in the trenches with me, were women, and my doctoral research focused on the role of energy deficiency in reproductive, metabolic, and bone health of recreational and competitive female athletes. A world of women focused on women's health. But little did I know that this experience would starkly contrast with my academic pursuits to follow.

Where are the women in cardiac rehabilitation?

Soon after beginning a Postdoctoral Research Fellowship in cardiac prevention and rehabilitation at the UOHI in 2013 (I was awarded the Jan & Ian Craig Cardiac Prevention and Rehabilitation Endowed Fellowship), I began to wonder: Where are the women with cardiovascular disease? Why are women under-represented in our exercise-based cardiac rehabilitation programmes? Where are the women-focused programmes to meet their needs and address their poor cardiovascular health?

The state of affairs in women's cardiovascular health

Cardiovascular disease continues to be a principal cause of premature death in women, and was responsible for 35% of total deaths in women in 2019 (Vogel *et al.*, 2021). Yet, research shows that more than 40% of women lack knowledge of cardiovascular disease risk factors, or do not know their own risk level (Mosca *et al.*, 2013). This awareness gap is substantially greater for racial and ethnic minority groups (e.g., Black, Hispanic) (Mosca *et al.*, 2013). Women who suffer an acute coronary event (i.e. myocardial infarction, sudden cardiac death) are more likely than men to be physically inactive, have lower exercise capacity, and die in the next year. They also report poorer quality of life and mental health. There are global calls for action from healthcare providers and patients to improve the management of cardiovascular disease for women.

Current cardiac rehabilitation programmes do not meet women's needs

Strong evidence demonstrates that exercise-based cardiac rehabilitation participation improves exercise capacity, quality of life, mental health, and cardiometabolic risk factors, and reduces cardiovascular morbidity and mortality. A Cochrane systematic review showed that cardiac rehabilitation likely results in a 42% and 28% reduction in hospitalisations and myocardial infarctions, respectively (Dibben et *al.*, 2021).

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Current cardiac rehabilitation programmes do not appear to meet women's needs, as women are less likely to adhere to and complete current cardiac rehabilitation despite poorer cardiovascular disease risk-factor control. For those who participate in cardiac rehabilitation, more women than men demonstrate poor exercise capacity, experience anxiety and depression, and present with obesity, hypertension, diabetes, and dyslipidaemia.

Cardiac rehabilitation programmes may fail to achieve minimal clinically important differences in women's cardiovascular risk factors. Reviews, including our own, and patient interviews reveal that women perceive the following as deterrents to adherence to current cardiac rehabilitation programmes: time constraints; inflexible class times; lack of motivation; boring classes; not challenging enough; or, services tailored to older people's needs (Vidal-Almela *et al.*, 2021). New strategies for programmes that meet women's needs are required; fortunately, efforts by many scientists to identify and develop such strategies are underway.

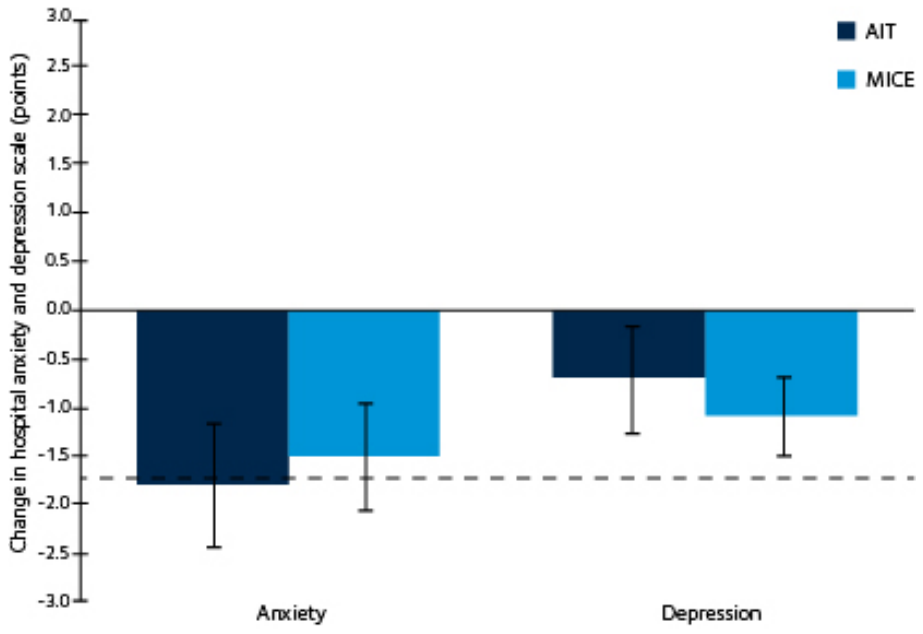

Figure 1. Change in HADS scores from baseline to follow-up in women participating in MICE and AIT. Negative change scores indicate an improvement in anxiety and depression severity. The MCID is represented by a black dashed line (i.e. 1.7 Points). AIT: aerobic interval training; HADS: hospital anxiety and depression scale; MCID: minimal clinically important difference; MICE: moderate-to-vigorous intensity continuous exercise. Values are presented as means ± standard error of means. (Redrawn from Reed *et al.*, 2018).

Growing a research programme focused on women's cardiovascular health and exercise

Over the previous 11 years (a gift of time, but oh how quickly it passes), my mentors, colleagues, trainees, and I have (i) examined the role of physical activity as a fundamental marker of health and wellbeing among nurses in Canada (most of whom are women) (Reed *et al.*, 2018), (ii) designed and tested a dance-based high-intensity interval training (HIIT) programme for women with cardiovascular disease (see Fig.1) (Reed *et al.*, 2019), (iii) shared our perspective on HIIT meeting the needs of women enrolled in cardiac rehabilitation (Way and Reed, 2019), (iv) investigated sex- and gender-based responses to exercise-based cardiac rehabilitation and

Cardiovascular disease continues to be a principal cause of premature death in women, and was responsible for 35% of total deaths in women in 2019. Yet, research shows that more than 40% of women lack knowledge of cardiovascular disease risk factors, or do not know their own risk level

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Working alongside women with lived experiences of these conditions to design and provide practical exercise strategies to target their cardiovascular health

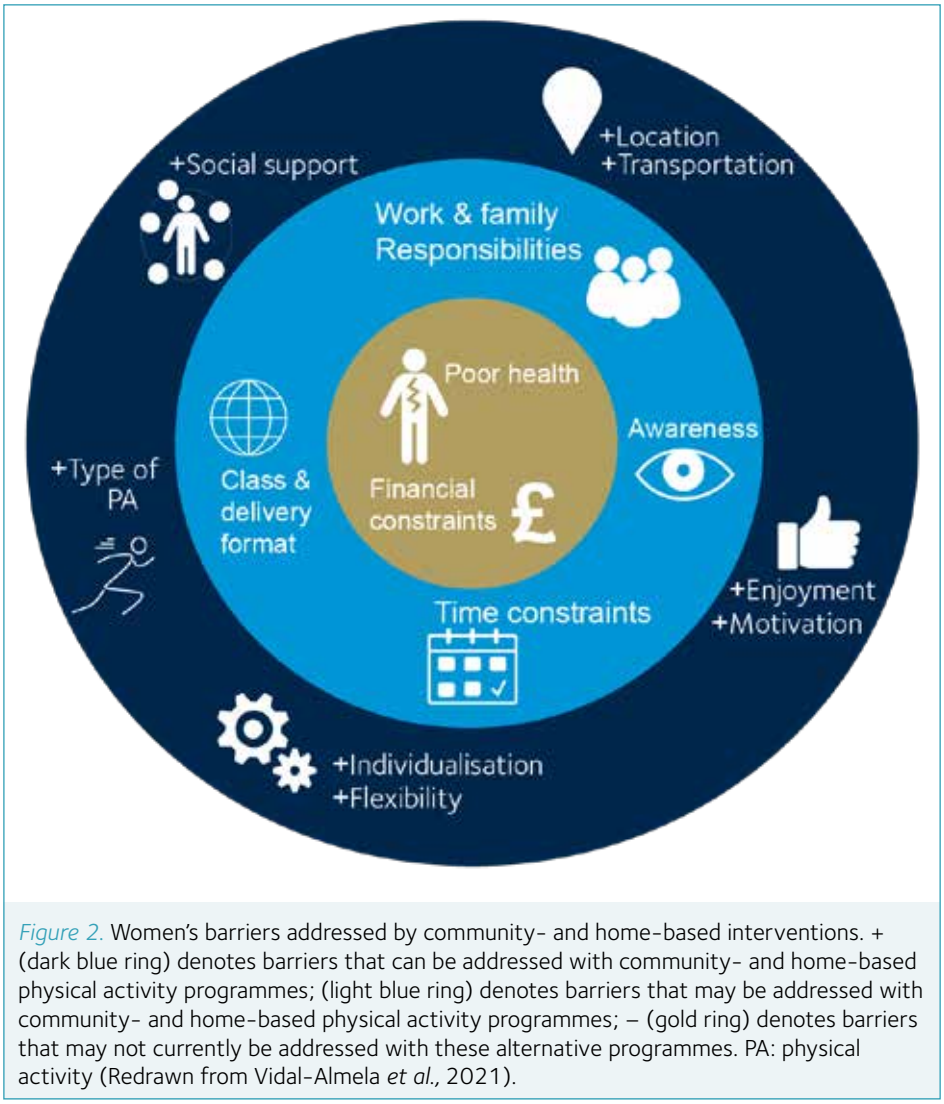

Figure 2. Women's barriers addressed by community- and home-based interventions. + (dark blue ring) denotes barriers that can be addressed with community- and home-based physical activity programmes; (light blue ring) denotes barriers that may be addressed with community- and home-based physical activity programmes; – (gold ring) denotes barriers that may not currently be addressed with these alternative programmes. PA: physical activity (Redrawn from Vidal-Almela *et al.,* 2021).

physical activity programmes (O'Neill *et al.,* 2022; Way *et al.,* 2021), and (v) shared a review highlighting how cardiac rehabilitation can be enhanced by understanding the specific needs of women (see Fig.2).

Our motivation for these projects was emphasis that novel elements such as programme offerings, convenient settings, and opportunities for socialisation should be considered when designing cardiac rehabilitation programmes (Vidal-Almela *et al.*, 2021). Most recently, I was awarded peer-reviewed funding from the Canadian Institutes of Health Research (CIHR) to lead a randomised controlled trial testing the efficacy of various exercise modalities on the physical and mental health of women with cardiovascular disease. Our work is only a mere fraction of the outstanding achievements by other scientists across the globe who are dedicated to understanding, preventing, and treating cardiovascular disease in women.

Seeing aspirational women mentors approach work-life balance within academic roles instilled in her the confidence to pursue a similar path; this is one of the many reasons why the equal representation of women in science and leadership positions is critical

Meet some of the many other inspiring women focused on women's cardiovascular health and exercise research

As I established (September 2013) and have since grown my research programme, not only have I focused on women's cardiovascular health and exercise, but I have also recruited, trained, and, importantly, learned from the next generation of female scientists, who are passionate about women's cardiovascular health and cardiac rehabilitation. To address the under-representation of women in exercise science research and leadership positions, I launched an *International Student Research Internship for Women* in 2019. Using a virtual format to reduce known barriers associated with access (i.e. location, time, and participation costs), the selected interns learn about our research programme by engaging in project management, data collection, quality assurance procedures and processes, manuscript development, and knowledge translation activities. I am hopeful this strategy will support more females into faculty and leadership positions.

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Dr Carley O'Neill, PhD
Carley completed her Postdoctoral Fellowship in Cardiac Prevention and Rehabilitation at the UOHI (2019-2021). She is currently an Assistant Professor in the School of Kinesiology at Acadia University, Canada, and Director of the Acadia Cardiac Maintenance Program. Her research programme focuses on improving access and options for exercise-based rehabilitation among women, particularly for those living in rural communities and from under-represented groups (e.g. French-speaking and 2SLGBTQ+ communities). Carley is passionate about increasing the representation of women in chronic disease research and is hopeful that her developing research programme will improve access to quality and effective exercise-based rehabilitation for all who identify as women across Canada and beyond (O'Neill *et al.,* 2022). She considers herself fortunate to have had all female mentors throughout her graduate and postgraduate training, and firmly believes that seeing aspirational women mentors approach work-life balance within academic roles instilled in her the confidence to pursue a similar path; this is one of the many reasons why the equal representation of women in science and leadership positions is critical.

Dr Kimberley Way, PhD
Kim completed a Postdoctoral Fellowship in my Exercise Physiology and Cardiovascular Health Lab at the UOHI (2018-2020). She is an early-career researcher at the Institute of Physical Activity and Nutrition at Deakin University (which is led by women) and a Lecturer in Clinical Exercise Physiology in the School of Exercise and Nutrition Sciences at Deakin University, Australia. Additionally, Kim is an Accredited Exercise Physiologist with over 10 years' experience, where she has predominantly worked in cardiac rehabilitation settings. Her research programme centres on providing pragmatic exercise training and testing solutions to identify and manage cardiovascular disease in cardiometabolic populations. She also uses cutting-edge imaging techniques to understand changes to cardiovascular physiology. Despite females constituting 50% of the population, Kim was alarmed and disheartened by the undertreatment and under-representation of women in cardiovascular disease research. This sparked a passion to investigate the unique changes to the cardiovascular system in women with cardiometabolic conditions and to work alongside women with lived experiences of these conditions to design and provide practical exercise strategies to target their cardiovascular health (Way *et al.,* 2021).

Isabela Roque Marçal, MSc, PhD student

Isabela is a PhD student in my Exercise Physiology and Cardiovascular Health Lab at the UOHI. Her dissertation research is investigating the sex and gender differences in the effectiveness of varying exercise training programmes in improving the short- and long-term physical and mental health of patients with cardiac implantable electronic devices. Isabela's personal experiences in Brazil heavily influenced her aspirations to pursue doctoral studies in Canada. She completed her MSc studies at an institution with limited resources, in a country continuously suffering from substantial financial cuts in research. She understood that higher education and science afforded opportunities, and if she wanted to expand her research skills, experiences, and accomplishments, she would have to 'jump in with both feet'. Isabela was awarded the 2021 International Student Research Internship for Women, which introduced her to women's heart health and exercise research (Marçal *et al.,* 2023). Women often receive exercise therapies based on research trials with insufficient samples of women and, thus, do not appropriately consider their unique biology and psychology. These sex and gender disparities and lack of data on important outcomes limit our understanding of women's responses to exercise programmes. Isabela strongly feels it is our generation's responsibility to make amends for these inequities to inform and change the course of future research focused on women's heart health and exercise.

The future is unknown but promising

Here we are, a few of the many female scientists who are passionate about women's cardiovascular health and exercise. We are unsure of what the future holds. But we hope that views from the rearview mirror will show that our efforts, scientific rigour, and passion have positively impacted the lives of women at risk of and with cardiovascular disease.

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Invisible killers: Toxic particles and the heart

A comparative approach to understand how air pollution could harm the heart

Professor Holly Shiels

Holly's fascination with physiology and extreme environments laid its roots early in her career. As an undergraduate at Western University, Ontario, Canada she was exposed to the harsh environments of the Bay of Fundy, which has the largest tidal change in the world, while working at the Huntsman Marine Station in New Brunswick. Studying the intertidal organisms that survive huge waves and cycles of emersion and immersion drove a lifelong interest in extreme physiology and a career travelling the world to learn more about the supreme athletes and champions that live in the world's aquatic environments. The crux of Holly's work has been the cardiorespiratory system. She has investigated this in a dazzling array of fish, amphibians, reptiles and mammals across all life stages to better understand the extraordinary lengths and limits of animals' physiological systems. Holly teaches Animal Physiology at the University of Manchester, is a Director of the Company of Biologists and the President of the Fisheries Society of the British Isles. In 2023 she became a Fellow Member of The Society.

It turns out that we have more in common with fish that one might have assumed. Unfortunately, that link is a shared vulnerability to fossil-fuel pollution. We asked Professor Holly Shiels to tell us more.

The world is in a precarious state; we are witnessing the shocking impact of environmental extremes and living with the rising threat of climate change and air pollution. Questions about adaptation and survival to these extremes has brought the field of comparative physiology into the mainstream. This field may once have been considered esoteric, pursued by the curiously minded exploring life's mysteries for interest. However, the rapid rate of current environmental change perfectly positions comparative physiology to answer questions around tolerances to increasingly extreme environments. We speak to Holly Shiels, Professor of Integrative Physiology at the University of Manchester who is exploring the effects of fossil-fuel-based pollution on both fish and mammal hearts. She talks about how her findings should serve as a warning of the damaging effect that pollution is having on human hearts.

Life on the edge

Physiology helps us understand how living things work. However, comparative physiology takes our understanding a step further by helping us determine how organisms survive in their habitat. Studying extreme environments gives us clues about physiological tolerance and limits, like temperature, heat, or hypoxia, and this helps us see how far physiological systems can be pushed and tested. Speaking to Professor Holly Shiels, she explained the unique insight that comparative physiology provides, she said:

"Inherent in doing comparative physiology is looking at the diversity of ways that organisms cope with a given environmental challenge. We investigate whether organisms have the same physiological responses to a challenge, or whether there are entirely unique physiological strategies employed across species.

"As well as looking at the extremes, another advantage of comparative physiology incorporates the One Health concept. When you see consistency in physiological responses to environmental challenges across a diverse range of organisms, it reminds you that we are 'all in it together' - simultaneously experiencing the changes that are happening to our planet. Also, if a bivalve, a fish and a human heart all respond to a factor in the same way, we have potentially found a conserved and fundamental mechanism."

Holly's research in cardiorespiratory physiology has led her to investigate the limits of the heart, as well as metabolism and life history traits.

"The heart is the linchpin of survival. It is the organ that can limit or propel you, depending on the environment. For aquatic organisms, we can see this quite acutely. Their hearts are sensitive to environmental change, so when conditions exceed their optimal range, for example in scenarios such as temperature or exposure to a pollutant, we see detrimental effects at both the individual level and at the population level."

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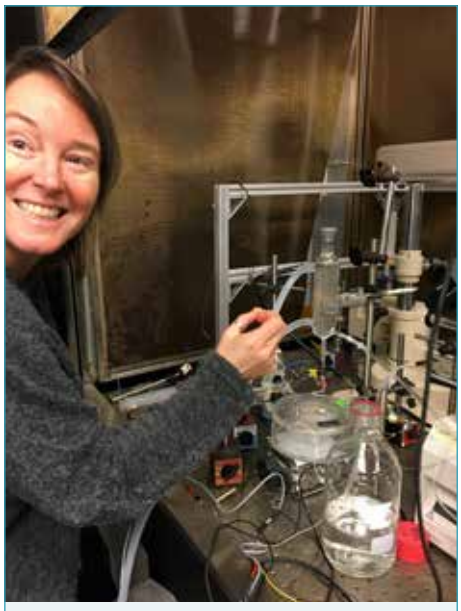

Holly working in Norway on an isolated cod heart to study the impact of phenanthrene on electrical activity, January 2019.

Holly with her PhD students and colleague in Norway while they were studying the effect of oil pollution on halibut. From left to right: Drs Daniel Ripley, Sana Yaar, Prescilla Perichon, Holly.

Physiology and physiologists have a crucial role to play in responding to changing environments and exploring human tolerances. Holly's focus on fossil-fuel pollution in fish may have a role to play in understanding human tolerances. Combustion of fossil fuels is the largest contributor to air pollution. And air pollution threatens our health and quality of life, being responsible for the premature deaths of 6.7 million people each year worldwide. An astonishing 99% of the human population are reported to be living with air quality that falls below World Health Organization guidelines. As global levels of pollution continue to rise and with more people moving to urban areas, we need to increase our knowledge of the effects of exposure to the compounds that make up air pollution.

"One chilling aspect of our research on fossil-fuel pollution is finding repeating patterns in a range of species. We have recently identified that air pollutants cause the same heart defects in fish, crayfish, and mammals. This makes you appreciate that the risk of toxicity is a widespread problem for all life on Earth."

Pollution's harmful agent

For decades, since the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska that decimated the pristine environment and habitat of the plentiful wildlife, researchers have been investigating the devastating effects of fossil-fuel pollution.

Thanks to a united effort by toxicologists, physiologists and ecologists, involving many comparative studies using several different species and across a range of life stages, researchers identified a particularly harmful class of pollutants, polycyclic aromatic hydrocarbons (PAHs), which are a key component of crude oil. When oil or other fossil fuels are burned, PAHs are volatilised and exist in the gas phase or bind to the surface of small particles in the air, called particulate matter (PM).

In 2010, following the Deepwater Horizon oil spill in the Gulf of Mexico, US, Holly worked with colleagues from Standford University to investigate the pathways of PAH toxicity in fish to figure out what channels or mechanisms were being disrupted and causing the heart to malfunction.

The Deepwater Horizon oil spill was catastrophic and is considered one of the largest environmental disasters in world history. The damage was caused by an estimated 210 million gallons of crude oil spilling into the Gulf of Mexico over the course of 85 days (Deepwater Horizon Oil Spill Report, 2011). Because crude oil is a mixture of hydrocarbons, with different viscosities and densities, oil polluted the surface of the sea, as well as spreading down below the surface, even as far as the seabed. Holly and colleagues from Manchester and Stanford started investigating the cardiac responses to crude oil in the heart cells of the fish species that were swimming through the oil.

By studying the effects of the oil spill on the fish heart, they recognised that the compound phenanthrene, a low-molecular-weight PAH, was the culprit responsible for cardiac dysfunction as it blocked ion channels that can lead to cardiac problems, including reduced contractility and arrhythmias (Brette *et al.*, 2017).

We have recently identified that air pollutants cause the same heart defects in fish, crayfish, and mammals. This makes you appreciate that the risk of toxicity is a widespread problem for all life on Earth

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Knowing what was happening to the heart in fish allowed us to quickly understand the level of risk and human susceptibility to air pollution. It is a testament to the comparative approach!

Problematic hydrocarbons in the air

"I presented the results of this work at The Physiology Society meeting in Dublin. My now colleague and good friend Jules Hancox from University of Bristol was intrigued by my fishy poster. Jules realised the similarity between the mechanisms we had uncovered for how fossil-fuel pollution impacted ion channel function in the fish heart, with blockers of ion channel function in human hearts. This set us on the path researching the ubiquitous nature of the cardiotoxicity of air pollution."

"Phenanthrene is a major component of crude oil and, worryingly, the second most abundant PAH in the polluted air that we breathe, and we knew it was cardiotoxic in fish."

By studying the effects of phenanthrene on the mouse heart and on human induced pluripotent stem cell-derived cardiomyocytes and recombinant human ether-a-go-go-related (hERG) channels, Holly and Jules realised that not only was phenanthrene present in the air, but it was having the same cardiotoxic response in mammalian models.

A matter of the heart

Alarmed by the results, Holly and Jules, together with their students and postdoctoral research associates (PDRAs) supported by the British Heart Foundation, and with international support from co-authors in Russia, recently published the findings about the presence and cardiotoxicity of phenanthrene to mammals in *Environmental Health Perspectives* to raise awareness among public health practitioners and the wider general public.

"The problem with phenanthrene is that it can contribute to the development of arrhythmias and can block key ion channels, like hERG, the channel responsible for repolarising the heart. Repolarisation is when the electrochemical gradients of the heart's ventricles are reset; which allows the heart muscle to relax in between beats. The hERG channel is always tested in drug research and development, and we are concerned that this direct and fairly potent hERG channel blocker (Al-Moubarak *et al.,* 2021). If a pipeline drug demonstrated such hERG potency, it would be dropped from further development.

"We are also concerned as to how detrimental phenanthrene could be for the young, elderly or anyone living with a heart condition. Our results are based on healthy animal models and cells, so we need to understand how the heart responds in vulnerable groups to assess whether they could be at greater risk."

Phenanthrene inhibiting ion channels

Changes in ion channel expression are useful for studying health and disease. Using computational modelling, Holly and Jules, together with their colleagues have started to explore the nuances across species, analysing how phenanthrene could impact the electrical activity of the heart.

"There can be two different modes at play, that act together: Electrical dysfunction of the heart or contractile dysfunction of the heart. Electrical dysfunction is based mainly on ppotassium and sodium fluxes, while contractile function is based on calcium fluxes. Whether the response is dominated by the electrical or contractile problem, seems to be species dependent, which could be due to variable expression of the ion channels."

Holly with her PhD student Martins Ainerua and colleague Dr Elin Sørhus from the Institute of Marine Fisheries in Norway, working on the impact of oil pollution on the fish heart.

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Holly discussing her work on air pollution with meeting attendees at a public engagement event in London as part of a BHF sponsors day. Looking through the scope, viewers see a zebrafish embryo. A species useful to study the impacts of air pollutants on heart function.

Studies in sheep show calcium ion channels are relatively resistant to phenanthrene but potassium channels are inhibited. This results in electrical dysfunction of the heart. In fish, both calcium and potassium channels are inhibited, and overall fish hearts seem more sensitive.

The power of comparative physiology

The conserved mechanisms Holly and colleagues found in how the heart functions and how ion channels are inhibited across all vertebrates allowed them to act quickly.

"The vast effort by toxicologists across decades working to understand the impact of crude oil spills on fish in the aquatic environment provided the knowledge and evidence for toxicity pathways that we have rapidly applied to terrestrial species. Knowing what was happening to the heart in fish allowed us to quickly appreciate the level of risk and human susceptibility to air pollution. It is a testament to the comparative approach!"

A warning sign that air pollution could poison our hearts

As global levels of pollution continue to rise, we need to take note of the warning signs. This means increased monitoring. Most human studies have focused on the PAH benzo(a)pyrene; this is a large-molecular-weight PAH and a known carcinogen, so its levels are already monitored, though not widely, while phenanthrene-specific testing is absent. Although phenanthrene is not a strong carcinogen, its toxic impact on our heart and ion channels means we need to step up our activity.

"It is remarkable how fast we have moved from discovering the effects of this pollutant in mammals to calling for changes to public health guidelines."

"We're all in it together. These pollutants will affect everything and anyone interacting with their environment. It doesn't matter whether the pollution is in the air from combusting fossil fuels or in water following an oil spill, or occurring as a result of volcanos or forest fires. Hydrocarbons bind to the surface of PM, so the pollutants are carried into our lungs, or enter our bodies via the food that we eat, like fish. And it is mostly humans who introduced these harmful particles in the environment. The time is now to boost our research efforts to understand the chronic effects of air pollutants' toxicity and the heart damage it can inflict."

The time is now to boost our research efforts to understand the chronic effects of air pollutants' toxicity and the heart damage it can inflict

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A new hope for overcoming addiction

Could popular weight-loss drugs be a promising new treatment for alcohol and substance use disorders?

Professor Anders Fink-Jensen

Studying anatomy as a medical student led Anders to an interest in psychiatry. Training in this specialist field involved a fair amount of work in pharmacology. What started out as a collaborative research opportunity at Novo Nordisk, the Danish pharmaceutical company renowned for innovations in diabetes healthcare, turned into almost a decade devoted to developing compounds for mental health conditions such as schizophrenia. Longing to return to work with patients, Anders took up a clinical role where he could help patients and carry out research. Years later he became Professor and Head of Clinic at Mental Health Centre Copenhagen and University of Copenhagen, Denmark, continuing this balance between treating and researching mental health conditions.

In this interview, we speak to Professor Anders Fink-Jensen who is a clinical psychiatrist. His work with patients has furthered the study of a particular group of compounds, called GLP-1 receptor agonists, most commonly used in the treatment of people living with type 2 diabetes and/or obesity. This research is encouraging for the future development of anti-addiction drugs.

Millions of people around the world are suffering from alcohol, tobacco and substance use disorders. The figures are staggering; approximately 35 million people live with substance use disorders worldwide (United Nations Publication, 2020) and 280 million people live with alcohol use disorder (AUD) (World Health Organization, 2018). In this interview, we speak to Anders Fink-Jensen, Clinical Professor of Psychiatry at the University of Copenhagen, Denmark who tells us that: "Despite decades of research, treatment options are sparse or missing." Current U.S. Food and Drug Administration (FDA)-approved drugs for patients with AUD only work for a small percentage of people. Since the 1980s, there have been no new compounds available to test or develop for the treatment of addiction. Only repurposed drugs, like an injectable version of naltrexone that was approved for AUD in 2006, have been used in the last 40 years.

That is until the discovery of glucagon-like peptide 1 (GLP-1), a hormone that is produced in the gut that monitors appetite and blood glucose levels. The GLP-1 analogue receptors are used for diabetes healthcare and people living with obesity.

Semaglutide

You have most likely come across the group of GLP-1 compounds, in the form of the popular type 2 diabetes drug Ozempic and weight management drug Wegovy. Both are brand names of the active ingredient semaglutide. These drugs have been stealing the limelight in the media with celebrities and members of the public alike talking about their role in weight and blood sugar management.

"Semaglutide is the most potent GLP-analogue because it binds more tightly to the GLP-1 hormone receptor." This is why it is the active ingredient in the popular drugs, Ozempic and Wegovy, both of which have been changing the landscape of diabetes and obesity treatment. Ozempic is approved by the FDA for use by adults with type 2 diabetes, while the FDA approved Wegovy, a drug specifically designed for chronic weight management for people living with obesity. Wegovy has a higher dose of semaglutide than Ozempic.

There have been a series of reports and studies documenting the effects of semaglutide for weight loss. One study showed people living with obesity lost more than 15% of their body weight whilst taking regular doses of semaglutide (Weidling

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et al., 2021), propelling semaglutide into fame. However, whilst there seems to be an appeal of using semaglutide as a weight management strategy, the downside is that its popularity could mean less access for those who need it for managing their health. In addition, there have been several warnings from medical professionals of its use for those not living with type 2 diabetes or obesity – the two conditions that it is currently licensed for.

Weight loss is not the only effect making the headlines. There have also been anecdotal reports from patients who report drinking less alcohol. "This has created much hype over the potential clinical applications of semaglutide and other GLP-1 analogues for alcohol and substance use disorders. However, we don't yet have the hard scientific data and evidence to support this use to curb alcohol cravings," warns Anders, concerned how people could interpret and act on speculative evidence.

Semaglutide: A promising drug to treat those with addition?

As a clinical psychiatrist, Anders has devoted many years to working with patients with schizophrenia and other mental health disorders. Some of the most effective medications for schizophrenia can have unfortunate side effects, such as weight gain, metabolic issues, prediabetes and type 2 diabetes. The GLP-1 receptor agonists manage blood glucose levels by helping the pancreas make more insulin and thus lowering blood sugar levels. It mimics the naturally occurring hormone response to food, signalling to brain that you are full, reducing your appetite, and it slows down the movement of food in your gut. When food takes longer to leave your body, you stay full for longer, so you eat less overall.

The use of GLP-1 receptor agonists against type 2 diabetes was first approved by FDA in 2005 and over the following years some of Anders' colleagues started to notice an interesting side effect.

"The patients who had type 2 diabetes began reporting that they no longer seemed to desire alcohol. Those who enjoyed drinking with friends and going on wine tastings asked if they could temporarily stop taking the medication to enjoy alcohol again," shares Anders, slightly amused when remembering this request. "This gave us hope after several years of searching for a new anti-addiction drug."

An unexpected finding

The observation that patients who were treated with GLP-1 receptor agonists reported a lack of interest in alcohol piqued Anders' interest. He and a global team of researchers began investigating why GLP-1 reduced alcohol consumption, carrying out the first randomised control trial on the effects of GLP-1 in AUD patients. This study was a six-month double-blinded, placebo-controlled clinical trial (Klausen *et al.*, 2022) testing 127 patients. All the participants went through behavioural therapy to encourage them to drink less, and 62 patients received weekly injections of a form of GLP-1, called exenatide. Exenatide is less potent than semaglutide, but semaglutide was not available for clinical use when the study was initiated.

Anders reports: "We measured and compared the activity of three brain structures in the reward centre using functional magnetic resonance imaging (MRI). The reward centre was activated in both the placebo and exenatide groups when shown photographs of alcoholic drinks. However, one brain structure, the ventral striatum, showed less activity in the patients who had been treated with exenatide."

He was surprised that both groups (placebo and exenatide) cut their alcohol intake by roughly the same amount and the number of days on which they drank heavily by 50%. To unpick this inconclusive finding, they carried out a statistical analysis, which revealed that the most dramatic reduction in alcohol intake was for people with a BMI over 30 (indicating obesity).

To investigate the link between GLP-1 and alcohol in a larger sample, Anders and colleagues also carried out a nationwide register-based cohort study of new users of GLP-1 (38,454) and comparing alcohol events to those who were new users of dipeptidyl peptidase 4 inhibitors (n = 49,222). They found that use of GLP-1 receptor agonists was associated with a lower risk of a subsequent alcohol-related event compared with use of DPP-4 inhibitors after adjustment for covariates (Wium-Anderson, 2022).

Cutting back on alcohol

Most research on the effects of GLP-1 analogues has been carried out in rodents and monkeys (Klausen *et al.*, 2022a). When exenatide is directly injected into different regions within the reward centre of the brain,

Since the 1980s, there have been no new compounds available to test or develop for the treatment of addiction

The use of GLP-1 receptor agonists against type 2 diabetes was first approved by the FDA in 2005 and over the following years some of Anders' colleagues started to notice an interesting side effect

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We still don't know the precise neural mechanisms. There is also no guarantee at this point of the research that the same pathways will be activated in the same manner in both animal models and humans

rodents significantly reduce their alcohol consumption. These inhibitory effects are reversed when the GLP-1 receptors are knocked out in the brain. "This suggests that the effects on alcohol intake are most likely to be controlled centrally by the brain and spinal cord rather than nerves at the periphery of the system," he explains. Similar findings have been found in monkeys, specifically African vervet monkeys (Thomsen *et al.,* 2018), a species with a known preference for alcoholic beverages and long-term exposure to alcohol. They reduced their intake of alcohol after treatment with exenatide.

Studies have also reported a decrease in the rewarding effects in the brain (Shirazi *et al.,* 2013; Sirohi *et al.,* 2016; Klausen *et al.,* 2022a). Anders says, "These give us clues as to the drug's mechanism and how it could affect brain circuits."

Clues in the brain's reward centre

Researchers believe the effects of GLP-1 analogue receptors are regulated by the brain and central nervous system. Several structures in the brain produce the GLP-1 hormone or carry receptors for the hormone, including areas that are involved in our reward pathways. Dopamine can activate the reward centre of the brain. GLP-1 appears to be operating in the same regions where dopamine is released.

"We need to explore the influence of the brain–gut axis. Interestingly we've seen an overlap with all GLP-1 treatments affecting appetite. We know that the GLP-1 hormone is an appetite regulator that is released when we eat, so calorie value could be playing a role with alcohol."

Activities or food our brain perceives as pleasurable can dominate our behaviour and actions. Overriding this reward pathway could be the key to suppress cravings to help tackle addictive behaviours.

"We still don't know the precise neural mechanisms. There is also no guarantee at this point of the research that the same pathways will be activated in the same manner in both animal models and humans," cautions Anders.

Treating addiction – the difference between "wanting" and "liking"

No-one is certain how addiction develops, but the most dominant theory is based on excessive "wanting". A process termed "incentive sensitisation", where the desire is triggered by reward cues in the brain of addicted individuals. Wanting is believed to be generated by dopamine, while "liking" is controlled by hedonic hotspots in the brain rather than controlled by dopamine. As an individual becomes more addicted, the "wanting" overshadows "liking" (Berridge and Robinson, 2016).

This could lead to impulsive and compulsive behaviours. "This is a dark and powerful driver for people who use alcohol as a coping mechanism or form of self-medication to alleviate anxiety, depression or to avoid a deeply unpleasant thought or feeling. We could see very different results for the use of exenatide between an individual who is addicted to alcohol compared to someone who enjoys the taste and sensation of alcohol," says Anders.

Most research has focused on acute effects rather than the long-term effects. As AUD can be a chronic and relapsing illness that typically requires long-term treatment, the acute findings won't adequately predict the effectiveness of the drug with repeated or chronic usage.

So far studies have been based on modest quantities of alcohol. More research is needed to understand the effects of high levels of alcohol consumption. We also need to study its effects for people living with a dependence on alcohol to alleviate their mood or negative thoughts. Both avenues need to be explored further to examine brain adaptations and pathways.

Human clinical trials

Studies in rodents and primates have supported that GLP-1 treatments diminish the desire for substances such as alcohol and nicotine. Only a few clinical trials have been completed in humans.

"We have two clinical trials underway to investigate the effects of GLP-1 receptor agonists on alcohol intake in "heavy drinkers" or patients diagnosed with AUD. Both are double-blind, randomised, placebo-controlled studies. The first is to investigate reduction in heavy drinking days after patients diagnosed with AUD receive a once-weekly dose for 26 weeks. The findings could offer insight into the potential neurobiological changes."

GLP-1 analogues could also help reduce smoking. Only one clinical study (Yammine *et al.,* 2018) to date has suggested that GLP-1

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analogues could control nicotine addiction. In this study, they found that 46% of patients stopped smoking following weekly injections of GLP-1, in the form of exenatide alongside nicotine patches. This is compared to 27% who stopped smoking out of the group only given the patches. Studies in animals have started to explore the effects on opioids and cocaine, but no human studies have been performed.

Risk of unwanted side effects

Whilst animal and some human studies seem promising, Anders is concerned about the potential side effects of GLP-1 analogues. "We are still not sure if GLP-1 affects an individual's mood. There have been cases linking GLP-1 to a condition called anhedonia that lowers an individual's ability to enjoy life's experiences. It can be a common symptom of depression and other mental health disorders." A couple of cases have also reported suicidal thoughts among users. This prompted the FDA and the Europeans Medicines Agency to investigate the link, finding no higher risk at this time (Chiappini *et al.*, 2023; EMA, 2023).

The use of GLP-1 receptor agonists is still in its infancy, having only been on the market since 2021. With widespread and ongoing use, we could see new problems emerge. An approved cannabinoid receptor 1 drug was taken off the market after one year because of increasing reports linking it to depression and suicide. However, a very recent register study published in *Nature Medicine* did not support concerns of increased risk of suicidal ideation with semaglutide (Wang *et al.*, 2024).

Promising but unproven treatments for alcohol and substance use disorders

Animal studies and anecdotal evidence from initial human studies have given much promise about the use of semaglutide for alcohol and substance use disorders, but it is clear its use must be regulated until the safety and efficacy have been rigorously tested. "We need to have the data from research and clinical studies to clarify how the drugs work and understand the capabilities and patient benefits. We don't want individuals using them to help with alcohol-related use based on speculative observations alone (Leggio *et al.*, 2023). However, we are hopeful that in the future we may get another effective tool to help treat alcohol and substance use disorders."

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Searching for why and how the body adapts to exercise training

Physiological Report's Paper of the Year Award 2023

Dr Aurel Leuchtmann

Dr Aurel Leuchtmann is a molecular biologist specialising in how our bodies respond to exercise and how musculoskeletal tissues adapt to training. His curiosity about human physiology, specifically understanding the influence of exercise and the reasons why it benefits us, led to him studying Health Sciences and Technology at ETH Zurich, Switzerland. He then went on to complete a PhD in Molecular Biology at the Biozentrum of the University of Basel, Switzerland, working on a range of projects aimed at elucidating the nuances of training adaptation and the functional dynamics of adult and ageing skeletal muscle.

How does the body respond to different training regimens? Dr Aurel Leuchtmann tells us about his PhD research exploring a mouse model to study endurance, muscle mass and strength gains to exercise. The project, it turns out, would win him and his co-authors *Physiological Report's* Paper of the Year 2023.

In January, Aurel Leuchtmann and his co-authors were awarded *Physiological Report's* Paper of the Year Award 2023, a new Prize launched by the journal to recognise the research papers of highest sound science quality published in the year December 2022 to November 2023.

Aurel and his co-authors were working on identifying specific training interventions to help researchers select the best models to study the factors and mechanisms for exercise training adaptations. Exercise could be used as a preventative approach against a range of diseases and to improve quality of life. However, the mechanisms explaining the benefits need to be fully understood to better allow health professionals to develop and use exercise-based strategies to support health management, disease prevention and ageing.

A surreal moment

"I was so surprised to receive the email informing me of the prize that it took me a few moments to put aside my scepticism and assure myself that the award was genuine! I thought our study was quite niche, so I am overjoyed that the research is appealing to others. It verifies to me and my co-authors that the work is interesting and valuable for the community. I feel especially honoured as this paper was the first to receive the prestigious 'Paper of the Year' award."

We discover how Aurel's interest in exercise physiology began early in life and how his sporting activities propelled his academic pursuits.

How can knowledge of physiology boost athletic potential?

Aurel was an athletic child. Playing a lot of sports during his childhood and teens years made him curious about how training could influence or enhance his potential as an athlete. "I wanted to understand how specific training protocols in combination with certain nutrients could affect my performance. From a young age, I wanted to know the physiological mechanisms that lead to adaptation to exercise training."

After high school, he was torn about what to study. It was a choice between two passions: medicine, or health sciences.

"My first interest was medicine, but once I found out about a new interdisciplinary study programme 'Health Sciences and Technology' at ETH Zurich, Switzerland, I knew it was the course for me." The degree was research-oriented and focused on education in medical sciences at the interface of human physiology, health, and technology. Aurel wanted to concentrate on the study of humans, rather than plants and other animals,

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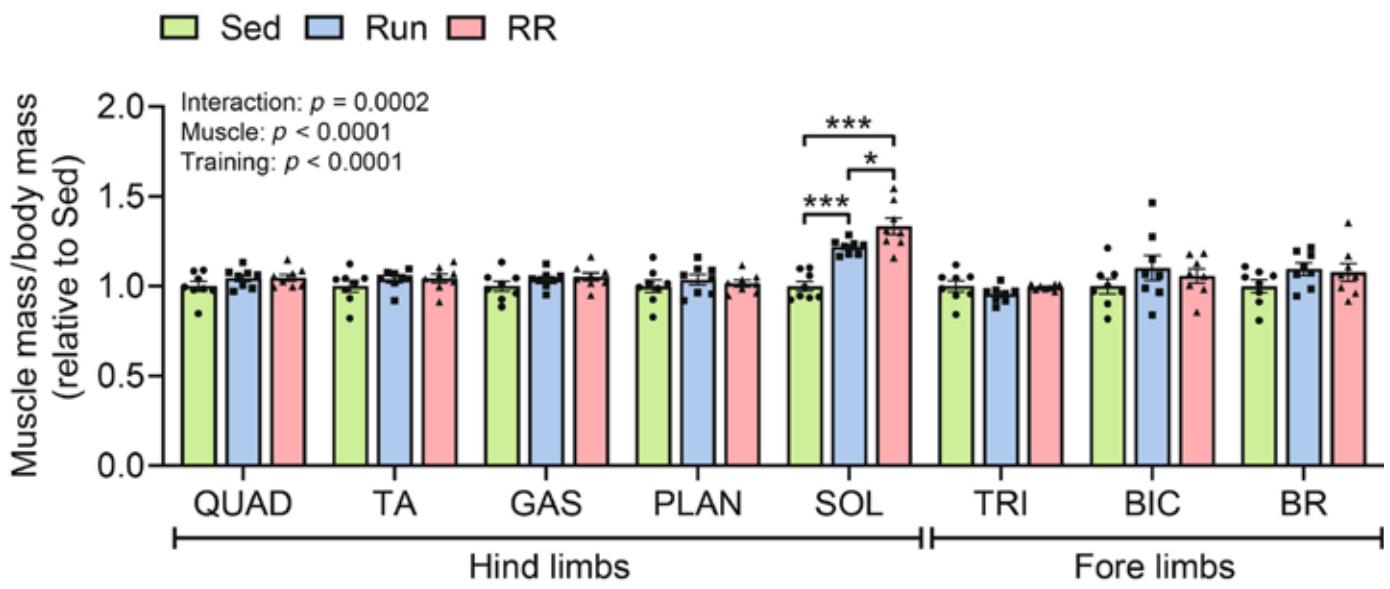

Figure 1. Figure showing the changes in individual muscle masses. Masses of various fore and hind limb muscles expressed as fold change relative to sedentary mice (Sed) after normalisation to body mass ($n = 8$). QUAD, M. quadriceps femoris; TA, M. tibialis anterior; SOL, M. soleus; GAS, M. gastrocnemius; PLAN, M. plantaris; TRI, M. triceps brachii; BIC, M. biceps brachii and BR, M. brachio radialis. Data are presented as mean ± SD including individual values. Two-way ANOVA followed by Tukey's *post hoc* test. $*P < 0.05$, $***P < 0.001$.

which can be the case with many biology courses.

"I was fortunate that we were taught by very good professors. I think this does inspire and nurture our interests." One teacher had a memorable and thought-provoking style of teaching. "He didn't just lecture, he asked questions. Everyone in the lecture theatre was made to think about potential explanations about a phenomenon. Only when the lecturer was satisfied with our answers, did he start to reveal the actual mechanism or concept that was behind what we were studying." It was this course that really piqued his interest in using research to answer interesting questions.

Exercise is beneficial, but how does it change our bodies?

When it came to his Master's thesis, Aurel saw an opportunity to explore one of the first questions that motivated his career in physiology. Setting out to answer, how does the body adapt to exercise? "I studied muscle biopsies in the lab to investigate how different exercise training affected the adaptation of the muscle," he explained. We found a key adaptation was the buildup of blood vessels. But it didn't tell us what was controlling the process.

Aurel went on to complete a PhD using animal and cell models to go deeper into the molecular mechanisms. It was during his time as a PhD student that he and his colleagues carried out the project that led to their award-winning paper.

We know that exercise is good for the body, showing cardiorespiratory, neural and metabolic benefits. Yet we still don't know the exact mechanisms that control these benefits, in particular when it comes to understanding how muscles grow and how strength increases in response to training.

"Initially, we wanted to study muscle hypertrophy (growth of an organ or tissue by increasing the size of its cells) and strength gains. But when we were discussing study protocols that we could use to study these specific exercise training adaptations, we realised that there are no standardised or well-characterised training interventions."

Using a mouse training model

Aurel and the team set out to characterise the interventions and adaptations. They studied male mice running in wheels, a popular model for endurance training. To simulate resistance training, magnetic brakes were added to the wheels to make it harder to rotate. The mice on these loaded wheels would have to work harder to run. The two training regimes would serve as useful models linking to human exercise training, allowing the team to investigate muscle growth and strength.

"The wheels let mice follow their natural activity patterns. The mice are free to choose when they run, how long for, and at what time of the day. Since mice are nocturnal, they tend to choose to run at night. The wheels offer a huge advantage because we could eliminate external factors that could otherwise influence the behaviour or adaptations, such as external stressors from a forced setting or human

But when we were discussing specific study protocols that we could use to study exercise training adaptations, we realised that there are no standardised or well-characterised training interventions

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By investigating systematic and functional adaptations at the molecular and cellular level in response to endurance compared to resistance training we have provided an optimal training paradigm for different exercise studies

I thought our study was quite niche, so I am overjoyed that the research is appealing to others. It verifies to me and my co-authors that the work is interesting and valuable for the community. I feel especially honoured as this paper was the first to receive the prestigious 'Paper of the Year' award

presence. It can be seen as more ecologically valid than training mice on a treadmill, where researchers might have to nudge or encourage the mouse to run if the timing of the activity does not fit with its natural activity pattern."

After 10 weeks, mice training on free-running wheels (the low-resistance group) were compared to mice running on high-resistance wheels (high-resistance group). Mice in both training groups put on more lean mass than fat compared to sedentary mice (see Fig.1), and both similarly improved their VO_2 peak, (a fitness marker measuring the rate of oxygen consumed at the peak level of exercise). "We also found similar adaptations in mitochondria and blood vessels of the plantar flexor muscles. This is the main group of muscles responsible for the angle of the foot and creating the motion enabling walking and running. So, it is not surprising that improvements occurred in both groups," says Aurel.

Treadmill endurance test

The mice were trained using wheels but were tested on the treadmill because it is easier to control.

"The low-resistance mice outperformed the high-resistance group in the endurance test. They had higher endurance capacity, which means they were better at running for longer periods," says Aurel. However, the team found that the high-resistance training mice on the loaded wheels had greater muscle strength. "They were quite a bit stronger than we expected and showed greater hypertrophy in the soleus (calf) muscle, one of the major muscles involved in running."

Calf muscle growth was greater for the high-resistance mice, but the low-resistance mice also showed a robust increase in the size of the calf muscle (see Fig.1). Aurel and his team were surprised by this response to endurance training alone and how quickly the muscle grew in response to this training regimen.

During the 10 weeks, the high-resistance group ran less overall than the low-resistance group. The mice in this group trained fewer times but experienced more intense exercise bouts because of the higher resistance compared to the low-resistance group, who could easily rotate the wheel, and so would frequently return to it. "Despite this, both forms of training had a similar impact on fitness, possibly because the total amount of external work was comparable. The high-resistance group had a lower training volume with lower time investment but yielded the same cardiovascular adaptations."

Endurance vs resistance training

"We don't yet know why the low-resistance mice were better endurance runners than the high-resistance group. As we saw similar adaptations in the heart and the muscles, we assumed that they would perform the same. One potential explanation could be that the training style naturally habituated the low-resistance mice to running longer distances and at higher speeds."

"By investigating systemic and muscular adaptations at the molecular and cellular level in response to endurance compared to resistance training we have provided optimal training paradigms for different exercise studies. Our results will help researchers design and select training interventions of animal models to support the discovery of factors and mechanisms controlling exercise adaptation. These could eventually translate to human studies," explains Aurel.

What advice has helped you in your academic career?

"It is difficult to nail down one specific piece of advice because you learn so much while carrying out your experiments and from failing. Both are extremely useful for your career development. But, if I had to pick one, then I would encourage you to get to know your lab members as well as people across your department."

Aurel was given this advice by his supervisor on his first day of his first lab internship as a Master's student. Top of his long task list was the mission to talk to everyone in the lab!

"I was to ask them about their work, what techniques they use and so forth. It is an excellent way to get to know who you can seek help from when needed, or who you should ask for feedback about your research. You gain novel interpretations of your work and good ideas of changes you could make."

Read Aurel's full research paper at physoc.onlinelibrary.wiley.com/doi/10.14814/phy2.15701

https://doi.org/10.36866/pn.133.28

The Physiological Society

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Meeting Report

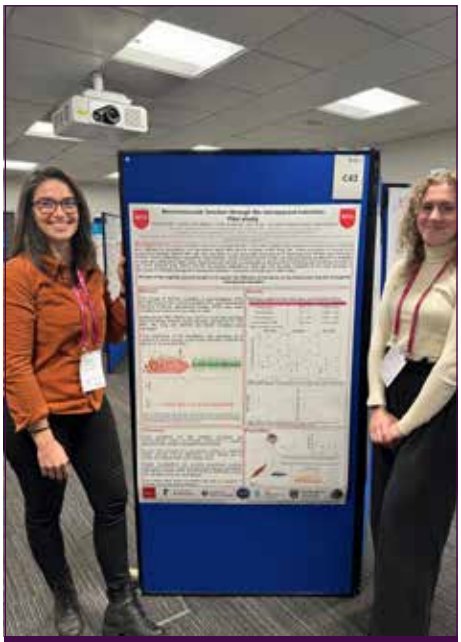
Neurophysiological Bases of Human Movement

12 – 13 December 2023, King's College London, UK

Neurophysiologists gathered at King's College London, UK for the two-day meeting

We had 96 speakers, organisers and neurophysiologists with an interest in human movement join us in London in December. The meeting focused on the fundamental aspects of human neurophysiology, in skilled motor control and pathophysiology, while also addressing topical issues such as diversity, variability and novel methodologies. Attendees were able to discuss hotly debated topics including "one versus many participants", "real world versus lab experiments" and "micro (neuron) versus macro (behaviour)" in neurophysiology.

Dr Marco Davare, Dr Irene Di Giulio and Dr Ricci Hannah (King's College London, UK) organised an exciting programme, which included eight oral communication presentations, many of which were given by early career researchers.



PhD students Mollie and Elisa (Nottingham Trent University) presenting their latest data on neuromuscular function across the menopause.

Early Career Oral Communication Prize Winners

Jonathan Tsay, University of Cambridge, UK

Sophie Grigutsch, University Medical Center Hamburg-Eppendorf, Germany

Jonathan Tsay, University of Cambridge, UK

"I thoroughly enjoyed the meeting. I loved the diversity of topics covered, spanning brain to behaviour, reaching to walking. It was a great idea to have the breakout sessions; it really encouraged discussion among researchers of all levels. I would definitely attend the Neurophysiological Bases of Human Movement again in the future."

Early Career Poster Competition Prize Winners

Arnault Caillet, Imperial College London, UK

Mollie O'Hanlon, Nottingham Trent University, UK

Shiyong Su, UCLouvain, Belgium

Mollie O'Hanlon, Nottingham Trent University, UK

"The event, Neurophysiological Bases of Human Movement, was organised well with a broad range of research topics. This has enhanced my understanding of the range of different methodologies used to explore scientific concepts. Additionally, it has allowed me to convene with a range of researchers allowing me to develop skills, such as communication, which is vital as an early career researcher."

Alessandro Del Vecchio, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

"Meeting other researchers engaged in addressing physiological problems is consistently an exciting opportunity for everyone working within the fields of medicine, neuroscience, or bioengineering. Physiology focuses on understanding the causes and mechanisms of the human body considered as a whole, offering a broad perspective on researchers studying the neural control of movement. Attending the Neurophysiological Bases of Human Movement meeting provided the chance to connect with numerous enthusiastic individuals dedicated to understanding the physiological mechanisms that enable human movement in health and pathology."

This meeting was supported by Brainbox Initiative, Delsys Europe, Cambridge Electronic Design Ltd and Digitimer Ltd.

https://doi.org/10.36866/pn.133.32

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40th congress of the international union of physiological sciences

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SAVE THE DATE

January 2025
start of registration and abstract submission

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Meeting Preview

Current Challenges, Innovative Practice and Student Experience in Physiology Education

15 – 16 May 2024, University of Salford, UK

Meeting organisers:

Dr Sara Namvar

Dr David Greensmith

Dr Matthew Jones

University of Salford, UK

Key dates

Early registration deadline:
12 April 2024

Registration deadline:
1 May 2024

We are delighted to welcome colleagues from across the sector to *Current Challenges, Innovative Practice and Student Experience in Physiology Education*. This meeting will take place at the University of Salford, UK on 15 – 16 May 2024 and is relevant to academics working in all areas of physiology-based education. The programme covers four key themes:

- Graduate Capital and Industry Engagement in Physiology Education
- Improving Physiology Education Through Playful Learning and Authentic Assessment
- Enhancing Local and Global Access to Physiology Education
- Resilience and Adaptability in a Changing Landscape of Higher Education

The higher-education sector is rapidly evolving in response to a range of external pressures. As such, universities must pay far greater attention to performance and metrics in areas such as widening participation, student experience and graduate outcomes. The role of the physiology educator therefore goes far beyond the information we convey in the lecture theatre and laboratory setting, and we are in fact key actors in the sector's response to societal challenges. The aim of this meeting is to bring together physiology educators and industry stakeholders of all career stages and across a broad range of fields, to share innovation and best practice.

We are proud to bring together key partners from the University of Salford, University of Manchester, and Manchester Metropolitan University under our civic partnership agreement, but encourage wider collaboration from across the UK and beyond. In addition to innovative physiology educators, the meeting will feature invited experts from several areas that sit outside STEM, a strategy that promises to introduce fresh ideas that may enhance your teaching practice. As well as an exciting programme of poster and oral presentations and hands-on workshops, the meeting will include expert panel conversations that will focus on industry/graduate employer needs and sector-wide challenges. Networking sessions will provide an opportunity for delegates to connect, exchange ideas and form strong pedagogical collaborative links.

Salford is a fantastic location, with accommodation to suit all budgets close to the university. There is a train station on campus, plenty of parking and we are just a stone's throw away from Manchester city centre. This meeting promises to have something for physiology educators from all areas of the sector and at all career stages.

Save the date and make sure you register by 12 April to save money with our early bird rates. Find out more and secure your place at physoc.org/currentphysiologyeducation

https://doi.org/10.36866/pn.133.34

Meeting Preview

Command and Control: Unveiling the Regulation of Smooth Muscle Function

25 – 26 June 2024,
Dundalk Institute of Technology, Ireland

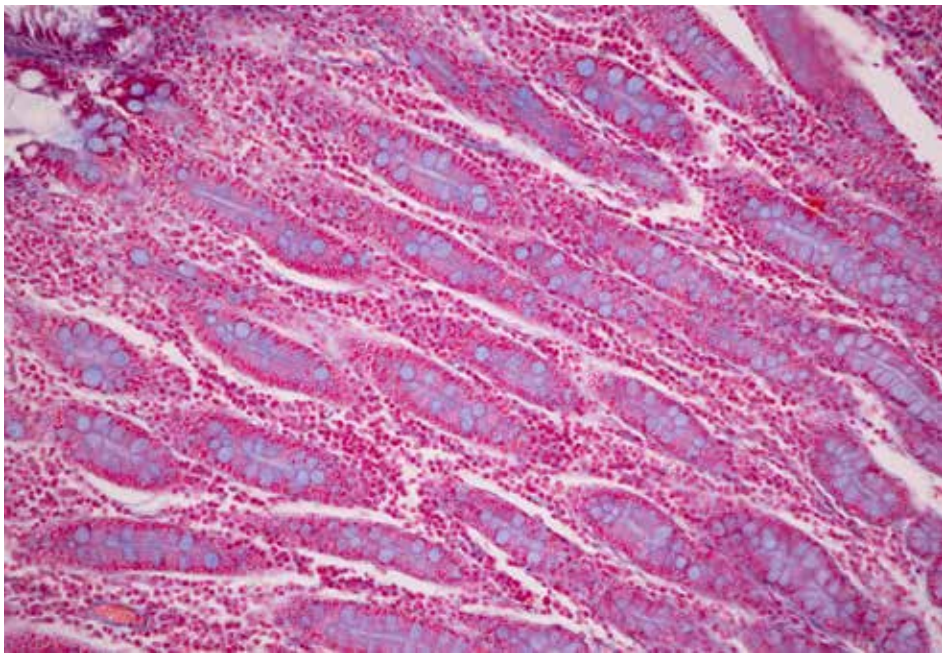
Meeting organisers:

Dr Bernard Drumm
Dundalk Institute of Technology, Ireland

Dr Harry Pritchard
The University of Manchester, UK

Dr Calum Wilson
University of Strathclyde, Glasgow, UK

Dr Matthew Lee
University of Strathclyde, Glasgow, UK



The organisers are delighted to welcome members and non-members alike to our two-day focused conference entitled *Command and Control: Unveiling the Regulation of Smooth Muscle Function*, at Dundalk Institute of Technology, Ireland on 25 - 26 June 2024. This conference will represent a meeting of worlds and expertise, where research from the entire breadth of smooth muscle tissues and organs will be presented and discussed. This conference is intended to bring researchers together from different physiological disciplines and subject areas under the general umbrella of smooth muscle regulation and disease. Thus, attendees are likely to find new audiences for their research and gain valuable insight into the diverse work of others within this field.

This conference will provide an opportunity for researchers studying the full range of smooth muscle organs (vascular, gastrointestinal, urinary tract, airway, reproductive tract etc.) to showcase contemporary research on topics such as smooth muscle electrical signalling, calcium dynamics and external control mechanisms, that will further our understanding of the physiology of life. Our conference is intended to allow early career investigators, trainees and students the opportunity to showcase and discuss their work alongside recognised and established international experts. The programme will feature contributions from researchers across the UK, Ireland, and beyond, and incorporate a dedicated early career researcher teaching session, to give an overview of the main excitation pathways and technologies used to study smooth muscle function.

Our two-day programme will deliver invited talks from key experts in smooth muscle physiology and pathophysiology with up to 14 additional slots available for oral communications selected from abstracts, as well as dedicated poster sessions. This will facilitate invigorated discussions of not only established concepts in smooth muscle physiology but exciting new paradigm shifts, works in progress, new ideas for future work and open up opportunities for cross-institutional collaborations.

Dundalk Institute of Technology, ideally situated one hour from both Dublin and Belfast, is home to the Smooth Muscle Research Centre, one of the largest smooth muscle research groups across Ireland and the UK. Dundalk itself is easily accessible by air, with daily frequent direct flights to Dublin airport from dozens of destinations in the UK, Europe, and North America. An hourly express bus service can bring attendees from Dublin airport to Dundalk Institute of Technology campus and regular buses and trains can carry visitors further field all over Ireland. Attendees will have the opportunity in the evening to explore one of Ireland's oldest Norman towns, located in the rich cultural region of County Louth, next to the mythical Boyne Valley (home of the Newgrange monument) with easy access to Dublin and Belfast city, the beautiful Carlingford and Cooley areas and the majestic Mourne Mountains.

We look forward to welcoming you to Dundalk in June. To find out more and book your place, visit: physoc.org/smoothmusclefunction.

Key dates

Abstract submission:
1 – 30 April 2024

Early review deadline:
8 April 2024

Early bird registration deadline:
24 May 2024

Conference Attendance Award deadline:
31 May 2024

Online registration deadline:
10 June 2024

https://doi.org/10.36866/pn.133.35

Meeting Preview

ISAN 2024, 13th Congress of the International Society for Autonomic Neuroscience

23 – 27 July 2024, University of Oxford and University of Birmingham, UK

The local organising committees of ISAN 2024 are proud to invite those with an interest in autonomic neuroscience, both fundamental and clinical, to this Oxford–Birmingham meeting. While the Oxford meeting has a cardiovascular focus, the Birmingham meeting, hosted in the green heart of the historic campus of the University of Birmingham, will cover the full breadth of autonomic research.

Oxford ISAN 2024: Cardiac Neurobiology: Concepts to Clinic

23 – 24 July 2024,
University of Oxford, UK

The autonomic nervous system regulates all aspects of normal cardiac function, and is recognised to play a critical role in the pathophysiology of many cardiovascular diseases. As such, the value of neuroscience-based cardiovascular therapeutics is increasingly evident.

This meeting will bring together the international community working in the field, with ample time to catch up with colleagues and establish new connections.

Local Organising Committee, University of Oxford, UK

- Professor David Paterson
- Professor Neil Herring

Keynote speaker

- Professor Gero Miesenboeck, University of Oxford, UK

Sessions topics

- From Central Nervous System to Peripheral Nervous System
- Cell–Cell Communication in the Heart
- The Bridge to Translation: Model Systems
- Neuromodulation and Target Therapies to the Heart

In association with this, there will also be a special issue of *The Journal of Physiology* and the call for papers closes on 1 May 2024.

This Special Issue will update the three white papers published in 2016 on the current state of understanding of human cardiac neuroanatomy, neurophysiology, pathophysiology, autonomic testing, risk stratification, and neuromodulatory strategies to mitigate the progression of cardiovascular diseases. In addition, there is an opportunity to submit original research manuscripts that target the three key areas below.

Topics for this call for papers include but are not restricted to:

- Neurobiology of cell–cell communication in the heart
- The Bridge to Translation: model systems
- Neuromodulation and target therapies to the heart

Guest editors:

- Professor David Paterson, University of Oxford, UK
- Professor Kalyanam Shivkumar, University of California, Los Angeles, US

Key dates

Early bird registration deadline: **27 May 2024**

Registration deadline: **7 July 2024**

https://doi.org/10.36866/pn.133.36

ISAN 2024

25 – 26 July 2024,
University of Birmingham, UK

Immediately following the Oxford meeting, the Birmingham meeting will cover the full breadth of autonomic research.

Local Organising Committee, University of Birmingham, UK

- Professor Janice Marshall
- Dr Keith Brain
- Dr Andy Holmes
- Dr Andy Coney
- Dr Davor Pavlovic

Keynote speakers

- Professor Andrew Allen, University of Melbourne, Australia
- Dr Jessica Folosa, Augusta University, Georgia, US
- Professor Kevin Tracey, Feinstein Institutes for Medical Research, US

Symposia

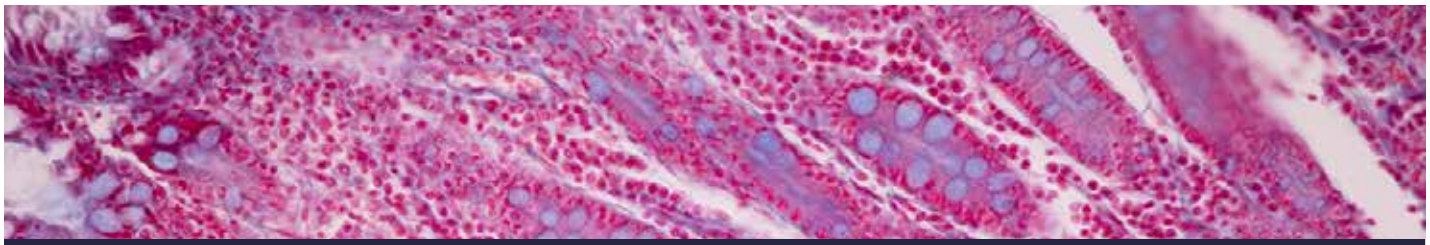
- Anatomical, functional, and molecular mapping of autonomic innervation of organs
- Bidirectional association between depression and autonomic nervous system alteration: New insights into therapeutic strategies
- Bioelectronic medicine
- Breaking news in cardiac autonomic regulation
- Central nervous control of blood pressure, brain blood flow, and cognitive health
- Integrative control
- Interrogating the physiology of the human vagus nerve
- Glucose sensing affecting autonomic activity – a new insight into neuronal control of metabolic homeostasis
- Neuroimaging of cardiovascular and respiratory control in humans
- Recent insights into the role of the vagus nerve in brain–gut communication and therapeutic implications of vagus nerve stimulation in the treatment of gastrointestinal disorders
- Targeting GI vasodilatory hormones for the treatment of postprandial syndromes in autonomic disorders
- Utilising NIH SPARC resources for ANS research
- Working towards selective vagus nerve stimulation to modulate autonomic function
- "You're so vein" – new insights into the function and autonomic regulation of the "forgotten" venous circulation

Key dates

Abstract submission closes: **7 April 2024**

Early bird registration deadline: **27 May 2024**

Registration deadline: **7 July 2024**



Command and Control:

Unveiling the Regulation of Smooth Muscle Function

25-26 June 2024 | Dundalk Institute of Technology, Ireland

This **dynamic two-day meeting** will showcase **cutting-edge research** on topics such as **smooth muscle electrical signalling, calcium dynamics** and **external control mechanisms**.

Register by
24 May 2024
for early rates

physoc.org/SmoothMuscleFunction

The Physiological Society

https://doi.org/10.36866/pn.133.36

Video Resources for New Physiology Lecturers

Professor Matthew J Mason

Department of Physiology, Development & Neuroscience, University of Cambridge, UK

What we study in physiology departments is drifting ever further from what we have to teach. Our research is leading us into hitherto unimaginable areas, often centred around molecular biology and genetics. However, students in the medical sciences still need to get to grips with the oozy, squishy, pulsating fundamentals of how the organs of the body work, just as they always have.

Teaching systems physiology requires us to bring together strands of knowledge not just from biological disciplines but also from physics, chemistry, mathematics and engineering, and somehow shape this into a coherent account that will be comprehensible to students from an increasingly diverse range of backgrounds. Getting started represents a mountain to climb for a new lecturer, whose training nowadays, if they are not clinically qualified, is more likely to have involved genes and gels than Poiseuille and pleura.

So how do we learn how to teach physiology? There are some excellent physiology textbooks out there, but they can exceed 1,000 pages of detailed information, and it is not always easy to extract the key points. There are many physiology websites, but it is often unclear who has created this material, and knowing what is reliable and what is not requires some experience with the field. Most such resources are aimed at the students directly.

The resources designed for lecturers tend to be on the general pedagogical side: what colour schemes to use in our slides, how to make our teaching more interactive, how to assess our stated learning outcomes. Such issues are important to consider, but they don't help us see how we will go about explaining the relationships between pressure, flow and resistance to our Monday morning medics, and how much of our 50-minute slot we should be devoting to this.

In order to help new physiology lecturers maintain a sure footing as they begin to climb that mountain, I have been working with The Physiological Society and Wilbee Films to create a set of video resources specifically for them. We first asked a focus group of young academics which topics they found most challenging to teach. Our shortlist included haemodynamics, electrochemical gradients, ventilatory mechanics and pH regulation. Notably, the first three topics borrow heavily from physics, the last from chemistry.

We then brought together a team of experienced physiology lecturers from around the country, who have been teaching these topics for many years. I took the haemodynamics topic myself, while Angus Brown from Nottingham took electrochemical gradients, Teresa Thomas from Birmingham took ventilation and Francesca Arrigoni from Kingston took acid–base balance.

The videos we produced, currently available on The Physiological Society's online Training Hub under "New Lecturer Resources", highlight what we consider to be the most important concepts that we should be teaching in each area. We focus on those that undergraduates struggle with, which therefore require special attention in lectures. We explain how we go about teaching them to our own students, providing tips and tricks including:

- Live demonstrations that we might perform in a lecture (I was slightly concerned about the arterial blood pressure I measured in myself, on camera!);
- Visual props, such as Teresa's split tennis ball, used to show how the chest wall tends to spring outwards from a compressed state;
- Simple diagrams, such as those Angus uses to explain Nernstian relationships;
- Clinical scenarios to gain the attention of medical students, like those Francesca introduces.

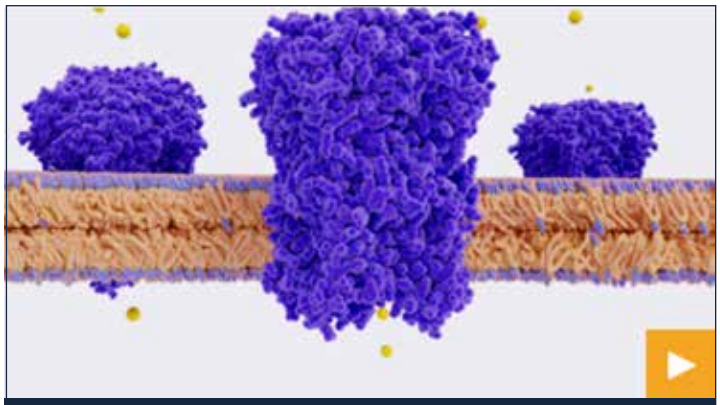
We don't claim that the way we present things in our teaching is the only way to do it. Perhaps you have your own tips and tricks for getting these concepts across in your classes – but if you do, you are probably not the target audience for these videos! Rather, you might be the ideal person to present a future video, if this project proves to be successful and we expand the range of topics as we hope to.

If you are a new lecturer, however, we hope that you will explore our current set of video resources when you are preparing your own lecture courses, and perhaps you will find something in there that will prove to be useful to your own teaching. If that's the case, do please tell us about it!

https://doi.org/10.36866/pn.133.38

Core Concepts of Cardiovascular Physiology

Respiratory Physiology



Electrochemical Gradients in Physiology

Acid–Base Balance Physiology

Training Hub
By The Physiological Society

Topics and concepts covered

- Cardiovascular lectures not flowing as they should? Matt Mason shows how the analogy of a garden hosepipe can be a useful way of illustrating to students the relationships between cardiac output, arterial pressure and peripheral resistance.
- Electrochemical gradients underpin cell physiology, from secondary active transport to action potentials, but the associated maths and physics can be daunting. Angus Brown suggests how we might spark our students' curiosity to explore further.
- The competing forces operating on the lung, chest wall and alveoli can be confusing. Teresa Thomas suggests how sketch graphs and visual props can help students grasp the key concepts – an inspiring introduction for new respiratory lecturers!
- Acid indigestion? How the body regulates extracellular pH is a topic that can be difficult for students to assimilate. Francesca Arrigoni shows how, beginning with no more than high-school chemistry and maths, we can help students understand how we respond to daily metabolic challenges.
- Bad puns not included in the actual videos.

Harley Stevenson-Cocks, Newcastle University, UK

"It can be difficult to know the best way to engage students in learning difficult, yet fundamental, physiological concepts like electrochemical gradients - and if you lose the students early, it's difficult to build on those key foundations in their subsequent learning. As a new lecturer, hearing how experienced staff approach teaching such concepts in a structured way, through The Society's Training Hub videos, is a great way to get inspiration and reassurance for your teaching. I'm always looking for ways to streamline difficult concepts for students and the Training Hub videos have been a big help on that front."

https://doi.org/10.36866/pn.133.38

New Physiology Grants Directory

Introducing our Physiology Grants Directory, your go-to place for all upcoming physiology funding opportunities in 2024. Julia Attias, Membership Programmes Manager at The Physiological Society, tells us more about this essential resource available via our Training Hub.

Julia Attias

Membership Programmes Manager,
The Physiological Society

What is it?

As an early to mid-career researcher, securing funding is crucial to help you progress in your career. We know how time-consuming it can be to search websites for funding opportunities, so we've done the hard work for you by putting all physiology grants for early to mid-career researchers in one place.

The Physiology Grants Directory uses a calendar function to enable you to view all open grants on any specific day. You can find information on the grant's opening and closing date, as well as information on eligibility, scope, application criteria, assessment method and key dates for applying.

How can it be used?

The Directory offers you a way in which to get to grips with the physiology grants landscape, by presenting a comprehensive overview of what is available and when. You may even want to take a closer look at funder-specific grants that you know your field of physiology is generally successful at acquiring and become familiar with their application requirements.

By having all available grants mapped out for you in any given month, you can proactively manage your schedule and optimise your time effectively. For each grant you want to apply for, you could mark the key dates in your calendar and allocate time for submission activities such as idea generation, writing, or requesting letters of support. Whichever way you choose to use the directory, we're certain you'll find value.

Start checking grants' opening and closing dates, as well as all the vital details at physoc.org/training-hub/physiology-grants-directory/

We hope the new Physiology Grants Directory will become your "go-to" place for finding physiology-related opportunities and shave hours off your time searching!

https://doi.org/10.36866/pn.133.40

Congratulations to our 2023 Rob Clarke Awards Winner

The Rob Clarke Awards were one of the highlights of the Member Forum held on Friday 1 December 2023. The award recognises excellence in undergraduate physiology projects.

Professor David Attwell (President of The Physiological Society) presenting the Rob Clarke Award to Anupa Sara Paulose University College Dublin, Ireland.

Seven students were shortlisted for an Abstract Award and invited to present a poster at the Member Forum for final judging. The judges were impressed by all the finalists but receiving the overall highest scores was Anupa Sara Paulose from University College Dublin (UCD), Ireland.

Anupa presented her poster on "Investigating Novel Drug Compound L4 as a Neuroprotective Agent in Alzheimer's disease". The judges praised Anupa for excellent presentation and responses to questions, and clear enthusiasm for the research area.

We interviewed Anupa to learn more about her research project and her ambitions to join the global efforts to help people living with Alzheimer's Disease, to offer them better treatments and delay the onset or even prevent the disease from developing.

What did you find?

Under the supervision of Dr Derek Costello (UCD, Ireland), I conducted my project as part of my final-year research at UCD School of Biomolecular and Biomedical Science. My research project explored the effect of L4, a novel coumarin-derivative drug, as a neuroprotective agent in Alzheimer's disease. I investigated its effect on oxidative stress and neuronal cell death, two of the major pathological hallmarks associated with Alzheimer's disease.

> This undergraduate research project motivated me to pursue a PhD

I found that the L4 drug significantly reduced oxidative stress and neuronal cell death in the neuroblastoma (N2a) cell line, which highlights its potential as a multi-targeted therapy for Alzheimer's disease.

What inspired you to choose this topic?

Dementia research holds a special place in my heart. I have been working part-time with the elderly for the past four years, and I have seen a lot of them suffer from dementia. This firsthand experience has fuelled my desire to contribute to the scientific community's efforts to combat this devastating illness.

When the opportunity arose to work on this project, I was absolutely elated. The project did come with a few challenges, especially when some of the experiments failed. However, I quickly understood that it was a part of research, and learning how to troubleshoot was certainly a valuable experience. Working with the researchers in Dr Derek Costello's group was undoubtedly an incredible opportunity, as they were among the most passionate people I have ever met.

Could you share your experience of presenting your work?

This was my first poster presentation abroad, which only added to my excitement and nervousness. From meeting several inspiring scientists in the field, to spending the day with my fellow Rob Clarke Award finalists, this was one of the best and most invaluable experiences I have had.

As nerve-wracking as it was to present my work in front of a panel of judges, I was grateful for the eye-opening feedback that I will certainly take on board. I also really enjoyed discussing my poster with attendees, and it was nice to see their shared excitement for my project.

Are you still working on Alzheimer's disease?

My ambition to do research on Alzheimer's Disease has certainly not diminished, and I am currently doing my PhD under the supervision of Dr Marie-Victoire Guillot-Sestier, at UCD School of Medicine. My project, funded by the Irish Research Council, focuses on investigating the role of microglia in the sex differences seen in patients.

I am very excited to embark on this new step in my research career because I know it is another step forward in my goal to help progress the field of Alzheimer's disease research. I always feel that there is still so much to learn and explore and I am eager about the new opportunities that my PhD will provide.

Has the award and your project influenced your career interests?

This undergraduate research project motivated me to pursue a PhD as my next step. Being in a collaborative lab environment, carrying out experiments, troubleshooting protocols, and doing something I was passionate about, made me realise that this is something I can see myself waking up to every day with a lot of enthusiasm.

https://doi.org/10.36866/pn.133.41

Celebrating life-saving research in Portsmouth

Researchers and colleagues attending the plaque unveiling at the University of Portsmouth's School of Sport, Health and Exercise Science

Life-saving physiological research took centre stage at an event to celebrate the University of Portsmouth's Extreme Environments Laboratory (EEL) in December. The EEL became the first institute to be given our inaugural Excellence in Physiology Award. To mark the accolade, a plaque was unveiled at the University's School of Sport, Health and Exercise Science, which is home to the ELL.

Formed in 1998, the EEL is home to the world-renowned Extreme Environments Group, which investigates the physiological and psychological responses to adverse environments, including heat, cold, and hypoxia and the preparation and protection of those who enter such environments. Their research has influenced global practices and policies, improving both athlete and occupational safety in extreme environments.

Research conducted at the EEL has paved the way for critical enhancements in international water-safety regulations, impacting athletes across 200 countries and various sports. The safety protocols of open-water swimming competitions have also been notably altered through the group's findings, considerably reducing the risk of dying while participating in cold-water swimming.

President of The Physiological Society, Professor David Attwell, and Professor Richard Thelwell, Interim Dean of Science and Health at the University of Portsmouth

President of The Physiological Society, Professor David Attwell, Professor Mike Tipton MBE, and Professor Richard Thelwell

One of the most impactful areas of the EEL's research lies in their work on drowning prevention, a global public health issue. Their efforts have given rise to "Respect the Water", a national water safety campaign initiated by the RNLI in 2014. Underpinned by the EEL's findings, the campaign has successfully increased public understanding of the importance of floating as a primary survival behaviour in water-related emergencies.

The British Olympic and Paralympic teams have also reaped substantial benefits from work carried out at the EEL, including improved training and preparation practices across ten Olympic and Paralympic sports.

"It is a huge honour for our work to be recognised by The Physiological Society. Research has helped us understand, evaluate and enhance people's comfort, performance and survival in extreme environments around the world. This event has been a brilliant opportunity to showcase the impact the EEL has had since its formation at the university 25 years ago, and celebrate this significant milestone

Professor Mike Tipton MBE, Co-founder of the EEL, University of Portsmouth, UK

https://doi.org/10.36866/pn.133.42

Congratulating our 2025 Prize Lecture Recipients

The Society is delighted to announce our 2025 Prize Lecture recipients, many of whom will be giving their lecture at IUPS 2025, which will be held in Frankfurt, Germany from 11 – 14 September 2025.

Annual Review Prize Lecture

Professor Lucilla Poston CBE, King's College London, UK

Bayliss-Starling Prize Lecture

Dr Mootaz Salman BPharm MSc PhD, University of Oxford, UK

Hodgkin-Huxley Prize Lecture

Professor Natalia A. Trayanova PhD MS, Johns Hopkins University, US

Sharpey-Schafer Prize Lecture

Professor Michael J. Welsh MD, University of Iowa, US

GL Brown Prize Lecture

Professor Damian Bailey PhD, University of South Wales, UK

R Jean Banister Prize Lecture

Dr Sylvia Schröder PhD, University of Sussex, UK

The Otto Hutter Physiology Teaching Prize and Lecture

Professor Matthew J. Mason PhD, University of Cambridge , UK

Find out more about our Prize Lectures

physoc.org/prize-lectures

https://doi.org/10.36866/pn.133.43

Celebrating Physiology Week

Physiology Week 2024: 18 – 22 November

In November last year, we held our first ever "Physiology Week", between 20 and 24 November. This global celebration of physiology saw hundreds of physiologists come together to organise 70 events worldwide and demonstrate the importance of physiology. From public lectures to coffee mornings, school visits to lab tours, our members opened their doors to the wider community and showcased why physiology matters.

Physiology Health Checks

"At The University of East London, myself and other colleagues in the School of Health, Sport and Bioscience set up a 'Physiology Health Checks' stand in one of the central foyers of the university. We had a range of physiological tests including pulse oximetry, grip strength and peak flow. Over the course of the morning, we had over 200 students stop by at the stand and complete our various tests. It was fantastic to see so many people interested in their own physiology and wanting to understand more about how to keep healthy."

Charlotte Thornton White, Sports Science & Physiology Supervisor, Department of Applied Sport & Exercise Sciences, School of Health Sport & Bioscience, University of East London

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Knit a Neurone

"As part of Physiology Week, we ran an activity called 'Knit a Neurone', where students at the University of Bristol could come along and knit, crochet or make a pom pom neurone. It was a great opportunity to come together with colleagues in the School of Physiology, Pharmacology and Neuroscience to talk to students about the importance of physiology and get them enthused about neuroscience."

Dr Dawn Davies, Associate Professor in Biomedical Education, University of Bristol

Night at the Vet College

"To coincide with Physiology Week, in November we held 'Night at the Vet College' our annual public engagement event where we open our doors to the public to showcase our innovative research, which aims to improve the treatment, understanding and welfare of animals. This year's event saw our biggest turnout with over 570 visitors enjoying the activities. These included practical activities in our labs, interactive stands, mini lectures, visits to our anatomy museum (which is not usually open to the public), and tours of the campus. As well as being a great opportunity to learn more about the Royal Veterinary College, it also gave our students and researchers the opportunity to talk about what they are learning on their degrees and to discuss their research".

Dr Grace MacKintosh Sim, Outreach Development Manager, & Caroline Pellet-Many, Lecturer in Biomedical Sciences, Royal Veterinary College, University of London.

During Physiology Week, we also ran a social media campaign called #FacesofPhysiology, asking our global community of physiologists to take part by sending us their picture and posting about their work. Through this campaign we celebrated the incredible breadth and depth of physiology and physiologists – from classrooms to clinics and from labs to lifeboats. This resulted in 229 submissions from physiologists all over the world. The showcase was unveiled at the Member Forum in December at The Royal Society in London. You can see a snapshot of the showcase on the back page of this issue.

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Obituary: Professor David Brown (1936-2023)

Professor David Brown, FIBiol, FRS

Professor David Brown, FIBiol, FRS was renowned worldwide for discovering the 'M-current', a non-inactivating K^+ current inhibited by muscarinic receptors (chemicals that modulate synaptic activity in the brain), in bullfrog sympathetic ganglion proteins in 1980 (Brown and Adam, 1980). Throughout his distinguished career, David was at the forefront of understanding the biophysical characteristics, function and regulation of the M-current and other ion channel currents in peripheral and central neurons, resulting in many seminal publications. As a fitting tribute to recognise his many contributions to the ion channel field, a one-day meeting on "Ion Channel Regulation and Neuronal Function" was held at the Royal Society in July 2013 (partly supported by The Physiological Society). It is, thus, with great sadness that he died last autumn, on 21 October 2023.

In recognition of his numerous groundbreaking achievements in the field of ion channels and their regulation he was appointed a fellow of the Royal Society in 1990

David obtained a first-class honours degree in Chemistry, Physiology and Zoology from University College London in 1956 followed by Special Physiology in 1957. He then gained a PhD in Pharmacology from St Barts Hospital Medical College. Following this, he became a lecturer at St Barts Hospital Medical College before taking up the position of senior lecturer at the School of Pharmacy in 1973. He went on to become the Wellcome Professor of Pharmacology at the School of Pharmacy (University of London; currently part of UCL) and to lead the Department of Pharmacology at the School of Pharmacy with distinction (1979 – 1987).

Through these early years and throughout his career, David recognised the value of international scientific collaborations. In fact, he obtained visiting professorships at the universities of Texas, Chicago, Iowa and Kanazawa and a Fogarty Scholar-in-residence at the National Institutes of Health (NIH). During these visits, he established numerous collaborations and connections, which he maintained for many years. These connections were invaluable in the many discoveries he made, including electrophysiological recordings of the M-current in bullfrog sympathetic neurons (Brown and Adam, 1980) and the first identification of receptor-ion channel transduction mechanisms in neurons involving phospholipase C (Higashida and Brown, 1986) (supported by Fogarty Scholar-in-residence, NIH).

He eloquently detailed his collaborations and adventures in research in an article published in *Annual Reviews of Pharmacology and Toxicology* (Brown, 2020). He encouraged colleagues to interact and collaborate with scientists at an international level. In recognition of his numerous groundbreaking achievements in the field of ion channels and their regulation he was appointed a Fellow of the Royal Society in 1990.

In 1987, he became Head of the Department of Pharmacology at UCL, holding the Astor Chair, a position he retained until his retirement in 2002. As Head of Department, he took a significant interest in helping colleagues, including PhD students and postdoctoral fellows, achieve their goals and aspirations. As a PhD student in his department, he encouraged me to apply for the Wellcome Trust International Prize Travel Research Fellowship. This enabled me to join Professor Daniel Johnston's laboratory (Baylor College of Medicine, US) to learn pioneering advanced electrophysiological techniques. The techniques are required for gaining new insights into the physiological properties and function of hippocampal and cortical neurons. This was a pivotal and invaluable experience for me, which I attribute to David. Even after returning from US to start my independent research career in the UK, David was helpful in providing insightful career advice. He has provided similar guidance and support to many others at UCL and around the world.

Another key factor that David attributed to his success was his pursuit of reading peer-reviewed articles on research in other disciplines. When entering his office, I was always struck by the number of scientific journals stacked on a table near his desk and

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the volumes of books on the shelves, which he would spend time browsing and reading. As journals transitioned to online, he perused the online content on a regular basis and shared articles that he thought would be relevant and of interest to colleagues. This fountain of knowledge was particularly useful to him for innovative research ideas and writing review articles or books, such as the book *From Neuron to Brain*, which he was energetically editing up until a few days before his passing.

In addition to his roles at UCL, David had numerous international appointments. David served as international secretary for The Physiological Society for three years, during which time he travelled to many countries promoting physiology. He was also chief editor for *British Journal of Pharmacology* and was a member of the editorial boards for *Neuron*, *Trends in Neuroscience*, *The Journal of Physiology*, *European Journal of Neuroscience* and *Proceedings of the Royal Society* (among others). He served on grant committees and advisory boards, including the Deutsche Forschungsgemeinschaft and Max Planck Society. He had a full, distinguished and illustrious career. Importantly, he enjoyed engaging with fellow scientists. For David, taking on all these roles was not an imposition but an honour.

Despite all his remarkable achievements, David was a humble, modest and respectful person who treated everyone equally and without prejudice. Evidence of his modesty is in an article in which he wrote "his own career was nothing unusual" in the context that three of his colleagues (Professor Humphrey Rang, Professor Tom Connors and Professor Christine Armett) who completed "Special Physiology" with him also had distinguished careers (Brown, 2020).

His personality together with his approachable attitude were, in my view, most important for his success as a world-renowned leader in science. I, as many other colleagues, will miss the insightful and witty conversations and e-mail exchanges we had with him.

Written by Professor Mala Shah, University College London, UK

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Pictures taken from our #FacesOfPhysiology campaign, run during Physiology Week 2023.