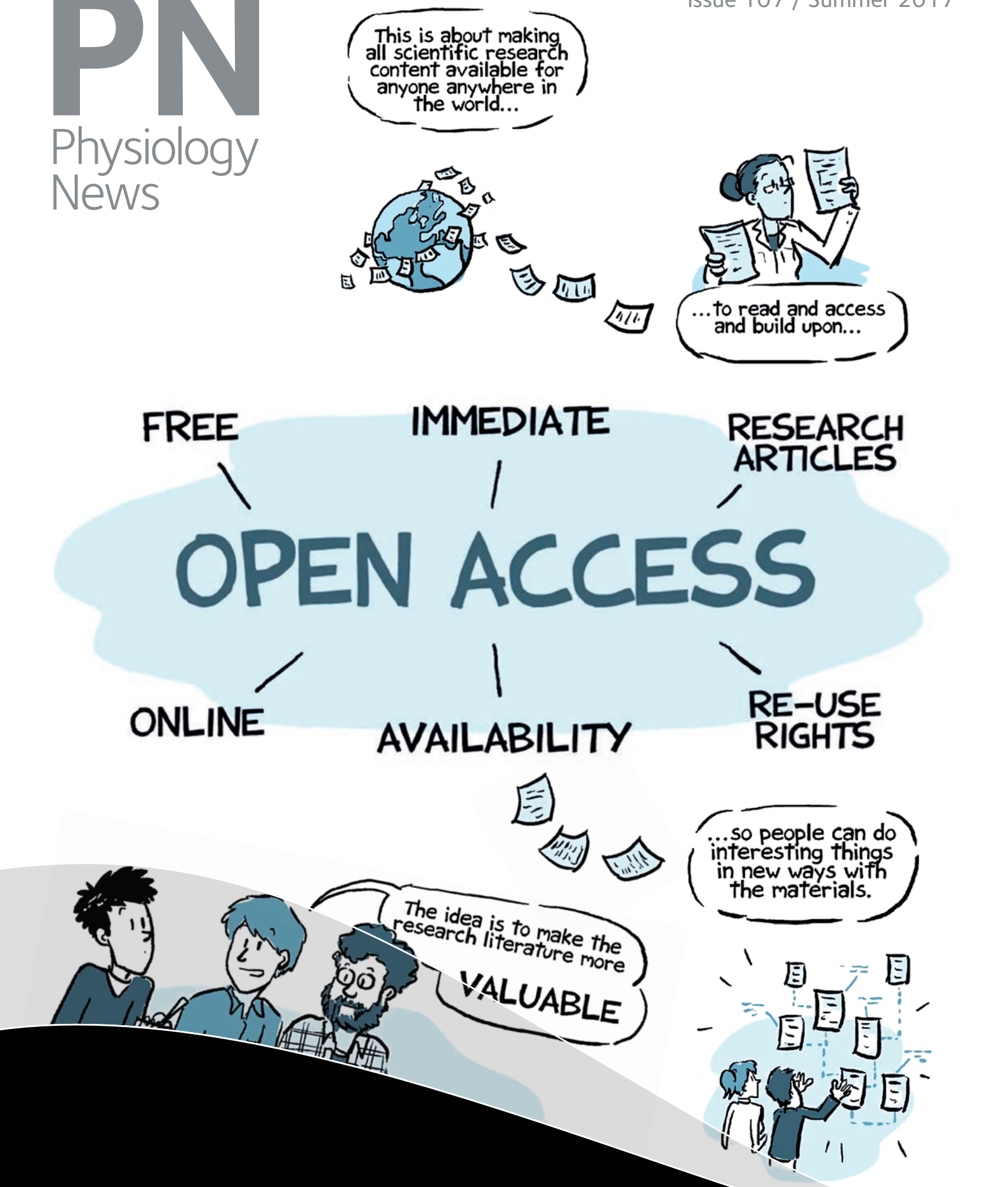
PN
Physiology News

Issue 107 / Summer 2017



Open science movement

The war to liberate knowledge

The Physiological Society

Future Physiology

13 - 14 December 2017

Leeds, UK

A two-day scientific and career development conference organised by early career physiologists.

www.physoc.org/futurephysiology

The Physiological Society

Physiology News

We welcome feedback on our membership magazine, or letters and suggestions for articles for publication, including book reviews, from our Members.
Please email **magazine@physoc.org**

Physiology News is one of the benefits of membership, along with reduced registration rates for our high-profile events, free online access to our leading journals, *The Journal of Physiology*, *Experimental Physiology* and *Physiological Reports*, and travel grants to attend scientific meetings. Membership offers you access to the largest network of physiologists in Europe.

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Welcome to the Summer 2017 edition of *Physiology News*

Introduction

News in brief

News in depth

Meetings & events

Features

Membership

Cover image: This work is a derivative of 'Open Access Explained!' [https://www.youtube.com/watch?v=L5rVH1KGBCY] by ©PhDComics.com Licensed under CC BY. Read the first of our two-part series about open science on p. 24.

Annual General Meeting 2017

Wednesday, 12 July from 14.30

Wellcome Collection, London, UK

All members can attend, only Full and Honorary Members can vote

More information at www.physoc.org/agm-2017

Roger Thomas
Editor

This issue of *Physiology News* is full of interesting material. The long and thoughful article by Keith Siew about aspects of the open science movement (part 1, part 2 will be in the next issue, written by Vivien Rolfe) is very thought-provoking. Of course, prestigious journals such as *The Journal of Physiology* are not at first 'open', since subscribers have to pay. The Society does benefit considerably. There is an intriguing article by Tilli Tansey about physiologist winners of the Nobel Prize. Many Nobel laureates were Members before winning, others were only elected afterwards. Universities like to boast about winners who studied there, even if their research was done elsewhere. There is also a fascinating article on the 1923 International Congress, held in Edinburgh. It was too soon after the First World War for some Europeans to feel able to attend. There are also two articles about aspects of stress, and there will be more in *PN* 108.

If all goes well, this issue should appear just before the IUPS congress in Brazil, which replaces The Society's normal main summer meeting. I have been to several IUPS congresses, most memorably in Sydney, but I cannot make it to Rio de Janeiro. I hope all who attend have a great time. We remainers in the UK will have the consolation of an exciting Annual General Meeting (AGM) in London at 14.30 on 12 July. The AGM will be followed by 2 hours of selected Affiliate presentations - flash oral communications and posters. After that there will be a President's Lecture and a reception. When I joined The Society, the AGM was always held in University College London; this year it will be held in the Wellcome Collection nearby. It is remarkable how few meetings, if any, are now held in Universities, when not so long ago they almost all were. One reason, I suppose, must be the multiplication of suitable conference centres, which undertake all the arrangements previously left to the hosting departments. Sadly, such venues rather rule out any demonstrations, which for many were the highlight of meetings of The Society. I was myself the local organiser of several Society meetings in Bristol, one involving a train ride to Bath for the meeting dinner in the pump room. I suppose my efforts were all rather time-consuming and irrelevant to the Research Assessment Exercise. But I do miss the opportunities to see what is going on in other physiology laboratories.

Members may be interested to know that oversight of *Physiology News* has passed to the Policy Committee of The Physiological Society, which has been renamed the Policy and Communications Committee (PCC). The change was discussed and agreed by all of Council, and also agreed by the PCC committee and the Chair of Publications Committee. *PN* was previously seen as a publication and was thus overseen by PubComm. I am happy with this new arrangement. To be fair, PubComm is concerned with peer-reviewed journals, and *PN* cannot be so described. It did start life as *Committee News*, and I am pleased that it will now include more reports from The Society's many committees. It has taken me over a year to persuade some of the various committee chairs to supply such information. When *Committee News* was launched in 1983, The Society had only the one committee; now it has 12 if I include the Council of Trustees. Admittedly there were various sub-committees in earlier days. Actual membership of The Society has perhaps only doubled over the same period.

I have already participated in a meeting of the PCC, but only via telephone. This was my first experience as a teleconferencer rather than as chairman of a meeting with one or two members phoning in, and I was not always able to work out who was talking. I look forward to reading the minutes so I will understand what we all agreed. I complained about the excessive use of acronyms in the minutes of the previous meeting, held before I was an ex-officio member.

As the exam season is now upon us, I am reminded again of my personal doubts about whether the UK method of examinations for biology-related subjects is fit for purpose. How important in real life is it to be able to write essays on a relevant topic with no access to any notes, books or the internet? The current system rewards good memory rather than any real understanding of the subject being examined. I understand that the Italian system is quite different, with mostly oral exams, but of course it still rewards a good memory. This may be even more stressful than four sessions of writing three essays in three hours, and the lack of paper evidence may lead to accusations of favouritism. It does avoid the problem of poor handwriting at least. The big advantage of the UK system is that it's hard to cheat as long as mobile phones and similar technology is eliminated from the exam venue, but reading and assessing great piles of essays is extremely taxing for the examiners. I earnestly hope that soon some way will be found to allow candidates to use word-processors. Medical student handwriting is often appalling.

Reports of recent Committee meetings

The purpose of these short updates is to keep you informed about the inner workings of our Committees. The following summaries detail the meetings of the past few months.

History & Archives Committee

Several topics recently discussed by the History and Archives Committee (HAC; chaired by Graham Dockray) have already been covered in *PN*. For example, the last issue contained a piece by David Miller on AV Hill's Nobel Prize Diploma (*PN* 106, p.12–13): HAC has debated the most appropriate way to represent the diploma at H^3. Should we display the original diploma (given that it is unique there are security and insurance issues here)? Should we produce a facsimile for display, and if so should it be a copy of the whole diploma, front and back, or just the main part? Should it be on a wall or in a display cabinet? Before long, visitors to Hodgkin Huxley House should be able to see the outcome of these discussions.

Oversight of The Society archives is a major part of the HAC remit. The last issue of *PN* (106, p. 10–11) contained a piece by Georgina Lever describing her work on the accrual of the latest batch of archives, which is something that is done every 5 years. The archives provide a research resource that, for example, was used by Tilli Tansey for her piece in this issue of *PN*, page 44.

The 150th anniversary of the founding of The Society will occur in 2026. The development of a strategy on the part of HAC to meet the challenge was the focus of a special meeting in January. A number of relevant projects have been initiated including enhancement of open access resources on our own website.

Policy & Communications Committee

The Policy and Communications Committee (PCC, ex-Policy Committee, chaired by Lucy Donaldson) is working on several projects at the moment. Of note for The Society's Members is that we are looking at the structure of the committee to identify areas in which we could strengthen its membership. If you have an interest in contributing to our work with research funders or to our external communications, we'd like to hear from you.

We have recently released several reports on our activities, including our events at last year's party conferences, a YouGov survey about stress, a membership survey about Brexit, and the report on the PCC/Education and Outreach joint meeting on the Teaching Excellence Framework, in partnership with Universities UK. We also contributed to the recent HEFCE consultation on REF2021.

The *In Vivo* sub-committee, chaired by Andrew Trafford, continues to work with the UK Bioscience Sector Coalition in meetings with the Animals in Science Regulation Unit (ASRU). Currently, ASRU is looking at the process and form of the PPL, hosting stakeholder meetings around the UK. Our Members have been contributing to this process, meeting with ASRU in January and March in preliminary discussions, and contributing to these on-going stakeholder consultations.

Affiliate Working Group Committee

The second meeting of the newly formed Affiliate Working Group (AWG) was held at H^3 on 22 March 2017. As the Society's Annual General Meeting (AGM) will be held in London (on 12 July), and will not be part of the main meeting in Brazil, it was decided there will be several talks and presentations around the meeting, some of which will be delivered by our Affiliate Members. All members of the AWG agreed that a mixture of oral and poster presentations would work well, with the addition of a prize for the best of each.

The AWG is also actively involved in organising Future Physiology **www.physoc.org/futurephysiology**, our first multi-day conference dedicated to early career researchers. The conference, happening in Leeds in December, includes invited presentations by early career and senior researchers, oral and poster presentations, inspirational talks, and career development workshops.

The use of social media to engage the Affiliate membership was the next point of discussion. It was agreed that more could be done, but the question is more of what? Managing a social media account is no small task, so it was agreed that an Affiliate-focused newsletter would be a good way to establish regular communication. If any Affiliate Members have ideas, we're all ears!

With this in mind, all members felt regular columns in *Physiology News* would be a good idea to improve membership engagement. It was agreed after discussion with the *PN* Editorial Board that the AWG will guest edit issue 109 later this year, which members should receive shortly before the Future Physiology meeting.

Full details of the AWG can be found online at **www.physoc.org/affiliate-working-group**

Education & Outreach Committee

The main points of business at the Education and Outreach Committee meeting in April, chaired by Sarah Hall, included an update on the progress of the new Physiology Massive Open Online Course (MOOC), and a report on the impact evaluation of the Vacation Studentship scheme. The Committee met with the project team that is leading on the development of our MOOC, which will be an introductory course aimed at 16 to 19-year-olds to encourage them to consider studying physiology at university.

General feedback regarding content was given to the team from the University of Liverpool, which is developing the MOOC in partnership with The Physiological Society and FutureLearn. The Committee also recommended potential avenues for advertising the MOOC to its core demographic. Enrolment on the course will open this summer. Read more on page 18.

The Committee was very pleased with the responses presented from a recent survey of past Vacation Studentship awardees during 2013–2015: 84% of respondents are still in academia, 60% of whom are doing what they consider to be physiological MSc, PhD or

postdoc research, and 100% said the Vacation Studentship had a positive impact on their career plans. A full report of the survey findings will be published in *PN* 108.

Membership & Grants Committee

Tasked with leadership of The Society's membership strategy and grant oversight, the Membership & Grants Committee held the first of their bi-annual meetings this April, chaired by Rachel Tribe.

The agenda covered membership reporting, grant impact reporting and developments to the newly installed customer relationship management (CRM) system. A member of the Affiliate Working Group attended to discuss matters relating to Affiliates, and to update on planning for Future Physiology. Also discussed was the launch of Fellowships and the unfortunate delay with getting the first round of applications approved. With the technical delay to be resolved shortly after the meeting, the Committee were confident those applicants waiting on a decision would be notified soon.

The Committee also heard the initial highlights from the 2017 membership survey, which had closed 2 days before. The results of this survey will feed into the Committee's planning over the next 18 months, ensuring our activities are geared towards the needs of the membership. Further insight from the survey can be found on page 12.

Meetings Committee

Plans are progressing for Europhysiology 2018, and discussions are under way regarding the events in 2020 and 2022.

Looking ahead to The Society's next main meeting, taking place in 2019, the Committee is currently considering three potential Scottish locations for this. There are several topic meetings in the pipeline including 'Mitochondria – Form and Function', which takes place in London on 14–15 September 2017, and the organising committee for 'Experimental Models in Physiology' (planned for 2018) will shortly be finalising the programme for this event. The H³ symposium on 'The Integrative Physiology of Physical Inactivity Across the Lifespan' was approved, and it was deemed that this, together with another proposal, would make for a good combined event. Support for international meetings in 2017 will be given to the 37th PSN Conference in Kaduna, Nigeria, as part of our remit to enhance the communication of physiology both nationally and internationally.

On a more general note, re-forecasting of budgets (where necessary) and a review of registration fees for events taking place in 2019 and beyond, to enable widespread participation from all physiologists, regardless of career stage, will be carried out. The Society will be drafting a form for the online submission of proposals for topic meetings and H³ symposiums. Lastly, Sue Deuchars has replaced Ken O'Halloran as Chair of the committee and will continue in this role until the 2018 AGM.

Publications Committee

The Spring Publications Committee was held on May 4 2017 and chaired by Prem Kumar.

Since the last meeting, a new long-term publishing contract with Wiley for *Experimental Physiology* and *The Journal of Physiology* has been signed.

The Editor-in-Chiefs (EiCs) of *Experimental Physiology* and *The Journal of Physiology* have continued to implement their strategic plans for the journals. Mike Tipton, EiC of *Experimental Physiology*, has restructured the Editorial Board, with one new Senior Editor and 44 Reviewing Editors being appointed. Kim Barrett, EiC of *The Journal of Physiology*, is improving the evenness of coverage across physiology and is particularly pleased to have appointed new renal and endocrine Reviewing Editors, Dennis Brown and Fiona Gribble. The number of direct submissions for *Physiological Reports* has gone up, with the overall number of submissions increasing too. The Joint Management Board is in the process of appointing the new EiC, to take over when Sue Wray steps down at the end of the year.

Wiley provided a publisher's report for each journal, showing that article downloads are increasing.

Ken O'Halloran has stood down from the Publications Committee, and Sue Deuchars as the interim Chair of Meetings Committee, has replaced him as an ex-officio member.

Bringing you snippets of the latest intriguing research

Therapeutic vaccine controls HIV without drugs

The immune systems of five HIV+ patients treated with two vaccines and the cancer drug romidepsin were able to suppress the virus unaided. The therapeutic vaccine is a treatment for people already infected with HIV as opposed to preventative immunisation, and is the first to stop the virus from replicating without the use of daily drugs.

bit.ly/2kTzTxU

Unlimited blood supply

The first human immortalised adult erythroid line (Bristol Erythroid Line Adult or BEL-A) can generate functional red blood cells *in vitro* for clinical use sustainably and scalably.

DOI: 10.1038/ncomms14750

Repurposed drugs prevent neurodegeneration

Trazodone, a licensed anti-depressant, and dibenzoylmethane (DBM), a compound being trialled as an anti-cancer drug, have both been found to prevent brain cell death in prion-related disease and improve memory tests for other neurodegenerative diseases in mice.

DOI: 10.1093/brain/awx074

Salt makes you hungry not thirsty

The assumption that high salt intake increases drinking has been turned on its head by two new studies. Long-term high salt diets in humans and mice increase hunger and reduce water intake despite increased urine volume. This is due to glucocorticoid-induced breakdown of the body's fat and muscle which generates surplus water.

DOI: 10.1172/JCI88530
DOI: 10.1172/JCI88532

Short-term memories don't become long-term memories

Contrary to the standard theory of memory consolidation, which says that you gradually transfer the memories, optogenetic studies have discovered that long-term memories develop at the same time as short-term memories, only staying quiet while they mature.

DOI: 10.1126/science.aam6808

First group of Members awarded Fellowship

In January of this year, The Society launched its new membership category of Fellowship, to enable Members to demonstrate career progression, professionalism, and commitment to physiology and The Society.

The review panel, members of the Membership & Grants Committee, were impressed with how well the applicants demonstrated wide engagement with The Society's activities. Those elected to Fellowship are as follows:

- Damian Bailey, University of Glamorgan
- Deborah Baines, St George's University of London
- Kim Barrett, University of California
- Angus Brown, University of Nottingham
- Marco Canepari, National Institute of Medical Research
- Gordon Cooper, University of Sheffield
- Susan Currie, University of Strathclyde
- Timothy Curtis, The Queen's University at Belfast
- Brian Day, Institute of Neurology
- Mary Diaz, University of Edinburgh
- Jack Feldman, University of California
- Stuart Galloway, University of Stirling
- Simon Gandevia, Neuroscience Research Australia
- Carolyn Greig, University of Birmingham
- Patrick Harrison, University College Cork
- Christopher Johnson, The Queen's University of Belfast
- Andrew Jones, University of Exeter
- Andrew King, University of Oxford
- Peter Kohl, University Heart Centre Freiburg
- Ken O'Halloran, University College Cork
- David Paterson, University of Oxford
- Susan Pyner, University of Durham
- Andrew Randall, University of Exeter
- Richard Ribchester, University of Edinburgh
- Alexey Semyanov, Institute of Neuroscience Russia
- Luis Sobrevia, Pontificia Universidad Católica de Chile
- Rachel Tribe, King's College London
- Jeremy Ward, King's College London
- Michael White, University of Birmingham
- David Wyllie, University of Edinburgh
- Alexander Zholos, Kiev National Shevchenko University

The Trustees of The Society congratulate these members on their achievement.

Full details can be found here:
www.physoc.org/fellow-membership

Getting excited about pacemaking in the athletic heart, the first R Jean Banister Prize Lecture

Alicia D'Souza

University of Manchester, UK

It was a tremendous compliment to receive the inaugural award. Much more so, once I learned about the life and work of Jean Banister from one of her former pupils, Hilary Brown. What really struck a chord is that Jean Banister's former mentees (including Hilary Brown, Susan Noble, Wayne Giles and Dario DiFrancesco) went on to discover concepts fundamental to our modern understanding of pacemaker electrophysiology, the current focus of my research. And thus, for engineering a connection to the historical greats in the field, I am forever indebted to The Society.

I received my PhD in 2011 studying structural remodelling in diabetic cardiomyopathy with Jaipaul Singh at the University of Central Lancashire. It was at this time that my interest in electrophysiology was piqued, and I subsequently moved to The University of Manchester to investigate exercise-induced arrhythmogenic cardiac remodelling with Mark Boyett.

Veteran athletes are prone to cardiac arrhythmias including sinus bradycardia, heart block and atrial tachyarrhythmias but the underlying mechanisms are poorly understood. Our work in mice has shown that training-induced sinus bradycardia and first-degree heart block, the most common rhythm disturbances in athletes, are due to diffuse downregulation of pacemaking ion channels in the sinus and atrioventricular nodes. Delineating the transcriptional 'switch' that produces this phenotype could lead to new targets for managing arrhythmogenesis in athletes and hence our focus is on upstream control mechanisms with specific emphasis on microRNAs and transcription factors.

In the R Jean Banister Prize lecture I present evidence demonstrating that the transcription factor NKX2.5 upregulates microRNA-423, causing downregulation of the pacemaker channel HCN4 and sinus bradycardia in the athletic heart. I also present novel evidence that the core circadian clock transcription factor BMAL1 drives a rhythmic circadian variation in HCN4 and ultimately intrinsic heart rate, explaining an increased incidence of nocturnal bradyarrhythmias, also known to be more frequent in the athlete. We are delighted that our work has received prominence through publicity in the popular media and awards including a shortlisting for the GW Mendel Medal at 'SET for Britain' (now called STEM for Britain) in 2013, the 2014 International Society for Heart Research/Servier Fellowship Prize and the 2016 Cairn Electronics 'New and Notable' award.

I am filled with enthusiasm for the future, as we continue to identify key players in training-induced electrical remodelling and work with clinical colleagues towards translating these findings into small molecule therapies for arrhythmias in the athlete. Within the broader remit, I envisage that our future studies may reveal novel therapeutic strategies for other pathological conditions where ion channels are dysregulated, e.g. atrial fibrillation and heart failure.

Henry Lovett

Policy and Public Affairs Officer, The Physiological Society

Members' views on Brexit

Brexit could be called the elephant in the room, but it is dominating political attention even more than the average pachyderm. It is the elephant, bedecked in flashing lights and wailing klaxons, in the room. The Society recognises that Brexit could have significant effects on the life and work of scientists, and so sought to understand our Members' opinions on the critical elements of any Brexit process. The 350 responses to our survey conducted earlier this year give a detailed picture of the issues that matter. Key points included:

- Fundamentally, physiologists voted heavily to remain in the EU (85%).
- Movement of people was seen as the most important single issue of the campaign (34%).
- Free movement for scientists and students (42% combined) is seen as a bigger key goal for Brexit negotiations than EU funding access (33%).
- That said, there are significant concerns about funding, with 61% of respondents thinking their research funding will be reduced by Brexit.
- Of those respondents whose opinion on the outlook for science after Brexit has changed since the result, 78% think it has got worse.
- Large numbers of respondents (approx. 20% across different issues) have already experienced problems related to international collaborators or EU staff, and even more expect problems in the future.

The science sector has been vocal in communicating its concerns around Brexit to policymakers. However, it seems our efforts must be redoubled, because 52% say there has not been enough activity from the sector in response to the leave vote.

View the full results of the survey as an infographic here: **bit.ly/brexitsciencesurvey**

Higher Education & Research Bill becomes law in parliament's last-minute rush

With the unexpected announcement by Theresa May of a snap election, a hard deadline was slammed down in front of all legislation going through parliament. If it could not be passed before dissolution for the campaigning period, it would cease to exist. This frantic period of trying to pass outstanding legislation is known as the 'wash-up'. It tends to require significant compromises from the government in order to prevent Bills being blocked until it is too late. This was the case for the Higher Education and Research Bill, which had been due to have significant Lords' amendments return to the Commons chamber.

The final form, now the Higher Education and Research Act 2017, mostly follows the government's agenda as planned, with the formation of UK Research and Innovation as an umbrella body overseeing the Research Councils, the Office for Students replacing Hefce, and the Teaching Excellence Framework (TEF) rating universities' teaching quality. However, significant concessions mean the TEF will not be linked to differential fee increases until at least 2021 (with across-the-board increases with inflation allowed instead). Additionally, the opening of the higher education market to new 'alternative providers' will now require additional quality assurance stages. With a few other small changes, the Bill was deemed acceptable by the Commons and Lords and has received royal assent.

Bringing you snippets of the latest intriguing research

Bioengineered pancreas replaces insulin injections

A year after transplanting insulin-producing islet cells into the omentum of a woman with type 1 diabetes, the cells continue to function and have restored stable glycaemic control without the need for exogenous insulin.

DOI: 10.1056/NEJMc1613959

What makes people reject science?

Psychological meta-analysis studies have found that people who reject scientific consensus are generally just as interested in science and as well-educated as the rest of us. However, people cherry pick studies that back up prior-held beliefs, or in other words – cognitive bias. A big part of the growth in science denial is that people now associate scientific conclusions with political or social affiliations due to a polluted science communication environment. To convince people, avoid directly taking on surface attitudes and instead tailor messages to align with their underlying motivations.

bit.ly/2j9r79u

Bones are endocrine organs

Researchers have shown that a hormone secreted by bone, called lipocalin 2 (LCN2), suppresses appetite. Osteoblast-specific LCN2 knockout mice have 67% lower circulating levels of LCN2, eat more and show increased fat mass and body weight

DOI: 10.1038/nature21697

Using 'poo' to extend lifespans

Middle-aged killifish receiving young gut microbiome transplants extended their median lifespans by 41% compared to fish exposed to microbes from middle-aged animals, and lived 37% longer than fish that received no treatment.

DOI: 10.1101/120980

How Sherpas overcome hypoxia

In a comparison between lowlanders and Himalayan Sherpas making the ascent to Everest Base Camp, researchers found Sherpas' mitochondria were more efficient at producing ATP and had lower levels of fat oxidation, suggesting they were better at generating energy from sugars, which is a less oxygen-hungry fuel source.

DOI: 10.1073/pnas.1700527114

Experimental Physiology

Top 10 referees in 2016

Experimental Physiology (*EP*) would like to thank all of the people who submitted reviews over the last year. In particular we would like to thank our top ten referees (those listed have agreed to be named):

- Louise Deldicque
- Timothy Etheridge
- David Low
- Nathaniel Szewczyk
- Rachel C Drew
- Wim Lammers
- E Matthew Morris
- Can Ozan Tan

Early Career Author Prize winners

The Early Career Author Prize of $1000 (for articles published in 2016) was awarded to Havovi Chichger, Anglia Ruskin University, for 'Experimental type II diabetes and related models of impaired glucose metabolism differentially regulate glucose transporters at the proximal tubule brush border membrane'.

Brittany A Edgett of Queens University, Canada, received the runner-up award of $500 for 'SIRT3 gene expression but not SIRT3 subcellular localization is altered in response to fasting and exercise in human skeletal muscle'.

Case Studies

Case Studies providing a perspective on one-off cases and individual presentations in both humans and animals may now be submitted to *Experimental Physiology* for consideration.

They must have a physiological focus and adhere to the journal policy for human and animal experiments. As these are likely to be studies of exceptional individuals or cases they can provide unique and revealing insights that other papers do not.

Editorial Board update

We welcome Peter Rasmussen to the *Experimental Physiology* board as Reviewing Editor in the area of human/environmental and exercise physiology.

EP at Experimental Biology

Experimental Physiology held an Editorial Board at The Experimental Biology annual meeting in Chicago. We also hosted an extremely well-attended Meet the Editor(s) session where delegates were able to meet the Editors whilst drinking beer and eating pizza.

EP at IUPS

The Editor-in-Chief (Mike Tipton) and Reviews Editor (Jeremy Ward) of *Experimental Physiology* selected the following Symposium from the IUPS Meeting programme for sponsorship:

SYMPOSIUM 16 – Autonomic Rhythms in Health and Disease

- Susan Deuchars (Chair, UK) – Changing levels of rhythmic sympathetic nerve activity
- Song Yao (Australia) – Blood-brain barrier and autonomic rhythms
- Ruth Stornetta (USA) – Pre-sympathetic C1 neurones: a nodal point for stress?
- Alex Gourine (UK) – Glial control of autonomic circuits

Subject to submission/review, reports from this symposium will be published in *Experimental Physiology* following the meeting.

The Journal of Physiology

2016 Early Investigator Prize winners announced!

The winners are Calum Wilson and Matthew D Lee for their paper 'Acetylcholine released by endothelial cells facilitates flow-mediated dilatation'.

The two runners-up are Matthew S Brook for his paper 'Synchronous deficits in cumulative muscle protein synthesis and ribosomal biogenesis underlie age-related anabolic resistance to exercise in humans', and David G S Farmer for his paper 'Brainstem sources of cardiac vagal tone and respiratory sinus arrhythmia'.

The winners will share a prize of $1,000 and the runners-up each receive a $500 prize.

We are thrilled that Calum also won the 2015 prize, which is testament to the great work he is doing at the University of Strathclyde!

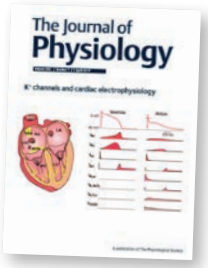
Winners Calum and Matt

Read up on our latest CrossTalk debate!

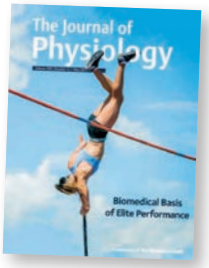
Paula Rodriguez-Miguelez, Melissa L Erickson, Kevin K McCully and Ryan A Harris argue that 'Skeletal muscle oxidative capacity *IS* altered in patients with cystic fibrosis', whereas Erik Hulzebos, Jeroen A L Jeneson, Cornelis K van der Ent and Tim Takken believe that oxidative capacity *IS NOT* altered in cystic fibrosis patients.

Read our CrossTalk debates here: **bit.ly/CrossTalkDebates**

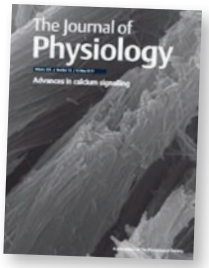
Recently published special issues



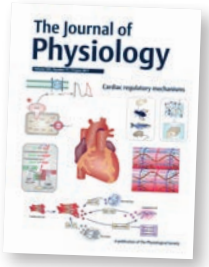
K^+ channels and cardiac electrophysiology
Volume 595, issue 7 – April 2017



Biomedical basis of elite performance
Volume 595, issue 9 – May 2017



Advances in calcium signalling
Volume 595, issue 10 – May 2017



Cardiac regulatory mechanism
Volume 595, issue 11 – June 2017

Call for papers!

The Journal of Physiology is delighted to announce that it will be publishing a special issue dedicated to recent advances in cellular and integrative control of oxygen and carbon dioxide homeostasis.

This call for papers is linked to the XX Meeting of the International Society of Arterial Chemoreception (ISAC) (23–27 July 2017, John Hopkins University, Baltimore, MD, USA).

The Journal of Physiology is seeking the submission of original articles covering the full scope of oxygen and carbon dioxide homeostasis, from the cellular level to the whole organism. Examples may include but are not exclusive to the following topics:

- Molecular responses to hypoxia and hypercapnia
- O_2/CO_2 sensing in the carotid body
- O_2/CO_2 sensing in the brain
- Polymodal properties of arterial chemoreceptors
- Adaptive and maladaptive responses to chronic or intermittent hypoxia
- Role of chemoreception in disease

The following speakers from the meeting have agreed to contribute to the special issue:

- Cormac Taylor, University College, Dublin
- Christopher Wyatt, Wright State University, USA
- Jay Nanduri, University of Chicago, USA
- Rodrigo Iturriaga, Pontificia Universidad Católica de Chile
- Michael Joyner, Mayo Clinic, USA
- Andrea Pozionato, University of Padova, Italy
- Camillo Di Giulio, University of Chieti, Italy
- Patrice Guyenet, University of Virginia, USA
- Nino Ramirez, Seattle Children's Hospital, USA

Deadline for submissions is 30 September 2017. Contact Managing Editor Sally Howells (**showells@physoc.org**) for more information!

Physiological Reports

New Editorial team

At the end of the year, *Physiological Reports* will reach another landmark when Sue Wray, the founding Editor-in-Chief, stands down after 5 years at the helm.

Anyone who has encountered Sue in this role will appreciate the ambition, creativity and hard work that she has brought to it. A few arms have been twisted (with a charming smile, of course) along the way but only where absolutely necessary. Unquestionably, the success of the journal is very largely down to the drive of Sue and her editorial team.

Sue Wray and Tom Kleyman

The Joint Management Board (JMB; joint, that is, between The Society and the American Physiological Society) was tasked with finding Sue's successor. There was strong competition for the position. In the event, the JMB appointed Tom Kleyman of the Department of Medicine at University of Pittsburgh. Tom has served as Deputy Editor-in-Chief of *Physiological Reports* since its launch and is a former Editor-in-Chief of *AJP: Renal Physiology*.

The new Deputy Editor-in-Chief will be Professor Morten Bækgaard Thomsen of the Department of Biomedical Sciences at University of Copenhagen. Morten works on cardiac arrhythmias and heart failure, and is currently an Associate Editor of *Physiological Reports*.

We look forward to the journal's continued development and growth under the editorship of Tom and Morten.

First formal citation metric

Physiological Reports has taken another step forward in receiving its first formal citation metric. Without going into the technicalities, CiteScore is a new metric based on Scopus citation data. It is calculated in much the same way as Impact Factor, but with a longer window of cited papers (3 years' worth rather than 2 years) and including all types of article rather than only research and review papers. The 2016 CiteScore for *Physiological Reports* is 0.69.

The membership survey results are in!

Jen Brammer
Membership Engagement Manager,
The Physiological Society

Conducted biennially, the recent Membership Survey provided an opportunity for you to share your views on The Society, what it is doing well, what we need to improve, and what is important to you. These results directly feed into our strategic and operational planning, to ensure The Society and the support we offer our members remains current.

We will share an executive summary of the responses with all Members, but until then here are some highlights.

Approximately 13% of Members responded, which is less than anticipated, but this still provides really useful data as those who replied provided a real insight into the feeling and needs of the membership.

Membership

Members were asked to indicate the benefits they most value, providing insight into the reasons why people join, but also why they remain. World-class scientific meetings ranked highest with 63% of the votes, opportunities to present research came second with 52% and networking opportunities closely behind in third with 51%. Career development and mentoring were key opportunities that respondents said would add more value to membership.

Support for Affiliate members was highlighted as an area where progress has been made, with respondents favourable of initiatives introduced so far. There were also a lot of new ideas suggested as well, which will feed into the work of the Affiliate Working Group.

Policy

Respondents were asked to select their top three areas they felt The Society should focus on in its policy activities. The top three results reflect the current environment and key concerns for Members.

The results included research funding environment (79%), higher education policy (69%) and raising the profile of physiology amongst policymakers (47%). Members reported that they contribute to science policy debate through their institution or company. Interestingly, 38% of respondents do not engage with policy debate. The Policy team of The Society are keen to reduce this figure.

Meetings & events

Respondents gave very positive reasons for attending The Society's meetings and this reflects the efforts of our Event Managers who provide high-level engagement through top-quality programmes. Hearing about cutting-edge research ranked highest with 76%, opportunities to present was second with 65% and networking opportunities was third with 64%. For those organising their own scientific meetings, the results highlight an appetite for marketing and meeting planning support.

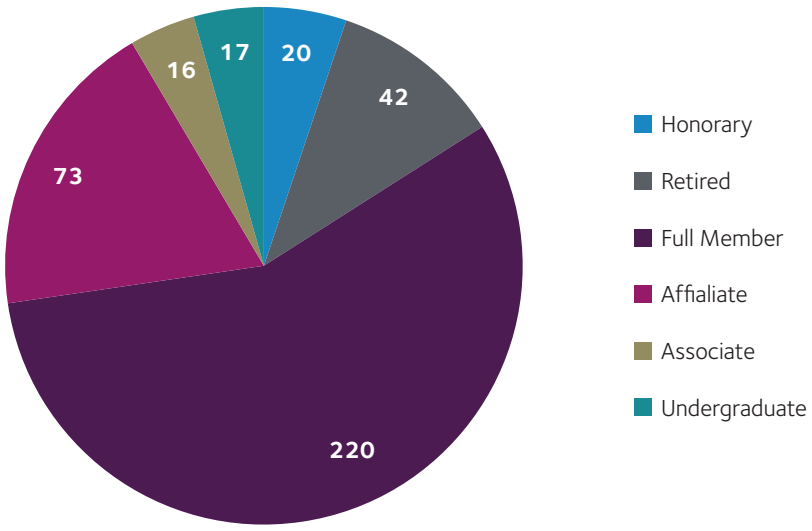
Education & outreach

Members value engaging the public with their research, with 67% carrying out activities involving the public. Engagement with schools and children was lower (31%) with a lack of support or resources to do this cited as barriers. Respondents suggested that partnership opportunities (45%) and personal development skills training (46%) were key areas where The Society could better support engagement activity.

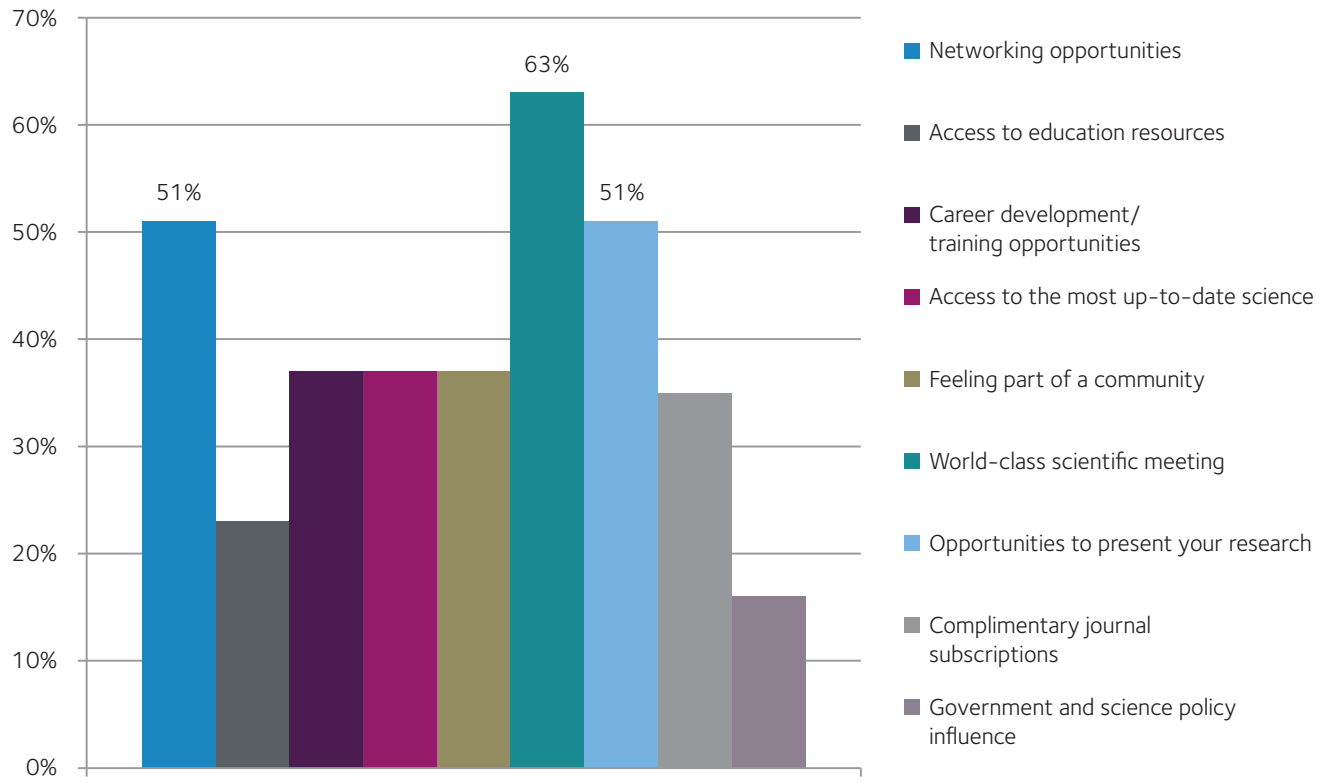
Communications

Members are happy with the monthly newsletter with 46% saying they found it useful and the content pitched at the right level. 34% of respondents use social media to keep up to date with the latest published research, with 75% expecting to see the latest *Physiology News* in The Society's social media content. On the website, Members would be interested in more information about meetings and events, general research news and theme-focused news.

Composition of respondents by member type



Perceived value of Member benefits



Physiology News

The content of the magazine was highly rated. 'News in brief' was most popular (85% responded good or very good). Reading the magazine in print remains the most popular choice of members (44%), with 27% opting for a combination of in print and online.

Equality & diversity

The Society's commitment to strengthening practices in diversity, quality and inclusion has made great progress since the signing of the declaration in October 2014. Awareness of goals was slightly lower than expected, but 60% of respondents support The Society's goals and most respondents knew about specific activities.

Overall, the results of the survey are very positive; members are supportive of the work being carried out by The Society and the Member-focused activities we deliver. We would like to extend our thanks to all the members who took the time to complete the survey and we will continue to report specific actions arising from this survey as they are implemented.

An executive summary will be made available to all members on The Society website. Anyone wishing to discuss the survey and the results further, can contact Jen Brammer, Membership Engagement Manager, at **jbrammer@physoc.org**

Raise The Society's profile and support your colleagues with membership!

As a Member, there are several ways to engage with us and our activities and to help you make the most of your membership. One way is to become a Society Representative (Rep). Our growing network of 94 UK and overseas Society Reps work with us to promote The Society, membership, and access Rep-only grant schemes.

As a Rep you can apply for funds, as part of the Departmental Seminar Scheme, to support travel and accommodation costs associated with attracting visiting speakers to departments.

You are also able to nominate a student for the Undergraduate Prize in Physiology, recognising your institution's best BSc physiology research project or an outstanding MSc student who has performed well throughout their degree.

We can provide support for open and induction events, by either arranging for someone representing The Society to attend or providing marketing material.

Reps also have the chance to attend operational and best practice focused meetings, organised by The Society, to support their role and enable networking with Reps based in other regions.

All Members can view a list of current Reps via the membership directory, **https://portal.physoc.org/Membership-Directory**, and filtering by Committee on Society Representative.

Interested in finding out more? Read more about the role of Reps at **www.physoc.org/what-do-society-reps- do** or get in touch with Jen Brammer, Membership Engagement Manager, at **jbrammer@physoc.org**

Help us reach our aim of having a Rep for every institution and organisation where we have members!

Belief, science and facts

A March for Science in response to the recent US election

Mike Tipton
University of Portsmouth, UK

Mike White
University of Birmingham, UK

'Science is science and facts are facts' appeared in a Donald Trump pre-election (2016) response to a science questionnaire distributed by Science Debate, a non-profit organisation that urges scientific literacy and accountability from political candidates. Fast forward to Saturday, 22 April 2017 when your correspondents were enjoying a post-breakfast stroll around the Grant Park area of Chicago contemplating the forthcoming board meeting of *Experimental Physiology* set for that afternoon. It was then that we joined a steady stream of people with banners and signs making their way towards the park for what was the pre-gathering of the March for Science. Soon we were joined by over 40,000 (some sources now state 60,000) people; in fact, numbers were so large that the police made media broadcasts to stop others attending

It was a diverse, buoyant crowd with some of the best posters we had ever seen. The initial speeches were given from a stage erected in the shadow of Trump Towers (a metaphor?).

It was deeply satisfying to see so many young children attending the rally. One 8th grader spoke passionately and confidently recited his essay titled, 'Why I love Science' to surely the biggest tutorial group ever assembled!

But we had one nagging worry, why in 2017, did we need a 'March for Science'? Surely, we have come a long way since Copernican ideas were deemed heretical and Galileo was placed under house arrest? Surely, people value scientists and see science as the cornerstone of modern civilisation?

Well, apparently not. Increasingly, science is regarded by politicians as an inconvenience. Worse, increasingly scientists are being portrayed as alarmist, self-opinionated 'boffins' who live in a fantasy world. They are funded by government yet, it is claimed by some that they contribute too little to society.

It struck us how easy it has become for politicians and their publicity machines, to

dismiss science as merely another form of personal opinion which can be sprinkled into TV 'debates' or denounced and occasionally supported in a short tweet, i.e. 'science, bad!' or 'really clean coal'. And how easily rigorously gathered, peer-reviewed evidence can be dismissed as fake news because the implications of the evidence do not suit a political viewpoint. In short, the virus that is 'spin' appears to have infected science.

Ignorance of the scientific method is now sufficiently widespread to avoid immediate challenge to a preposterous statement. How boring to organise a debate only to find that all are in agreement, as the evidence is incontrovertible!

But who is at fault here and why have we regressed? Is it the work of politicians, their campaign teams and their marketing strategists, for attacking what they see as an inconvenient truth but one which they see is conveniently soft? Or are the scientists, technologists and engineers at fault for assuming that everyone knows what they do and how valuable it is to society, thereby producing that soft target.

Many of the banners at the recent march in Chicago illustrated, with great originality and humour, that perhaps the science community is waking up to the idea that we can no longer assume our efforts and their value are automatically understood. 'Remember polio? I don't. Thank a scientist' read one poster.

If we allow the media to continue to use terms like 'boffin', when reporting any new discovery or technological advance, what picture does that conjure up in the minds of most people? We didn't see any Dr Who lookalikes or Star Wars Stormtroopers at the rally; they were all at the nearby Comic-Con event, where belief in time travel and teleportation would be easy to find. In fact, our crowd looked remarkably normal and diverse.

Our collective memory of schoolboy science may be rose tinted (we are after all two men of a certain age) but it seemed back then that young people had a good idea where science and technology could lead and what it had contributed to society. Is it really the case that many people now do not see this connection and are put off science by the stereotypical portrayal of the mad scientist, the white coat and the laboratory?

The rally in Chicago and others that took place all around the world showed that there is a groundswell of opinion that supports science. We as scientists must keep up the pressure on our politicians to understand and support science and perhaps we all must do more to educate and inform people about the work we do and its importance to society. To ignore, disregard or belittle science is to disregard a way of acquiring knowledge. An approach that has been developed and tested over centuries, which people have fought for and are fighting for again. Science is a special method of findings things out; the bridge between belief and the truth. Importantly, science is also fun (some of the time!). We are not the 'geeks' that are portrayed in the media and we do have a life outside of science – some of us in rock bands! (GI Distress, a group composed of scientists including Kim Barrett, Editor-in-Chief of *The Journal of Physiology*, and Mark Frey, Senior editor of Experimental Physiology, played a gig at a pub in downtown Chicago).

Nearly 500 years after Galileo, we have to fight once more for science. So, whenever you get the chance and you catch someone using a device or marvelling at new technology remember to say 'science did that!'

Time to boldly go... and engage?

'The science community is waking up to the idea that we can no longer assume our efforts and their value are automatically understood'

Stressed-out Britain?

A report on our annual Theme and our survey

Lucy Donaldson

Chair of Policy & Communications Committee, The Physiological Society

Are British people as stressed as we all think? Everyone I talk to now mentions their busyness, the speed of life, and the expectation of immediate response or results. Has our stress really increased, and are the same things causing stress now as in the past? Are our parents correct in saying life was simpler and less stressful 'when they were young'?

'Life's most stressful events', such as getting married or moving house, are quoted time and again in the press. This list derives from the seminal work of Holmes & Rahe in 1967 that resulted in the Social Readjustment Rating Scale (SRRS). In this work, 43 life events previously correlated with the onset of illness were rated by over 5000 medical patients. Marriage was given the standard score of 500, and all other events were ranked in relation to it. The results form the basis for the ranked list of life's stressful events quoted today. It's worth noting that most, if not all items on this list are negative events (Holmes & Rahe, 1967).

The stress response is a distinct combination of bodily responses that enable us to cope with challenges. Without this response, such challenges could be life threatening. This is the physiologists' take.

The ranked list defines stress as the feelings associated with a wide variety of situations, rather than the physiological definition. For most people, stress is a condition or feeling experienced when a person perceives that 'demands exceed the personal and social resources the individual is able to mobilise' (quote attributed to Richard S Lazarus).

Under our annual theme of 'Making Sense of Stress,' we are looking at stress in many different ways. We have public events, such as the lecture featuring Stafford Lightman, the topic meeting on The Neurobiology of Stress as part of the British Neuroscience Association's Festival of Neuroscience, and virtual issues of our journals on stress.

As part of the annual theme, The Society's Policy and Communications team took another look at the stress of people across the UK, in a broader group than just medical patients. We commissioned YouGov to survey over 2000 people in January of this year. Respondents rated a shorter list of life events according to how stressful they might find them (YouGov survey, 2016). We included some of the events from the SRRS as benchmarks, but also, after conversation with Professor of Health Psychology Kavita Vedhara of the University of Nottingham, we included some potentially positive events such as going on holiday or being successful at work.

Many of the key findings from the survey were not much of a surprise – going on holiday is the bottom of the list as we might expect, and just as Holmes and Rahe found. Similarly we would hope that success at work or being promoted would be a reasonably positive event, and (thankfully) it is close to the bottom of the list too. The events at the top of the list are hardly surprising either – death of a spouse or close relative was our benchmark for the most stressful event on the SRRS, but divorce has moved down the list relative to imprisonment or personal illness. This may be because divorce now carries less social approbation than in the 1960s. Planning a wedding has become relatively less stressful (the wedding planner is obviously worth it!).

Obviously, updating a study from decades ago afforded the opportunity to include some events pertinent to the 21st Century. Surprisingly, respondents said losing your smart phone is only marginally less stressful than the potential for terrorist threats, and more stressful than moving up the property ladder. Contrary to the picture painted in the media, Brexit is actually not very stressful for most people surveyed.

Regional variaitions in Stress

There are many more conclusions to be drawn from these data. For example, there is evidence that women report all these events as more stressful than men. Also, loss of your smartphone is more stressful for the younger generation (18–24) as is Brexit. There are also differences in responses to these different events across the UK. We hope to be able to examine the data in greater depth in a future issue of *PN*.

This YouGov survey obviously has limitations – it's not a 'scientific' study and isn't really directly comparable to the SRRS. It does, however, give us food for thought on how our perceptions of life's stressors may have changed. We included many of the negative stressors in Holmes and Rahe's list but also some potentially positive events. It is important to remember that stress can often be a positive experience. Hans Selye,

On a scale of 1 to 10, where 1 is 'Not at all stressful' and 10 is 'Very stressful', how stressful would you find the following situation?

Event	Mean rank
Death of close spouse/partner, close relative or close friend	9.43
Going to jail	9.15
Having your home flooded or damaged by fire	8.89
Being seriously ill	8.52
Being fired from work	8.47
Separation, divorce or end of a long-term relationship	8.47
Experiencing identity theft	8.16
Having unexpected money problems (e.g. due to car repairs, heating breaks, etc.)	7.39
Starting a new job	6.54
Planning a wedding (i.e. the marriage/civil partnership ceremony)	6.51
Arrival of first child	6.06
Experiencing commute delays	5.94
Terrorist threats (i.e. the potential for them to happen rather than experiencing this personally)	5.84
Losing your smartphone	5.79
Moving to a bigger house	5.77
Brexit (the process of leaving the European Union)	4.23
Going on holiday	3.99
Getting a promotion or having success at work	3.78

often considered to be the first person to demonstrate the existence of biological stress, found that some stress can be good for you, but it depends on how you respond to the situation.

By motivating someone to tackle a challenge, stress can lead to feelings of satisfaction and accomplishment. It's the spark that pushes us to do things we would normally not, and that extra encouragement is important, as without it, we would be complacent. Smaller amounts of positive stress – which Selye referred to as 'eustress' – have been shown to enhance cognitive abilities and boost mental prowess. This is because it helps us focus on the task at hand. Some studies have even shown that it boosts memory – which is really helpful when writing a grant proposal, preparing for your *viva* or marking to a deadline!

Rather than fearing stress, or always avoiding it, focus on harnessing it by believing in a good outcome and that you are in control. In his 1985 paper 'The Nature of Stress' (Selye, 1985), Hans Selye wrote about the importance of finding your own stress level to make sure that both the stress level and the goal are really your own, and not imposed upon you by society.

In closing, it is worth reflecting on the summary provided by Selye himself, 'Fight for your highest attainable aim, but do not put up resistance in vain.'

'Rather than fearing stress, or always avoiding it, focus on harnessing it by believing in a good outcome and that you are in control'

References

Holmes TH, Rahe RH (1967). The Social Readjustment Rating Scale. *J Psychosom Res* **11**(2), 213-8.

Richard Lazarus (1922–2002). Professor of Psychology, Emeritus, University of California, USA.

Selye H (1985). The Nature of Stress. *Basal Facts* **7**(1), 3–11.

YouGov survey. All figures, unless otherwise stated, are from YouGov Plc. Total sample size was 2078 adults. Fieldwork was undertaken between 22 and 28 December 2016. The survey was carried out online. The figures have been weighted and are representative of all GB adults (aged 18+).

Introducing our MOOC in Physiology

Chrissy Stokes

Head of Professional Development and Engagement, The Physiological Society

Sarah Hall

Chair of Education and Outreach Committee, The Physiological Society

Massive Open Online Courses (MOOCs) are university-led, distance-learning courses that are freely available online. The introduction of MOOCs around a decade ago generated considerable excitement and expectation, with free access to everyone, unlimited participation and low running costs promising to extend a university's educational activities beyond its bricks and mortar. However, the excitement soon faded amidst reports of low completion rates and copyright issues. Academics have now reached a more balanced view of the role of MOOCs in the education arena.

The Education and Outreach Committee watched these developments unfold, guided by the expertise of one of its members, Professor Neil Morris, who now holds the Chair of Innovation and Change at the University of Leeds. After considerable research and reflection, we began a bumpy journey to develop a MOOC that would help to raise the profile of physiology, and support the progression of students into physiology and related disciplines. Fast forward to 2017, and we are pleased to announce The Society's MOOC in physiology, entitled 'Physiology: The Science of Life', will run for the first time this autumn. It has been produced in collaboration with the University of Liverpool, our content provider, and is hosted by FutureLearn, one of the leading MOOC platforms.

The target demographic for our MOOC is A-level (or equivalent) students who are considering studying physiology, life science or medicine. The primary aims of the MOOC are to enhance and extend learning at A-level and equivalent, and to introduce concepts encountered in the first year of undergraduate study (in physiology and related degrees), in order to support the transition to university.

Three core topics, common to UK examination boards (for A-level Biology or equivalent), will be covered in the MOOC; these are the cardiovascular system, the respiratory system and the nervous system. There is growing concern about students' lack of preparation for university, especially with regards to their mathematical understanding. To address this, the MOOC will include activities on data handling, particularly physiological measurements. There will also be information about careers in and from physiology. School teachers and members of The Society's Education and Outreach Committee have the opportunity to review all the content produced by the University of Liverpool.

MOOCs are an attractive platform for both the learner and provider: they are freely accessible to anyone with an internet connection, content can be updated as necessary, and it facilitates the interaction of students and physiologists (through moderated discussion sessions), it provides a comfortable insight into university learning (demystifying the institution that may seem daunting to 16-year-olds), users can dip in and out of learning according to their needs or timetable, and it meets the rising demand for digital learning.

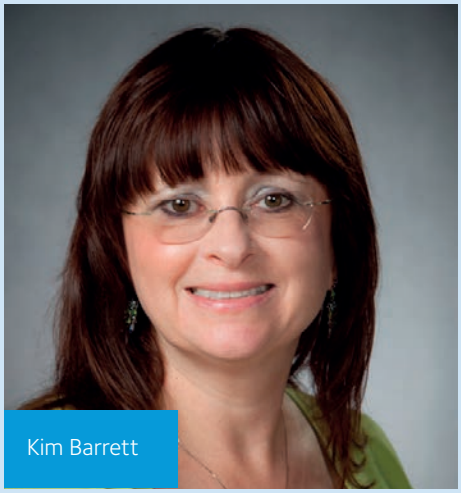
Completing the MOOC will be helpful to all students whose post-16 qualifications include physiology components. It will also benefit those looking for extension learning before university, and may help to inform those making difficult degree choices. Whilst we have identified students making the transition to university as the target audience, we are aware that the general demographic of MOOC learners extends beyond this – most tend to fall within the age range of 25–40 and to possess one or more degrees already – and this has been a consideration during the development of our MOOC. Although the broader public are unlikely to include the next Nobel Prize winner, they may be their relative, or a politician, and they will almost certainly be voting. The MOOC will therefore have a broader impact, raising the profile of physiology and improving understanding of, and appreciation for, our discipline.

Enrolment for the physiology MOOC will open in the summer, and the course trailer also provides an insight into the content. We hope that Members will be active in encouraging their local schools, and other interested individuals, to participate, and we look forward to reporting back on the success of the course later this year.

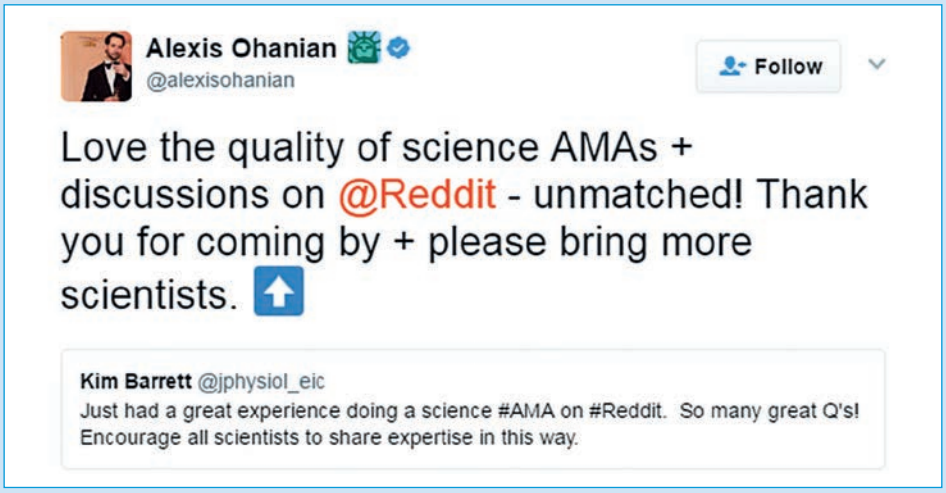
Terry Gleave teaching respiratory physiology as part of the MOOC

Reddit 'Ask me Anything' (AMA) with Kim Barrett

We ask *The Journal of Physiology*'s Editor-in-Chief about her experience



Kim Barrett



Reddit is a massively popular social news and discussion website with over 234 million members that has over eight billion page views per month. The 'subreddit' r/Science (also known as the *The New Reddit Journal of Science*) has over 16 million subscribers – that means over 16 million people interested in science! Reddit is a great way to engage with the online community and Ask Me Anything (AMA) sessions allow experts to spread their knowledge through an informal Q&A.

We asked Kim Barrett, Distinguished Professor of Medicine at UC San Diego and Editor-in-Chief of *The Journal of Physiology*, about her experience doing an AMA about her research on Reddit.

Kim's AMA proved to be largely popular with over 1500 'upvotes' (equivalent to likes on Facebook) and over 200 comments and questions. The co-creater of Reddit, Alexis Ohanian, also chipped in on Twitter, thanking Kim for her contribution to the science subreddit.

Reddit is a great way to engage with thousands of people about your research – and it's free! All it takes is a minimal amount of planning and a few hours of your time.

Have you ever used Reddit before? Did you find it easy to use and to schedule the AMA?

I had hardly even heard of Reddit before my AMA. The conventions, acronyms and language were a bit intimidating at first. It was easy to navigate the scheduling but I didn't receive much in the way of confirmation and feedback, leaving me a bit uncertain up till the day whether it was really going to happen, or if I had messed up somehow.

Were you surprised by the amount of engagement?

This really blew me away. When I logged on to the AMA I was amazed to find more than 1000 questions there already, with more coming in as the session began. I started out at the top of the list, but soon realised I could not possibly answer everything. After a while I started cherry-picking a bit to select the questions that were either the most straightforward to answer, or the most interesting to me.

Was there a big difference between engagement with the public and scientists? Were the questions vastly different?

The majority of questions were thoughtful and appropriate no matter who was asking them. It was clear that there were quite a few scientists and doctors engaged, but also members of the public.

Were there any surprising questions?

There were a number of questions that addressed quite personal and specific health issues. I guess I should not have been surprised, but it also was certainly not the venue to offer heath recommendations. There was also a fascinating question from an individual who wanted to know whether his childhood habit of ingesting washing up liquid bubbles would have altered his microbiome. I've never heard of kids doing that!

What are the advantages of engaging with the public on Reddit?

This was a low risk, efficient way of engaging with a lot of different people from all over the world. It is a very easy way to highlight an area and get your expertise out there. It was also a good opportunity to highlight *The Journal of Physiology* special issue on the microbiome [*J Physiol* **595**(2), 415–598], which was published in the same week.

Would you do an AMA on Reddit again?

I would gladly do this again. Perhaps the only limitation is that with the number of questions and the time allotted, it was not possible to engage in lengthy conversations with individuals.

Would you recommend that other scientists engage with Reddit?

I think it's really important that we as scientists make efforts to provide our expertise to the public and explain our areas of research in ways that are understandable to all. This is particularly urgent when research and research funding seems to be under attack. On both sides of the Atlantic, we need the public on our side to convince policymakers that research is a sound investment for public funds.

What are your top tips for other scientists or academics who want to do an AMA?

It is important to define a topic that is sufficiently broad and topical to attract interest, and to address your answers to an educated lay audience. I was a bit intimidated at the beginning but it is important to remember that you are not on stage and there is nothing to prevent you looking up a few facts before committing to an answer. The most important piece of advice is to just jump in. It's only a two-hour commitment and there is a lot of flexibility in scheduling it at a time that suits you. I was so intrigued by the questions that I actually went back at lunchtime and answered a few more!

2017 *Forthcoming events*

12 July

Annual General Meeting and President's Lecture
Wellcome Collection,
London, UK

www.physoc.org/agm-2017

1–5 August

IUPS 2017 – The Rhythms of Life
RIOCENTRO Exhibition & Convention Centre
Rio de Janeiro, Brazil

www.physoc.org/iups2017/

14–15 Sept.

Mitochondria: Form and Function
Hodgkin Huxley House,
London, UK

www.physoc.org/mitochondriaformandfunction/

8 Dec.

H^3 Symposium: Sensory Transduction in Insects
Hodgkin Huxley House,
London, UK

www.physoc.org/sensorytransductioninsects/

Meeting Preview

IUPS: the Two-way Physiology Street and the Mutual Benefits of Volunteering Expertise

IUPS 2017
Rio, Brazil

Anisha Tailor

Outreach Officer,
The Physiological Society

In 2015, I took a six-month sabbatical from my role as Outreach Officer at The Physiological Society to set up the pilot education project, Lab_13 Ghana. The project aimed to establish a 'proof of concept' for a new model of science education in resource-constrained environments.

We planned to increase positive attitudes by enhancing practical education, encouraging student-led investigation and enquiry, and supporting local teachers. The project put students in charge of their own learning and lab space while being facilitated by a 'Scientist in Residence' such as myself. Just like adult scientists, young people in the lab proposed their own questions based on their world observation and, with support from a Scientist in Residence, worked through experiments to determine their own answers. This was in contrast to traditional talk and chalk teaching methods usually employed in rural schools, with many teachers believing that 'doing' science required specialist labs and equipment that only the richest schools have access to.

Our stock cupboard was the local markets and our recycling. My experience allowed me to witness first-hand a change in student attitudes towards science in just 6 months of a student-led approach. It has not only given me insight into the struggles of teaching science with limited resources, but an understanding of what local teachers want to gain from internationals making visits to their school.

Anisha with students in Ghana

You can read a fuller account of my experience in *PN* 101, Winter 2015, pages 14–15, or, if you are heading to Rio this summer for IUPS, you can join me in the symposium 'The Two-way Physiology Street and the Mutual Benefits of Volunteering Expertise'. Joined by physiologists discussing their volunteer work in Zimbabwe and Nigeria, we will be discussing the benefits of volunteering, the discrepancies in the world between areas with plentiful resources and those who are resource poor, and the importance of partnerships.

Meeting Notes

British Neuroscience Association 2017 Festival of Neuroscience

10–13 April 2017,
ICC Birmingham, UK

Molly O'Reilly

University of Sussex, UK

I am a third-year PhD student at the University of Sussex, and this past April I was given the opportunity to attend the British Neuroscience Association (BNA) festival of Neuroscience, held in Birmingham. My research focuses on preventing the hearing loss associated with clinical drug treatments, which is rather a niche area. The conference was therefore a fantastic opportunity to network amongst the broader neuroscience community. It also provided a chance to broadcast my research, as I was selected to present a poster and also give a short talk during the rapid-fire poster session. As I had previously not given a talk to such a large audience, it was an invaluable experience.

My attendance at the event was facilitated by the support of The Physiological Society, who provided me with a travel grant in order to attend. I cannot thank them enough for their support, as I found the conference to be extremely beneficial, both in terms of personal interest and the gain of experience. The highlights of the festival for me personally were the daily poster sessions, some of the talks that were not related to my research but of a great interest to me, and The Physiological Society's own symposia on the theme of The Neurobiology of Stress.

The daily poster sessions were a really exciting part of the conference – the poster hall was lively and buzzing every day. The poster sessions were grouped in terms of their subject area, and I attended each day. The enthusiasm in the room was inspiring, and everyone was so inquisitive. During my own poster session, I had a great deal of interest and a constant audience, alongside lots of good questions and useful suggestions. I have already used some of the suggested ideas in my research back in the laboratory. I highly recommend attending these types of events.

The talks were also very good – there was such a diverse range of topics and presentation styles. As an example, some of my favourite talks included:

- The hidden wounds of childhood trauma: psychoneuroimmunology of early stress and the impact on mental health (Andrea Danese – King's College London, UK)
- See what you hear – how the brain forms a representation across the senses (Uta Noppeney – University of Birmingham, UK)
- APOE4 from man to mouse (Sarah King – University of Sussex, UK)
- Structural and cellular studies to elucidate the mechanisms of APOE isoform action and provide targets for therapy (Louise Serpell - University of Sussex, UK)

As you can see, some of my favourite talks were from researchers based at my own institution. It can be so easy to immerse yourself in your own research and lose sight of what other researchers within your institution are working on, so it was really enlightening to get a glimpse into this. There was a great representation of different institutions at the festival and a really broad set of delegates.

Lastly, the topic of neurobiology of stress really ignites my interest, so I was pleased to be able to explore this in such a comprehensive manner through The Society's symposia. The symposia were led in such a way that researchers without prior knowledge could engage. Overall, the conference was a fantastic experience and I cannot commend The Physiological Society enough for their role in my ability to attend.

Meeting Notes

Our Workshop: Introduction to Molecular Biology Techniques, Transfection and Functional Studies

25–28 April 2017,
University College London,
London, UK

Eleni Kaisis

University of Reading, UK

Following the success of previous years, this year The Physiological Society has again sponsored a number of workshops with the aim of enhancing laboratory skills for researchers. One such workshop was the 'Introduction to Molecular Biology Techniques, Transfection and Functional Studies'. As a first–year PhD student in the School of Pharmacy in Reading University, I found this workshop was a great opportunity to enhance my laboratory skills and learn new laboratory techniques which are valuable for a career as a research physiologist.

The workshop was divided into two sections. The first entailed an introduction to basic essential techniques used in molecular biology, such as RNA extraction, reverse transcription and PCR. The second section focused on techniques used for cell transfection and techniques to investigate protein expression and functionality, such as the widely used SDS-PAGE and Western blotting.

The workshop provided a nice balance between background theory and laboratory practicals. During the dinner provided by The Society, and the numerous coffee and tea breaks, we all had the opportunity to network and discuss each other's research work, identify issues and help in experimental troubleshooting, and even exchange ideas for future experimental work. The staff, especially Caroline Pellet-Many, were exceptionally friendly and cooperative, and helped us design protocols which we can apply in our own research. Additionally, during the workshop, we were given an interesting tour around the old hospital, where we were shown the mosaics which cover parts of the teaching labs that used to be the children's ward.

Overall, attending this workshop was an exceptional opportunity to learn and become confident in techniques which are widely used in research. It was enlightening to learn about other researchers' work, and it fired my enthusiasm for my own research. I am grateful to the Alzheimer's Association for funding my attendance, and to The Physiological Society for providing me with the opportunity to attend this extremely helpful and inspiring workshop.

Meeting Notes

H³ Symposium: Practical Innovations in the Life Sciences

25–28 April 2017,
University College London,
London, UK

Chrissy Stokes

Head of Professional Development & Engagement, The Physiological Society

'Practical Innovations in the Life Sciences' was an H³ symposium organised by the Education and Teaching Theme Leads, Sheila Amici-Dargan, Nick Freestone and Derek Scott. The two-day workshop was put together to facilitate the sharing of new ideas and best practice in practical and classroom teaching, as well as engagement with the public. The audience included educational practitioners and developers, technicians and undergraduate students.

Day one focussed on teaching practical science, with talks showcasing a variety of tried and tested methods to improve student engagement, skill and understanding. Day two began with a plenary session on the use of technology in learning, and was followed by sessions on alternative approaches to classroom teaching and public engagement.

Amongst the talks there was also a structured discussion looking at common obstacles in teaching practical physiology and opportunities to 'stretch the able', with attendees providing invaluable feedback regarding potential opportunities for The Society to provide support in these areas.

Following the meeting, the organisers have received excellent feedback including reports of new collaborations forming and new approaches being considered; we hope to also report on the development of these in future issues of *Physiology News*. In the context of this feedback, the organisers considered the event to be very successful (and co-organiser, Nick Freestone, shared his thoughts in a recent blog) but we have encouraged other attendees to share their perspective. On this page and the next we have pieces from Dr Harry Witchel, questioning the interplay between universities and commercial IT providers, and from one of our undergraduates who contributed with a talk summarising his experiences of completing a final year project on public engagement.

Harry Witchel

Senior Lecturer in Physiology, Brighton and Sussex Medical School, UK

Future issue: ethics, governance and commercial enterprises in research on social learning platforms

At the 'Practical Innovations in Life Science Education' H³ symposium, physiologists (and other life scientists) showed how they successfully incorporate social learning platforms into their didactic service provision and pedagogic research. Many of these IT platforms are externally provided, commercial systems, including the ubiquitous Quizlet [as highlighted by Louise Robinson's (Derby) talk on 'Gamification in HE Teaching'].

In Sheila Amici-Dargan's (Cardiff) talk 'Platforms with Potential', her team invited students to use Learnium (another social learning platform) to enhance their understanding of human pathophysiology. Their research showed that over half of the students surveyed said they used the system, while 54% stated they felt it was either useful or very useful.

This raises ethical questions about benefit sharing and revenues when universities interact with commercial organisations providing a nominally free service. Research is expected to provide shared benefits to participants, communities providing 'biological' material and future generations, as well as to the researchers, their universities and profit-making organisations. For example, when geneticists research a family with a rare genetic disease, individual research participants may have a right to share the benefits/profits of the intellectual property. Likewise, when traditional plant knowledge of an indigenous people is developed into a potential treatment by a company, we expect the indigenous people to benefit equitably. However, not all benefits are revenue streams, and in many cases there are practical difficulties in revenue sharing with research participants, even in genetics research.

How does this play out in ethical approval for pedagogic research with commercial IT platform providers? Commercial enterprises benefit from voluntarily engaged university-driven teaching research because of the publicity for the commercial platform and the database of use statistics they gain. Yet, as shown in the H³ symposium, these platforms are routinely used in educational research, and it is not standard ethical practise for universities to charge the commercial IT platform providers for access to their students. Quite the opposite, the commercial social learning platform providers often can charge money for user-access to those platforms. The argument is that this is not exploitation because the student end-users benefit indirectly via later improvements in their career prospects.

Reversing these institutional arrangements that benefit large platform providers is 'one of the major tasks now facing a critical political economy of culture and communications' [Murdock G (2011). Political economies as moral economies: commodities, gifts, and public goods. In: Wasko J, Murdock G, Sousa H (Eds), The Handbook of Political Economy of Communications. (London: Wiley-Blackwell), pp. 11–40].Thus, in the current climate, when senior managers request under-resourced education researchers to demand payments from commercial social learning platform providers in order to provide additional revenue to the university, it may be less related to current best practice in ethics or governance, and more related to wishful thinking.

(L–R) Elodie Cox and Patrick Evans

Patrick Evans

University of Bristol, UK

An undergraduate perspective on speaking at a Society symposium

I became aware of the workshop through my third-year supervisor, who advised us to give a talk about our final year neuroscience dissertation project. It was a public engagement project, which was a new type of project trialled for the first time this year. Together with my project partner, Elodie Cox, we created a video to explain our designated topic, which was memory engram cells, and presented it to a non-scientific public audience. We thought it would be of interest to share our experience.

Although I was initially quite nervous to be attending a workshop alongside university staff, it soon became clear that it would be a very valuable experience. There were a lot of ideas to be shared and it was great to see how absorbed and interested everyone was in each other's presentations. The morning presentations were focused on the use of technology in university, so as a student I felt very relevant to the discussions. The second session saw more talks on the theme of public engagement. It gave me an insight to a completely different side of university and it was encouraging to see the attendees were enthusiastic and committed to benefitting our learning.

In the future, a combined attendance of university staff and students alike could be very beneficial to both parties – after all, us students will be the first-hand receivers of many of the ideas that were discussed.

From the Archives: reports by the Meetings Secretary JS Gillespie of the Leeds and Cambridge meetings of 1967

Transcribed by Roger Thomas

Leeds Meeting, 14-15 April 1967

At the invitation of A Hemingway, a meeting of The Society was held in the Department of Physiology, Leeds University, on 14 and 15 April 1967. Beginning at 2 pm on Friday, five papers were heard before tea, which was followed by a very full programme of demonstrations, including several of the risky, live sort, all of which behaved splendidly. Members and guests were then transported to Bodington Hall for sherry, dinner, an informal resumption of the meeting in the bar until 11 pm and finally a good night's rest. After dinner, E Neil, in proposing The Society's thanks to its hosts, mentioned that this would be the last occasion on which A Hemingway would be the Chairman at Leeds. He remembered with affection the time spent working in Professor Hemingway's department, and paid tribute to his many sterling qualities including that of fitness through regular exercise which he, E Neil, in his own fashion, constantly emulated. RJS McDowall also spoke appreciatively of A Hemingway, whom he had both taught and later had on his staff at King's. In reply, A Hemingway welcomed Members and guests, thanked the members of his staff for their work in preparing for the meeting and hoped that when next The Society visited Leeds it would be in a new department, part of the ambitious and exciting development of the University.

On Saturday, the remaining part of the programme was taken in Bodington Hall, where Members, deeply ensconced in armchairs, remained remarkably vigorous, though sometimes invisible, in discussion. Under the successive chairmanships of A Hemingway, WJ O'Connor and RJ Linden, the remaining 15 papers were given and the meeting ended at 3.30 pm with tea. Demonstration 5 and Communication 3 were withdrawn.

Friday 14 April – Saturday 15 April
Signed: Bryan Matthews

Tea 100, Coffee 91
Dinner 107, Lunch 91
Tea 73

Cambridge Meeting 7 July 1967

At the invitation of BHC Matthews a meeting of the Society was held in the Physiological Laboratory, Cambridge on 20 May 1967, beginning at 10.30 am.

Although this meeting had the almost expected pleasure of an unusual Demonstration by GS Brindley who, on this occasion, played a recorder at both ends and showed a power-assisted bassoon, the meeting did have a number of unusual features. Because of the rising number of Communications, the meeting had been divided and 18 Communications were given in one theatre, with BHC Matthews in the Chair, while 16 Communications were given in a second theatre with WAH Rushton and EB Verney as Chairmen. Although one was withdrawn, there were three extra demonstrations bringing the number to 11; the Chairman modestly regretting that there were not more to an audience which is annually astonished by the efforts of departments which, in and out of term, can like Cambridge, demonstrate so well year after year.

Later, after sherry generously given by the University, Members and their guests had the unusual priviledge of dining, in term time, in the Hall of Pembroke College – a particular triumph for J Hickson who had persuaded the undergraduates to dine early and the Fellows to dine elsewhere. Here there were many distinguished foreign Members and guests including R Stampfli, Y Zotterman and SA Krolenko; with HH Dale at the high table the dinner became a special occasion.

After dinner, Y Zotterman, in a typically vigorous speech, thanked the Chairman and his colleagues. BHC Matthews in reply welcomed The Society's guests, especially the Master of Pembroke College.

Everyone present drank to the health of HH Dale who in return entertained them by accounts of earlier and more robust meetings when Chairmen could tremble with rage and irritation. On this amiable note this very agreeable meeting ended.

Signed: GL Brown 7 July 1967

The open science movement

Revolution is underway

Keith Siew

University of Cambridge, UK

'Information is power. But like all power, there are those who want to keep it for themselves. The world's entire scientific and cultural heritage, published over centuries in books and journals, is increasingly being digitized and locked up by a handful of private corporations.'
Aaron Swartz, in *Guerilla Open Access Manifesto*, 2008

The world's first academic science journal, *Philosophical Transactions*, was published by the Royal Society in 1665. At last count there were some 11,365 science journals spanning over 234 disciplines by 2015, and yet the primary model of scientific publishing remained largely unchanged throughout the centuries.

As a fresh-faced, naïve PhD student, I recall the horror I felt upon learning that my hard work would be at the mercy of a veiled, political peer-review process, that I'd be left with little option but to sign away my rights to publishers, and too often forced to choose between burning a hole in my wallet or forgoing access to a potentially critical paper!

The open science movement offers an alternative to this unjust system. In its purest form, the movement advocates for making scientific research and its dissemination an entirely transparent process, freely accessible to all levels of society. The aim of this two-part series is to present an overview of the various incarnations of open science and recent paradigm shifts. In particular, I address some of the more radical elements of the movement, existing open science opportunities and the reasons behind life scientists' relatively slow adoption of open science. This first installment details the ongoing struggle for open access, the growing angst towards closed peer review and fundamental shifts on the horizon in both the ways we communicate (i.e. preprints) and carry out science (i.e. open data and open notebook science). Featuring in the next issue of *Physiology News*, the second half of the series (*Opening Up Science Education* by Vivien Rolfe) will illustrate how open education has democratised access to knowledge and fostered engaging and creative approaches to learning and teaching.

Open access – 'tear down this wall'

In 1991, Sir Tim Berners-Lee gifted us the World Wide Web, forever changing the way we would access information. Fast-forward a mere quarter of a century later, and mobile-broadband networks now reach an estimated 84% of the global population and almost half of the planet engages in regular internet use. This ultimately resulted in giants like JSTOR, PubMed and Google Scholar displacing libraries as bastions of knowledge, and has ushered in an era of private, freely available, internet-based repository/database-searching from the comfort of one's office or home.

During the rapid transition from paper to PDF, publishers took advantage of opportunities to boost profits (Fig. 1), and continued the practice of hiking subscription fees at rates far in excess of annual inflation (Dingley, 2006).

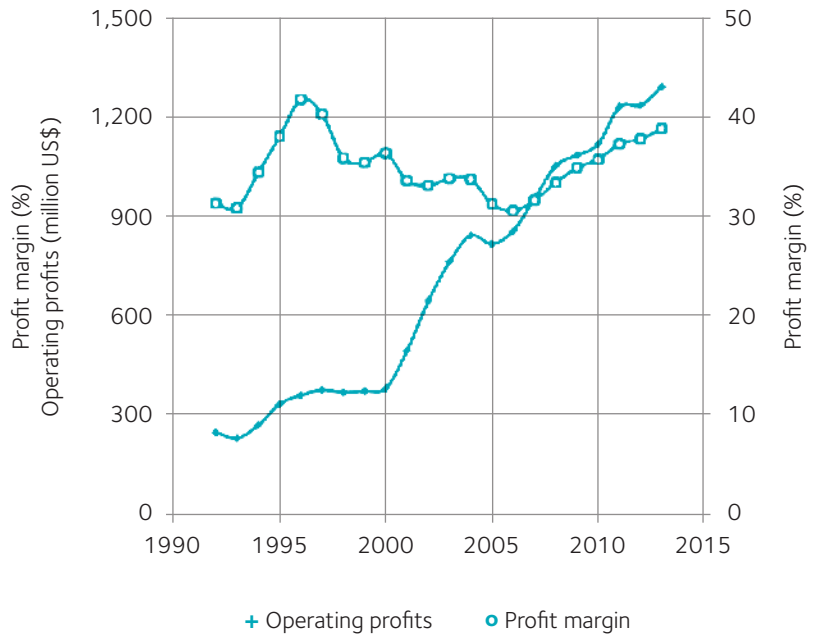


Figure 1. Profits from the scientific, technical & medical (STM) division of Reed-Elsevier (renamed RELX Group in 2015). Larivière V, Haustein S, Mongeon P (2015). The oligopoly of academic publishers in the digital era. *PLOS ONE* **10**(6), e0127502. [DOI: 10.1371/journal.pone.0127502]. © 2015 Larivière *et al.* and is licensed under CC BY 4.0.

'As of April 2017, more than 860 research and funding organisations worldwide have adopted open access mandates'

In the face of increasing soft copy demand and dwindling print production costs they chose to erect electronic paywalls and enforce copyright transfers, a crude yet effective transplant of their existing business model. It was this perceived blatant profiteering, exemplified by the continued imposition of nonsensical 'traditional print' service charges for online materials (e.g. colour figures, page counts and supplements), and ongoing disenfranchisement of authors from their work that fueled growing frustrations and a hunger for alternatives.

A change in winds occurred in 1996 when the editor of the *Journal of Clinical Investigation* whimsically declared: '*The vexing issue of the day is how to appropriately charge users for this electronic access. The nonprofit nature of the JCI allows consideration of a truly novel solution—not to charge anyone at all!*' Early adopters of this refreshing 'open access' approach were perfectly positioned to reap the benefits of increased exposure from new, government-run, digital repositories such as PubMed Central, and would later go on to inspire pioneers of wholly open access publishing models like *Biomed Central* and *PLOS (Public Library of Science).*

The culmination of the *Budapest Open Access Initiative, Bethesda Statement on Open Access Publishing* and *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities* from 2002 to 2003 proved most influential in the open access movement. Together, they made a call to action, setting forth the principles of open access and its definition, boldly stating: '*By 'open access' to this literature, we mean it's free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself.*'

The legacy of these declarations was the 'Open Access Mandate', a policy which requires researchers to make their articles open access by self-archiving the author's final peer-reviewed (and often non-typeset) version in a freely accessible repository, so called 'Green OA' (usually after an embargo period), or by publishing them in an open access journal, also known as 'Gold OA'. As of April 2017, open access mandates had been adopted by more than 860 research and funding organisations worldwide. This has been coupled with an explosive proliferation of open access scholarly journals across all disciplines, which now total over 9,427 from 129 countries, with Gold OA representing a significant proportion of new life science articles (Fig. 2). Governments have also implemented mandates, including the infamous UK REF (Research Excellence Framework) implementing an open access policy last year and the Council of the European Union calling for immediate open access as the default by 2020 (Enserink, 2016).

In spite of great leaps forward in open access, little has been done that addresses works that predate, or are unaffected by, open access mandates. As a result, this half-measure has been rejected by those unwilling to settle for anything less than the total liberation of scientific knowledge. The most notable of these crusaders was the focus of an award-winning documentary, *The Internet's Own Boy: The Story of Aaron Swartz* (Knappenberger, 2014). In 2001, the fourteen-year-old Aaron developed code for the RSS feed and by fifteen was collaborating with Sir Tim Berners-Lee to enhance internet functionality. He also co-founded Reddit and worked on the team that launched Creative Commons – the easy to use copyright licenses that empowers authors and has become the mainstay of open access publishing. Surprisingly, it was his highly influential *Guerilla Open Access Manifesto* and the events that followed which would inspire the movement. Published in 2008, the manifesto called on academics to revolt against the system by downloading copies of paywall-protected articles to publish online for the whole world to see (Swartz, 2008). Two years later, while a research fellow at Harvard, Aaron would singlehandedly download over 4 million documents from JSTOR using MIT's network. His intention was to publish the entire JSTOR repository online and make it freely accessible, but he was arrested in 2011 before finishing. Despite JSTOR reaching a settlement in the civil case with Swartz wherein he surrendered the downloaded data,

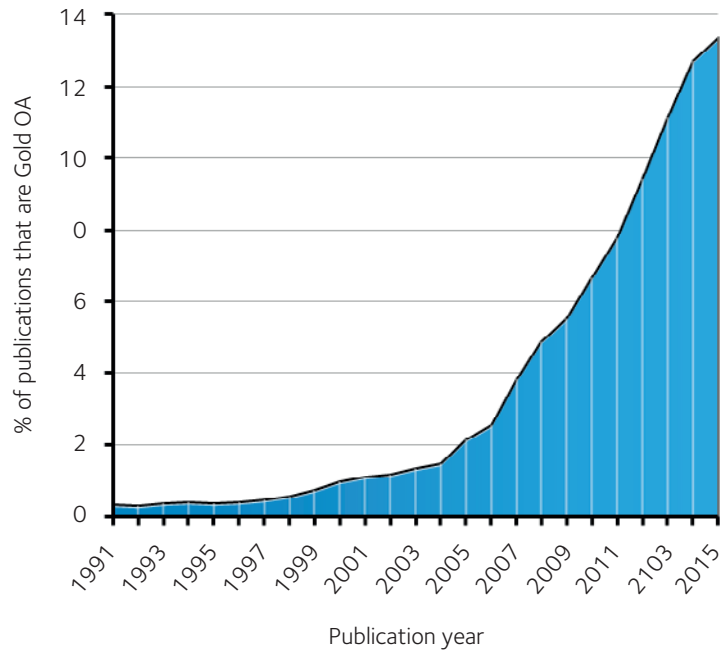


Figure 2. Life science publications made available globally through gold open access journals (not including hybrid journals). [http://ec.europa.eu/research/openscience] © European Union, 1995–2017

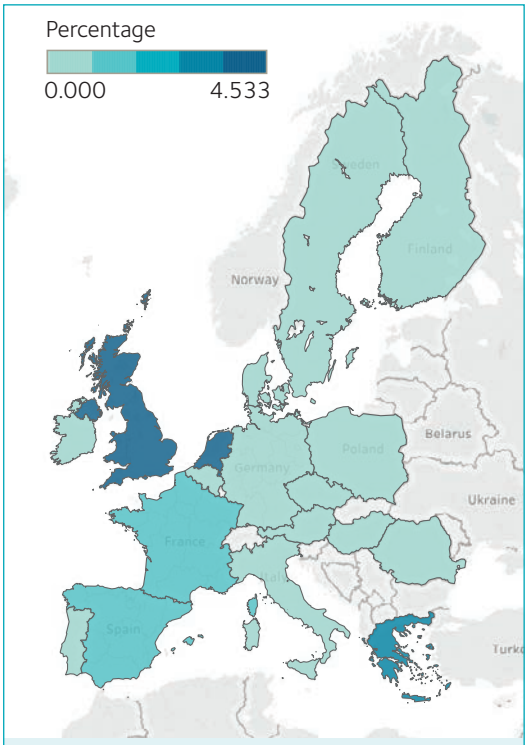


Figure 3. Proportion of life science peer reviews that were published (EU only). [http://ec.europa.eu/research/openscience] © European Union, 1995–2017

Federal prosecutors sought to make an example of this 'hacktivist' and brought 13 felony charges against him to the tune of 50 years in prison and $1 million in fines. Tragically, on 11 January 2013, afflicted with depression and under enormous pressure from the trial, Aaron Swartz committed suicide at the age of 26.

In the aftermath, Alexandra Elbakyan – a young neuroscience graduate student and computer programmer – was hailed as the spiritual successor to Aaron Swartz. Launched in September 2011, her Sci-Hub Project became the first pirate website in the world to provide free access to more than 62 million research papers. It works by first searching for an existing copy of the paper in question on LibGen (Library Genesis), a repository of pirated literary materials (where one can also find a myriad of academic textbooks). If it cannot deliver a copy, Sci-Hub will bypass publishers' paywalls and download a copy to LibGen by running through multiple institutional access systems and utilising login credentials anonymously donated by academics sympathetic to the cause. By February 2016, Sci-Hub was averaging 200,000 downloads per day from all corners of the globe. Surprisingly, some of the most intense use was concentrated in resource-rich European and American Universities, suggesting that aside from genuine access issues, the convenience of a fail-proof centralised search engine is just too great a temptation to ignore.

According to *Science Magazine*, Sci-Hub is either '*... an awe-inspiring act of altruism or a massive criminal enterprise, depending on whom you ask*.' Elsevier would certainly place it in the latter category, with Alexandra residing in Russia to evade lawsuits and extradition, and Sci-Hub safeguarding itself against shut-down attempts by taking refuge on the dark web and replacing compromised domain names as quickly as a decapitated hydra sprouting new heads. Despite some success with heavy-handed litigious efforts in the past, there is now great anxiety among publishers that refusal to adapt may leave them on the losing side of this culture war. For example, over half of all materials hosted on the popular scholarly networking site ResearchGate were uploaded in direct defiance of publishers' copyright, while nearly 88% of surveyed *Science Magazine* readers see nothing wrong with downloading pirated papers with three in five having actually used Sci-Hub in the past (Travis, 2016). Even those averse to dabbling in the morally grey can now comfortably circumvent paywalls using a free, fast web-browser extension called Unpaywall, which trawls 5,300+ public repositories to retrieve legal copies of papers.

This changing landscape leaves us with a question: in a world where total open access seems inevitable (by either legitimate or nefarious means), can the centuries-old scientist–publisher relationship survive and do traditional publishers belong in the future of online community-driven science communication?

Open review – 'out of the darkness'

Scholarly communication forms the bedrock of science and is the currency in which academics trade. Its integrity and quality was to be safeguarded by editorial oversight and peer review; a process instituted by the Royal Society of Edinburgh when *Medical Essays and Observations* became the first formally peer-reviewed publication in 1731. Applied irregularly and in numerous variations, it would not be until the mid-20th century that the practice was to become commonplace, finally transmuting into the externally recruited, anonymous, peer-review process we are familiar with today. Now, amidst crises in both study replication and academic publishing, we must question if our current system of peer review has become unfit for purpose and is in need of radical redress.

Much of the criticism is levied against masked peer review centres on the potential abuses of power by editors and reviewers shielded by anonymity. While the vast majority are honourable, authors must trust that reviewers will not suppress dissent against mainstream theories, exploit 'insider information' to gain advantage, plagiarise or even deliberately delay publications from competing groups with unnecessary revisions.

Although not a new idea, open peer review seeks to solve these issues by introducing complete transparency to the process. In this system, reviewers' comments and correspondence with editors and

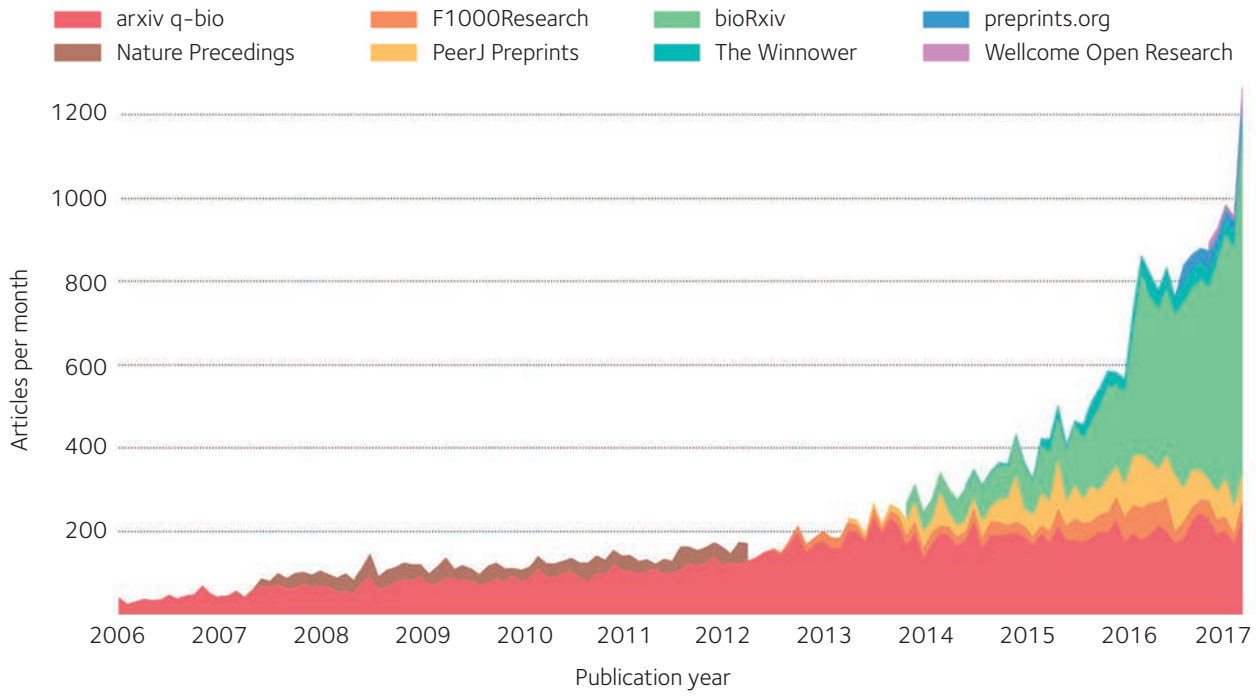


Figure 4. The number of life science articles submitted to preprint servers and open publishing platforms prior to peer review. Created using data from the PrePubMed search engine. Created by Jordan Anaya ©, and is licensed under CC BY 4.0.

authors is published alongside their names in transparency documents. The advantages of this approach are many, as it not only deters professional misconduct but also credits reviewers for their work (via initiatives like Publons), allays authors' misgivings, and educates the reader on the perceived weaknesses of the study and the steps taken to strengthen key conclusions. In the past, publishers have been slow to implement this with critics fearing that reviewer self-censorship would diminish peer review rigor. However, the data does not support this assertion with no negative impact on review quality found between open versus closed peer review in randomised controlled trials.

In parallel with the normalisation of open access practices, open peer review has experienced a resurgence in popularity. Recently, several journals have introduced editorial transparency policies either mandating or giving authors the option to have their pre-publication peer review proceedings published (although not always with reviewers' identities disclosed). This has led to a doubling in the number of European life science peer reviews published (with reviewers named) in 2016 compared to 2014, although the percentage is still low at ~2% of all peer reviews (Fig. 3).

Funding bodies have also shown keen interest in moving towards more transparent systems, paying close attention to the emergence of novel post-publication open peer review models, such as that spearheaded by *F1000Research*. This unorthodox process typically involves a quick sanity check by in-house editors before articles are published online (often within days of submission), then later arranging for invited open peer review post-publication to Pubmed-indexed articles. In acknowledgement of the value of this approach, NCBI developed *PubMed Commons* to introduce an additional level of peer review post-publication to PubMed articles. Here, indexed authors can openly question or share information on the work of their peers, with responses publicly displayed under the relevant abstract for discussion.

Proponents of post-publication peer review argue that its greatest strength is the increased speed of access to information. The median time from submission to publication has hovered at 4–5 months over the past 30 years, although the traditional model has also meant that over half of all authors have had to endure a wait of 1–5 years for a paper to be published during their careers (Powell, 2016). Notwithstanding the delay in time to publication, there is still a general reluctance to replace pre-publication with solely post-publication review models for fear it may reduce the overall quality of papers. Though attitudes may soon change as funders recognise the potential benefits of providing their fellows with rapid, transparent publishing routes, and begin to gradually make moves to create their own custom solutions. So far the Wellcome Trust and Gates Foundation have contracted *F1000Research* to manage their own open publishing ventures, namely *Wellcome Open Research* and *Gates Open Research*, with the European Commission rumoured to soon follow suit with its own platform. However, the two systems need not be mutually exclusive, and life scientists can borrow a tried and tested middle-ground solution from their cousins in the physical sciences – preprints!

Since 1991 physicists have been depositing electronic, open access, preprint manuscripts on the online repository *arXiv*, whereas the vast majority of life scientists have either never heard of preprint servers or don't fully understand them. In physics, astronomy, mathematics and computer science it is now standard practice that completed manuscripts be deposited on public preprint servers prior to, or with simultaneous submission to, scholarly journals. This has been accepted as a means for authors to rapidly disseminate important findings to boost the visibility and citation impact of their work (e.g. astrophysics papers with a preprint counterpart are cited twice as much as non-preprinted publications), whilst also establishing priority for discoveries, documenting evidence of ongoing projects for career progression, and gathering early feedback to improve their papers for later formal peer review publication.

The first life science preprint server *Nature Precedings* was launched in 2007, although with seemingly little appetite they ceased accepting new submissions after a 5-year period. Shortly after, a renewed interest in open science led to exponential growth in preprint numbers and creation of several servers catering to the life science community. The lion's share of these new preprints now go to *bioRxiv* – a platform launched by Cold Spring Harbor Laboratory in 2013 modelled on the success of *arXiv* (Fig. 4). It now hosts over 10,000 preprints which are searchable on prepubmed.org and recently received a cash injection from Facebook co-founder Mark Zuckerberg and his physician wife, Priscilla Chan, to develop an open-source platform and web-friendly article formats.

Nonetheless, many still fear that preprints could lead to getting scooped by competitors, missing out on credit for ideas or jeopardise the chances of manuscripts appearing in peer-reviewed journals. To address these concerns, a series of ASAPbio meetings (Accelerating Science and Publication in biology) started in 2016 with invited stakeholders representing junior and senior working scientists, funding agencies, scientific societies, industry, databases and journals (**asapbio.org/meetings**). Since then, there has been a cascade of major events that should quell concerns and encourage all life scientists to embrace preprints. First, Crossref has started accepting preprints as a content type that it will assign a DOI (Digital Object Identifier) to, which in turn makes preprints fully citable materials (e.g. preprints appear regularly in the reference lists of *Nature* and *Science*), enabling version tracking and linkage with the final peer-reviewed version. Second, the world's largest research funders, namely the Wellcome Trust, UK Medical Research Council, Howard Hughes Medical Institute, and the NIH (USA National Institute of Health), all announced policies to allow researchers to cite their own preprints in grant applications and reports (Luther, 2017). Third, there is a growing list of journals and publishers that now no longer consider preprints as 'prior publication', such as Elsevier, Springer, Nature and Wiley, a list which also includes The Physiological Society's own publications: *The Journal of Physiology* and *Experimental Physiology*. Lastly, after receiving a $1 million grant and the backing of major international funding agencies like the European Research Council, ASAPbio issued a RFA (request for applications) to create a central preprint aggregating service for life science similar to PubMed Central. The Center for Open Science (COS) with the support of 12 preprint servers (e.g. *arXiv*, *bioRiv*), 15 repositories (e.g. Mouse Phenome Database, Protein Data Bank, Figshare) and several stakeholders responded to the RFA with a proposal to set up *The Commons*.

This solution would bring us closer to the reality of a 'one-stop shop' for all life science preprints that will both greatly accelerate research and establish preprints as the currency for determining priority of a discovery. And for those who are still not convinced by this, I'd highly recommend reading the '*Ten simple rules to consider regarding preprint submission*' for more on this topic (Bourne *et al.*, 2017).

Open research – 'what's mine is yours and what's yours is mine'

Today we live in a world where separating fact from fiction has become a non-trivial task. Our senses are bombarded daily by 'alternative facts', experts find themselves mired in false equivalencies, and political talking heads present opinions, feelings and anecdotal evidence on an equal footing with that which is empirically true. Be it climate change denial, anti-vaxxers or the war on GMO foods, the growing trend in anti-science rhetoric is alarming and the erosion of the public trust in science must stop!

Replication and reproducibility are core to the scientific method, yet several decades of the 'publish or perish' mantra have eroded these foundations. According to *Nature*, more than 70% of surveyed researchers have been unable to reproduce other scientist's experiments, though it is feared this barely scratches the surface of the issue. A multitude of harmful practices such as selective reporting, 'p-hacking', inadequately detailed methods and limited strategies to decrease bias have all culminated in an unprecedented replication crisis which feeds into the ugly spectre of science's 'credibility problem' (Baker, 2016).

Moving to an open science future may be the only way to stem the tide. In order to increase scientific literacy and restore trust, we must re-engage the public as active stakeholders. Secrecy breeds suspicion, and as a community, scientists can no longer afford to conduct their affairs behind closed doors. Open research offers us an innovative way to face our problems head-on and restore public confidence in scientific research.

Open data is a key element of open research, the profound benefit of which was best demonstrated by the Human Genome Project. It was the first major initiative to encourage the free distribution of research data into the public domain, often releasing new DNA sequences within 24 hours of completion with the initial draft sequence finally published in 2001. Today there are 900+ life science data repositories which researchers can freely use for reproducing studies, hypothesis testing and data mining, provided the original source is attributed.

For a growing number of journals wishing to support reproducibility, it is a condition of publication that raw data be hosted alongside the paper or deposited in a citable public repository. Demand for the raw data underlying a paper's figures is not the only driver for the burgeoning creation of repositories, with open citable platforms like Figshare catering for unpublished and published research outputs in any file format from posters and presentations to datasets and code. This taps into a wealth of information that would otherwise remain locked away in hard-drives and notebooks, giving new life to miniature studies, negative results and optimisation experiments which may be critical to replicating crucial results.

While the move to open data has been generally welcomed as positive, there is mounting tension between speeding access to data and protecting the interests of those who laboured to collect them. This was evident when the team behind the groundbreaking SPRINT clinical trial learned that almost a third of their planned papers were at risk of being scooped after the NIH and *New England Journal of Medicine* gave competing researchers early access for a data-challenge competition. However, even if they are beaten to the punch on subsequent findings, the community will still await validation of any new results and show due deference to the confirmatory studies performed by the original discoverers. However, when the morals and ethics of situations like these are considered, especially for those studies immediately pertinent to human health or publicly funded, there can be no question that the potential for open data to expedite discovery far outweighs the downsides for those that collected them.

In that same vein, open notebook science, the logical extreme of open research, argues the benefits of transparency will always outweigh the cost. The practice involves placing raw and processed data with any associated materials online as it is generated, and explicitly includes making available failed, less significant or otherwise typically unpublished experiments. While most researchers get queasy at the thought of revealing their work habits and data with warts and all, scientists studying the Zika virus have been lauded for providing a daily-updated online open notebook for their research. Their brave move has paved the way for future pioneers of open research and was accompanied by a joint statement from over 30 global health bodies calling on all research data gathered during future public health emergencies to be made available as rapidly and openly as possible (Islom, 2016).

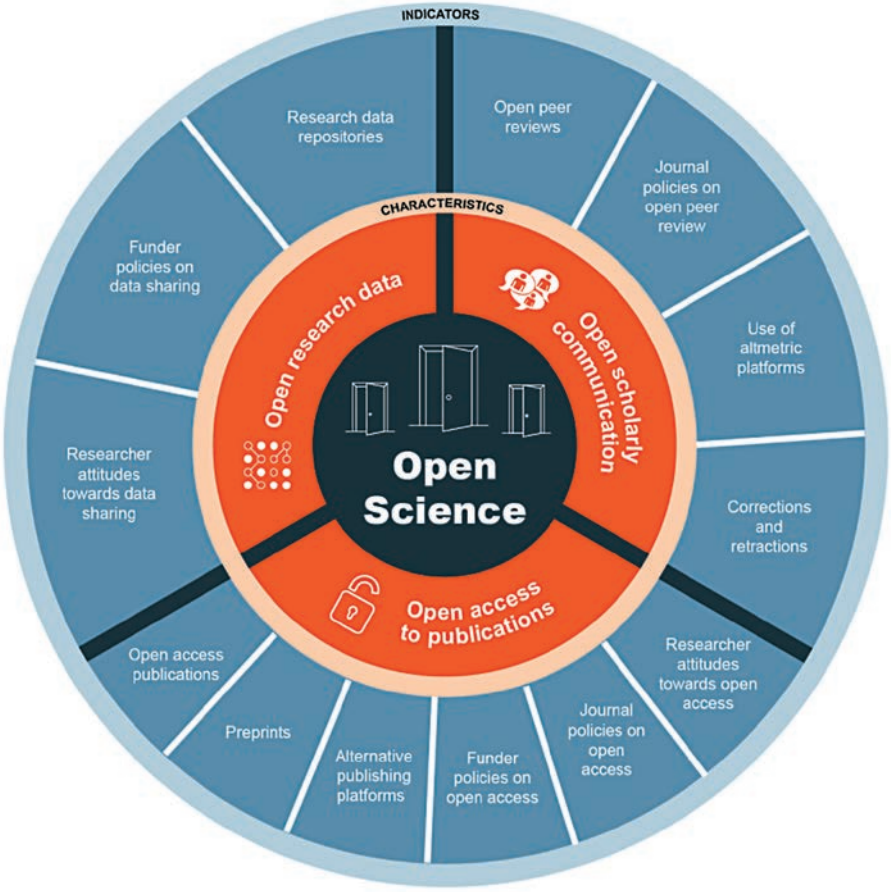


Figure 5. Open science characteristics and indicators tracked by the European Commission's Open Science Monitor. Created for European Commission – Open Science Monitor © OpenStreetMap.org contributors, licensed under ODbL and CC BY-SA 2.0.

Even though the virtues of open research are obvious, its practitioners are few. Seeking to change this, the EU-funded FOSTER project (Facilitate Open Science Training for European Research) was launched in 2014 to promote incorporation of open access approaches into researchers' existing methodologies. This was later formalised during the 2016 Dutch EU presidency, with the *Amsterdam Call for Action on Open Science* advocating for an environment where '*data sharing and stewardship is the default approach for all publicly funded research*' and the launch of the European Commission's Open Science Monitor to track trends and progress in open science worldwide (Fig. 5). Recently, the Wellcome Trust and University of Cambridge have teamed up to run a two-year, open research, pilot project in an effort to better understand the barriers to open research (Teperek, 2017). Should the project prove successful, the Wellcome Trust and others have promised to put their money where their mouths are and begin to actively fund cutting-edge open research, which will surely rally more to the cause.

Perhaps I am just an idealist, but I too share Aaron Swartz's dream of a day when access to the world's entire scientific heritage is free to all, as enshrined in article 27 of the Universal Declaration of Human Rights. It is not hard for me to imagine a future where discoveries are routinely documented in real-time, access to information is without restriction, and research projects are conducted transparently. I can see study registration reports being used to counteract bias and the publication of replication studies and negative results becoming commonplace. I genuinely believe the majority of scientists agree with the core principles of the open science movement, it is only fear of the unknown which holds us back. For my part, I will only publish open access, deposit my preprints on *bioRxiv* and may even upload completed sections from my lab notebook to Figshare. But more importantly, what steps will you take to realise an open science future?

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Cortisol: often not the best indicator of stress and poor welfare

The definitions of the term stress are often confusing and should not be linked to cortisol, which is a valuable welfare indicator, but context is needed to interpret it

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The glucocorticoid cortisol is produced in many mammals, such as primates, carnivores and ungulates, and in other animals. Corticosterone has the same function, being produced in rodents and many birds, including poultry, so reference to cortisol below generally applies to corticosterone as well. The hypothalamic–pituitary–interrenal response of fish that experience adversity involves interrenal tissue whose cell functions are very similar to those of the mammalian adrenal gland. Maximal concentrations of cortisol are produced in a trout when it is removed from water and hence deprived of oxygen.

Cortisol in positive and negative situations

A key, adaptive function of the glucocorticoids is to make energy available in emergency situations, and in some other situations where it is needed, but they have other important roles. The majority of cells in the human body have receptors for cortisol and glucocorticoids reach every organ, thus cortisol has a broad variety of effects, including effects on metabolic, cardiovascular and immune responses. There is a daily fluctuation in the secretion of cortisol, and hence in plasma cortisol concentration, beginning in humans with a distinct sharp rise of cortisol at the time of waking, followed by a steady decline over the course of the day, with the lowest levels in the early morning hours. The cortisol facilitates effective learning, via the functioning of the hippocampus, and maintains other normal functions in the body (Broom & Zanella, 2004). Hippocampal cells actively take up cortisol *in vitro*. Extreme adversity can suppress the daily cortisol cycle in humans (Kivlighan *et al.*, 2008) and lead to less effective hippocampal function and hence worse learning ability and memory.

The facilitation of learning is clearly a positive function, as is the increase in cortisol during courtship, mating and exertion to obtain food. Whilst cortisol has an adaptive function for the individual when it is produced in response to perceived danger, pain or difficulty to control interactions with the environment, these situations are negative and there may be some substantial negative consequences of the cortisol, as described below. Cortisol has roles in both positive and negative situations so it is erroneous to consider it to be always or generally harmful to the individual.

The meanings of stress and welfare

For most people, stress implies the effects of a challenge to the individual that disrupts homeostasis resulting in adverse effects. It is not just a stimulus that activates energy-releasing control mechanisms. Stimuli whose effects are beneficial would not be called stressors by most people. Also, situations that activate the hypothalamic–pituitary–adrenal cortical axis as part of a brief emergency response, but whose effects are useful to the individual, would not be called stressors by most of the public.

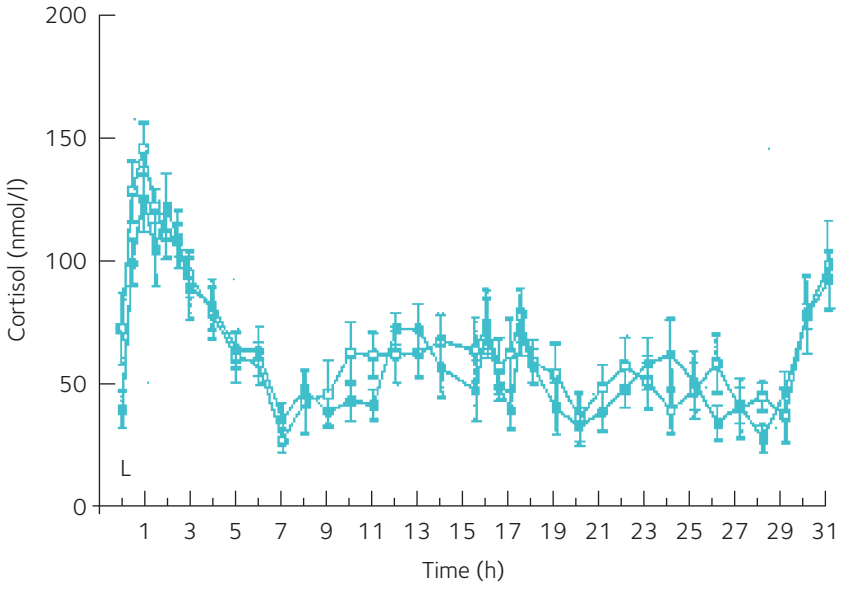

Figure 1. The concentration of cortisol in blood plasma was measured in two groups of catheterised sheep, after a period of adaptation to the catheters, during a commercial 31-hour journey. The basal concentration was close to 50 nmoles per litre. There was a one-hour stationary period at 15 hours.

'The context in which changes in cortisol occur is essential information for interpretation of the physiological data'

The writings of Selye, although stimulating useful research, have been scientifically confusing in relation to the use of the term stress. A definition of stress that is in line with the general public usage of the word is, stress is an environmental effect on an individual which overtaxes its control systems and results in adverse consequences, eventually reduced fitness, (Broom & Johnson, 1993; Broom, 2014). According to this definition, there is no good stress and effects that are called good stress should be called stimulation. During the development of individuals, stimuli that result from situations that are somewhat difficult for that individual can be useful experience but these are best not referred to as being stressful. This definition is similar to that of Lazarus (2006) who said that stress refers to a situation in which demands are perceived to exceed one's personal resources. However, whilst this definition depends on perception, it is better for the definition to depend on function and to apply to all animals.

Scientists and legislators now use animal welfare as a term that is a scientific concept describing a potentially measurable quality of a living animal at a particular time. The welfare of an individual is its state as regards its attempts to cope with its environment. Welfare can be measured scientifically and varies over a range from very good to very poor. Welfare will be poor if there is difficulty in coping or failure to cope. There are various coping strategies with behavioural, physiological, immunological and other components that are coordinated from the brain. Feelings, such as pain, fear and the various forms of pleasure, are often part of a coping strategy and feelings are a key part of welfare. Coping with pathology is necessary if welfare is to be good so health is an important part of welfare. There is a clear relationship between stress and welfare in that, whenever there is stress, welfare will be poor. However, welfare could be temporarily poor without any long-lasting adverse effect, so this would be poor welfare without stress (Broom & Johnson, 1993).

Writings about the concepts of 'one health' and 'one welfare' emphasise that the meanings of scientific terms concerning humans and non-humans should be the same. However, human usage and definitions sometimes apply only to humans and there can be an erroneous assumption that some mechanisms are confined to humans. The distinction between physical and psychological stressors may involve the assumption that most non-human stress is solely physical. Dedovic *et al.* (2009) suggest that a stressor facing a wild animal, with the anticipation of bodily injury, is physical while social evaluative threat would be considered psychological. It has been suggested that reactive stressors tend to implicate brainstem, specific hypothalamic nuclei and the bed nucleus of the stria terminalis, which all have direct connections to the paraventricular nucleus whilst anticipatory stressors, seem to engage limbic system regions. This is likely to be valid but does not differentiate non-human and human because the brain mechanisms are present in a range of species. A concept of the future and other aspects of sentience are evident from many non-human studies (Broom, 2014). Health, welfare and stress are the same concepts in humans and other sentient animals because most of the mechanisms are the same.

Cortisol as an indicator of stress and welfare

When humans and other animals are subjected to short-term problems, e.g. painful procedures, frightening situations such as being picked up or transported, or experiences that cannot be controlled, the increase in cortisol that usually occurs can be measured and used as an indicator of the extent of poor welfare. In some cases an experimenter can predict that there will be long-term harm so the individual can be said to be stressed. Cortisol concentration in blood and saliva and, later, the concentration of cortisol metabolites in urine, faeces and hair increases when a person hits their finger with a hammer, a rabbit is subjected to a temperature of 42˚C, a calf is loaded onto a transport vehicle, a sheep is driven around bends so that balance is difficult, a pig is introduced into a group of strangers, a salmon is pumped through a pipe, or a wild bird is brought into captivity. The increase can be assessed in relation to the basal cortisol concentration and the known maximum increase in such an animal. Provided that the sampling of, for example, blood is not itself the cause of any increase and the time taken for the cortisol increase to occur is taken into account, the magnitude of change gives useful information about the subject's welfare (Broom & Fraser, 2015).

An example of cortisol measurement giving useful information about animal welfare is shown in Fig. 1. During a period of monitoring sheep during a road journey, the sheep showed a very marked increase in plasma cortisol from the baseline when they were loaded on to the vehicle. This occurred despite the fact that the staff concerned were experienced animal handlers and did not treat the animals roughly. The sheep had never before been on a vehicle and were clearly very disturbed by the loading. The response lasted for 5–6 hours. The cortisol concentration then dropped to close to the basal level as the sheep became accustomed to their new environment. It did not change during a one-hour period when the vehicle was stationary. Most of the journey was on motorways, but the last 3 hours of the journey were on side roads with bends at intervals. The drivers drove just as they would with human passengers. However, a sheep standing on a moving vehicle has much more difficulty maintaining its balance than a human sitting in a seat. Cornering and acceleration caused problems for the sheep, so cortisol concentration increased. It is clear from studies over relatively short periods, like this one, that measurement of cortisol concentration can provide information about the welfare of animals and help in the formulation of advice about how to avoid welfare problems for the animals.

Long-term problems may be an accumulation of short-term difficulties in life, each of which is associated with cortisol production. Although this production of cortisol is essential for survival, after injury or various other problems, if it continues to be present it can break down the protein in muscle, inhibit the ongoing replacement of calcium in bone and produce myopathy, weakness, fatigue and decalcification of bone (Melzack, 2001). Frequent, high levels of cortisol production may lead to neural degeneration of the hippocampus, amygdala and pre-frontal cortex and suppression of immune system function (McEwen, 2007). People with Post-Traumatic Stress Disorder and other substantial long-term problems have hippocampal and other brain damage, some mediated via cortisol (Bremner, 1999). High plasma cortisol in elderly men is associated with lower cognitive ability (MacLullich *et al.,* 2005). Glucocorticoid effects on the immune system may include changes in the numbers of leucocytes, suppressing the activity of B-cells and cytotoxic T-cells and changing cytokine activity in ways which increase susceptibility to pathogens. These are clearly negative effects on the individual so frequent, high concentrations of cortisol are indicators of stress and poor welfare.

However, some environmental conditions, such as housing conditions that do not meet the individual's needs, may not lead to a change in cortisol concentration. Hence the absence of an increase in cortisol concentration does not indicate that there is no problem for the individual. Many chronic problems lead to attempts to cope not involving cortisol and to other negative effects so a range of welfare indicators is needed to identify that the individual has a problem. This is true of human and non-human subjects. Damage to the hippocampus and other regions of the brain, clearly an indicator of poor welfare, may be caused by high-fat diet, alcohol, food restriction or sleep deprivation with no effects on cortisol. Abnormal behaviour, such as stereotypies or high levels of aggression, are sometimes a very useful indicator of poor welfare in situations where there is no elevated cortisol. Fluctuations in cortisol may provide no evidence of poor welfare because they are preparation for courtship or active food-finding. Hence the context in which changes in cortisol occur is essential information for interpretation of the physiological data (Broom & Fraser, 2015).

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Science and politics

The 1923 International Physiology Congress in Edinburgh

Fernando Cervero

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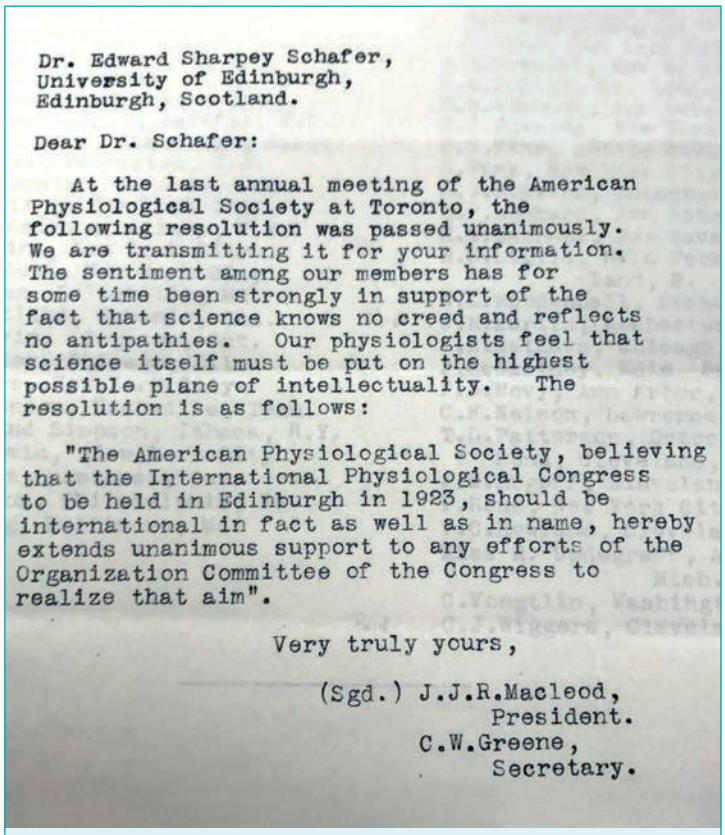
'La science n'a pas de patrie, parce que le savoir est le patrimoine de l'humanité, le flambeau qui éclaire le monde. La science doit être la plus haute personnification de la patrie parce que de tous les peuples, celui-là sera toujours le premier qui marchera le premier par les travaux de la pensée et de l'intelligence. Luttons donc dans le champ pacifique de la science pour la prééminence de nos patries respectives.'
Louis Pasteur, inaugural speech of the Pasteur Institute,
14 November 1888

The result of the Brexit referendum and the election of President Trump are largely due to increased nationalistic feelings in both the UK and the US, and there is evidence that these sentiments are also growing in other parts of Europe and the world. Nationalism has always had a challenging relationship with science, exemplified in extreme by the diaspora of German scientists under the Nazi regime; a mass exile which greatly benefited the receiving countries. As we are now being told that walls will be built and border restrictions will be imposed, it is worth having a look at how our predecessors dealt in the past with such problems.

In 1923, the 11th International Physiological Congress was held in Edinburgh at the invitation of the then Professor and Chair of Physiology of Edinburgh University, Edward Sharpey-Schafer. This was a major scientific event attended by more than 400 physiologists from all over the world (*BMJ*, 1923). These congresses, first started in 1889, were held every 3 years and led to the formation in 1953 of the International Union of Physiological Sciences (IUPS) (Schulz-Hofer, 2009). The 1923 congress was the second held in the UK, the first one took place in 1898 in Cambridge.

When I was a physiology lecturer at Edinburgh University in the late 70s and early 80s, I found, tucked away in the departmental library, a couple of cardboard boxes containing papers, letters and documents related to the organisation of the 1923 congress. Unfortunately, neither the Physiology Department nor its library exist today but some of the documents of the congress were transferred to the University main library where they have been safely kept.

Going through these records, it is intriguing to see how some things about congress organisation have not changed in the intervening decades whereas others are long gone, like the mention in the letter of invitation to the Lord Provost of Edinburgh that '*we already have an entry of close on 400, which does not include ladies accompanying members*'. But among registration letters, requests of accommodation, invoices and other such papers, the documentation of the congress contains written evidence of a key political issue: should scientists from Germany and Austria be allowed to attend the congress?



Dr. Edward Sharpey Schafer,
University of Edinburgh,
Edinburgh, Scotland.

Dear Dr. Schafer:

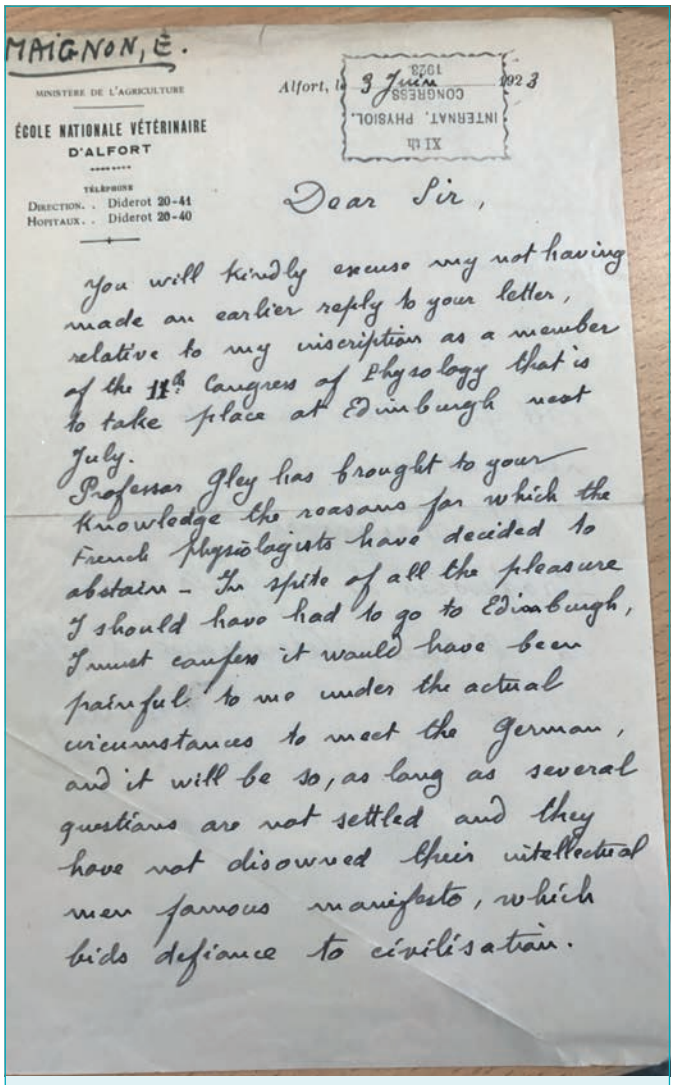
At the last annual meeting of the American Physiological Society at Toronto, the following resolution was passed unanimously. We are transmitting it for your information. The sentiment among our members has for some time been strongly in support of the fact that science knows no creed and reflects no antipathies. Our physiologists feel that science itself must be put on the highest possible plane of intellectuality. The resolution is as follows:

"The American Physiological Society, believing that the International Physiological Congress to be held in Edinburgh in 1923, should be international in fact as well as in name, hereby extends unanimous support to any efforts of the Organization Committee of the Congress to realize that aim".

Very truly yours,

(Sgd.) J.J.R.Macleod,
President.
C.W.Greene,
Secretary.

Figure 1. Letter dated 19 January, 1923, from the American Physiological Society supporting the inclusion of all physiologists in the congress (University of Edinburgh library).



MAIGNON, E.

MINISTÈRE DE L'AGRICULTURE

ÉCOLE NATIONALE VÉTÉRINAIRE
D'ALFORT

TÉLÉPHONE
DIRECTION. . Diderot 20-41
HOPITAUX. . Diderot 20-40

Alfort, le 3 Juin 1923

CONGRESS INTERNAT. PHYSIOL. 1923 XII th

Dear Sir,

You will kindly excuse my not having made an earlier reply to your letter, relative to my inscription as a member of the 11th Congress of Physiology that is to take place at Edinburgh next July.

Professor Gley has brought to your knowledge the reasons for which the French physiologists have decided to abstain - In spite of all the pleasure I should have had to go to Edinburgh, I must confess it would have been painful to me under the actual circumstances to meet the german, and it will be so, as long as several questions are not settled and they have not disowned their intellectual men famous manifesto, which bids defiance to civilisation.

Figure 2. Letter from a French physiologist (E Maignon) announcing his boycott to the congress because of the presence of German scientists. There is no mention in the letter of the content of the 'manifesto' (University of Edinburgh library).

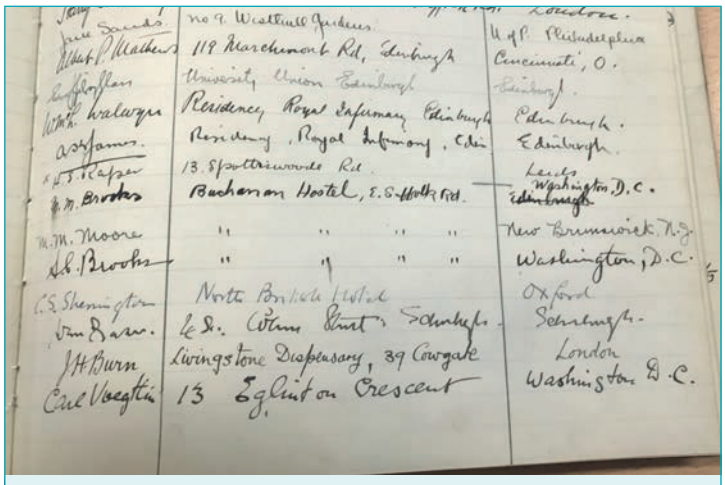
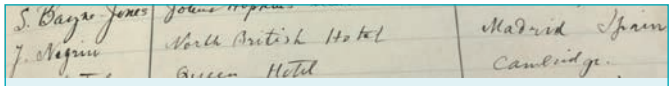


Figure 3. A page of the registration book of the congress. Delegates were asked to write their name and address as they registered. Note Sherrington's entry – 4th from the bottom. (University of Edinburgh library).



S. Bayo Jones — North British Hotel — Madrid Spain
J. Negrin — North British Hotel — Cambridge

Figure 4. Registration entry of Juan Negrin who would later become the last Prime Minister of the Spanish Republic before the Franco takeover. (University of Edinburgh library).

The meeting took place 5 years after the end of the Great War, and feelings among some attendees were still raw. The sequence of physiology congresses had been interrupted by the war and was only re-established in 1920 with a congress in Paris that deliberately excluded physiologists from the recently defeated countries. For the 1923 congress, a passionate debate raged as to whether the barring of German scientists should still be maintained. The debate was fuelled by the threat of Belgian and French physiologists to boycott the congress if German scientists were allowed to attend.

The Edinburgh organisers, led by Sharpey-Schafer, wanted to have a truly international congress, stating that science is universal and that all scientists should be allowed to participate, meet and debate with their peers. They opposed any ban for reasons of nationality and invited physiologists from all over the world to come to Edinburgh. In the case of Sharpey-Schafer this was even more poignant as his two sons had been killed in action in the Great War. He had changed his name in 1918 from Schäfer to Sharpey-Schafer after his son John was killed at the battle of Jutland. '*In our family we had to mourn the loss of my elder and only surviving son John Sharpey (Jack) … I decided to add the name Sharpey to my own name and duly advertised the fact. I did this partly on Jack's account, partly because it was the name of my old teacher & master of Physiology* (William Sharpey) – *the best friend I ever had*' (Sharpy-Schafer diaries).

The American Physiological Society endorsed the aim of the organisers in a letter addressed to Sharpey-Schafer (Fig. 1) stating that 'science knows no creed' and extending their support to the organizing committee to ensure a truly international congress. However, French and Belgian physiologists were less forgiving and some decided not to attend the congress in protest for the presence of German physiologists (see Fig. 2). But in the end the congress was a success and was attended by *la crème de la crème* of contemporary physiology including Adrian, Banting, Bayliss, Dale, Einthoven, Frank, von Frey, Fulton, Gasser, Haldane, Hill, Houssay, Langley, Pavlov, Sherrington and Szent-Gyorgyi among others (see Fig. 3).

The congress papers contain some gems regarding the sensitive issue of the German delegates. Two letters from the Edinburgh Association for the provision of Hostels for Women Students include some interesting sentences regarding the accommodation that they were offering for congress delegates. In one of them they state that the hostels '*will endeavour to divide the Germans from the French*' hoping that they would '*understand a sufficient amount of English*'.

In another communication they state that '*the question of receiving guests from Germany and Austria was considered and it was unanimously agreed that no objection should be raised*'. The letter also includes data on the accommodation charge: 8 shillings and sixpence (42.5p in today's currency) per head per night for dinner, room and breakfast.

Aside from the German-French question the congress papers also contain some other bits of political relevance. One of the Spanish delegates at the congress was Juan Negrin, Professor of Physiology at the University of Madrid who later in life became finance minister in the Spanish Republic and was appointed Prime Minister during the Spanish civil war (Fig. 4). Negrin was a physiologist turned politician who unsuccessfully tried to save the Spanish Republic from the Franco onslaught and the brutal repression that followed (Preston, 2016).

On the scientific side, highlights of the congress included lectures from Ivan Pavlov – delivered by his son – on hypnosis and sleep, by Langley on the axon reflex and a keynote lecture by John Macleod from Toronto on recent research on insulin from his laboratory. Interestingly, Frederik Banting, co-worker of Macleod and co-discoverer of insulin, or perhaps just discoverer depending who you believe, was also attending the congress but Macleod got the limelight of the keynote lecture. Both were awarded the Nobel Prize in 1923 only a few months after the congress and there is a considerable literature as to the respective achievements of either of them as well as to the contributions of Charles Best to whom Banting gave half of his prize money and James Bertram Collip who in turn received from Macleod half of his cash (**www.nobelprize.org/educational/medicine/insulin/discovery-insulin.html**).

Turning back to the question of science and politics, it is refreshing to see the efforts made by Sharpey-Schafer and his committee as well as from organisations such as the American Physiological Society to ensure a truly international congress, to remove barriers imposed by nationality and to build goodwill among fellow scientists. His own personal tragedy did not prevent him from achieving this aim. A lesson to us all.

Acknowledgements

My thanks to Dr Graeme D Eddie, Assistant Librarian, Archives & Manuscripts, Edinburgh University Library for finding the congress documents and to Tilli Tansey OBE for helpful advice and comments on this article.

'They opposed any ban for reasons of nationality and invited physiologists from all over the world to come to Edinburgh'

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What does the future hold for research into Epithelia & Membrane Transport?

What is the most important property of an epithelium?

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Co-convenors of the Epithelia and Membrane Transport theme

As a PhD student I was asked the question: '*what is the most important property of an epithelium?*' I tried my best to recite some typical textbook phrases like how it acts as a selective barrier to the external environment and its transcellular transport capabilities. On all counts I was wrong – the answer my superior was looking for was that '*the cells are polarised*'.

Some 10 years on, I cannot help but wonder what answer I would receive to this same question if I were to ask a PhD student in an epithelia research lab today. Of course, some may indeed still answer 'epithelial polarity', but possibly for less obvious reasons than the distinct plasma membrane domains allowing directional transport of molecules across the epithelium. In cancer research, loss of epithelial polarity marks the beginning of epithelia-to-mesenchymal transition in which cells acquire migratory and invasive capabilities, promoting metastasis in epithelium-derived carcinoma. A student in an epithelial barrier lab may also give this answer but in the context of epithelial wound healing, where epithelial polarity defines cellular differentiation vs proliferation potential. And in an infectious disease lab the same answer could be used to point to how certain bacterial pathogens are capable of reversing epithelial polarity as a mechanism of penetrating the epithelial barrier.

My guess would be that many would give much more diverse answers to this question, and I can only imagine what might be considered the most fundamental properties of an epithelium in another 10 years' time. In the context of the epithelium as a protective barrier against pathogens, new research into barrier properties and host–microbiome crosstalk could provide innovative alternative approaches to overcome inflammatory diseases affecting the intestinal and respiratory mucosa. Indeed new insights into the innate immune signalling or potential phagocytic capacity of epithelial cells could even see epithelia classified in physiology textbooks of the future as a type of immune cell. Beyond the well-studied tight and adherens junctions, new innovations in microscopy are expanding our understanding of epithelia cell–cell communication such as how deep nuclear invaginations form tunnels traversing the nucleus and encasing the cytoskeleton, providing a physical/mechanical link from the nucleus to desmosomes at the cell membrane.

And all this before one even begins to consider the possibilities of future research into epithelial membrane transport, an exciting field of research that has provided new therapies for many diseases and most notably in recent years has provided the closest thing to a cure for a small subset of Cystic Fibrosis patients through insights into the regulation of the CFTR ion channel. New insights into novel aspects of the regulation of membrane transporters and channels, such as the study of extracellular vesicles, may represent the next major breakthrough in the identification and treatment of the numerous disease states in which ion and solute transport become dysregulated.

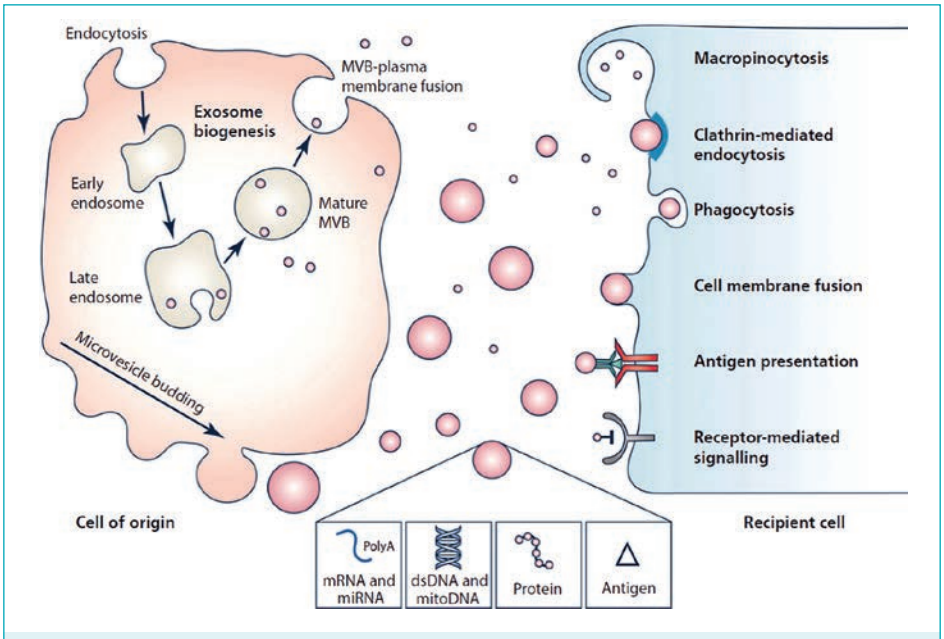

Figure 1. Extracellular vesicle (ECV) biogenesis and interaction with recipient cells. Figure used with permission from Morrison *et al.* (2016).

'The study of extracellular vesicles may represent the next major breakthrough in the identification and treatment of the numerous disease states'

Extracellular vesicles: novel regulators of epithelial transport?

One of the defining features of a polarised epithelium is its ability to transport a variety of different ions and solutes, as well as water. This occurs via transporters and ion channels differentially expressed within distinct apical and basolateral domains of the plasma membrane.

Membrane transport across epithelial tissues is subject to regulation by a wide variety of hormones and bioactive factors, which can either upregulate or downregulate transport processes. For instance, in response to increased plasma osmolality, release of the peptide hormone arginine vasopressin (AVP) promotes water reabsorption by inserting water channels within the renal collecting duct. These regulatory processes typically involve receptor-mediated signal transduction with resulting alterations to number and/or activity of transporters.

A novel route of cellular signalling has received a great deal of interest recently, namely the release of extracellular vesicles (ECVs) from cells. These nano-sized vesicles are released from nearly all cell types including neurons and immune cells, as well as epithelial cells. ECVs are typically classified by their size, origin and identifying markers, and multiple methods are now well established to isolate and identify ECVs (reviewed recently in *J Physiol*; Morrison *et al.*, 2016). ECVs have been proposed to carry cargo including proteins, lipids and RNA which upon release from the donor cell can be transferred and incorporated into a recipient cell (Fig. 1).

The identification of ECVs in human urine samples demonstrated that epithelial cells spanning the length of the nephron are capable of releasing these vesicles (Pisitkun *et al.*, 2004). Analysis by mass spectrometry revealed these ECVs contained a variety of proteins including tubular transporters as well as proteins involved in membrane trafficking. Interestingly, analysis of ECVs in urine collected from patients with Bartter Syndrome Type 1 showed a complete absence of the Na-K-Cl co-transporter 2 (NKCC2), revealing a potential use of ECVs as biomarkers of disease (Gonzales *et al.*, 2004). Indeed, biomarkers in urinary ECVs have been proposed across the entire spectrum of renal disease (Morrison *et al.*, 2016). The value of these potential biomarkers remains to be determined, and only large-scale population studies will reveal if these will be of clinical use in the future.

In terms of intercellular signalling, studies in renal epithelial cells have demonstrated that cells not only release ECVs, they can also take up ECVs. Importantly the contents of these vesicles can be transferred, as shown by the incorporation of ECVs with functional AQP2 water channels, collected from AVP-stimulated donor cells, into unstimulated recipient cells (Street *et al.*, 2016). In addition to the transfer of transporter proteins, there is now evidence that ECVs contain micro RNAs (miRNAs) which can alter epithelial transport (Gracia *et al.*, 2017; Oosthuyzen *et al.*, 2017). Interestingly, the targets of identified miRNAs are not only the transporters themselves, but intracellular kinases known to regulate them.

The physiological relevance of this form of cellular signalling remains to be determined. In what context does ECV signalling become important? Moreover, what additional control does ECV signalling exert alongside the more classical hormone/receptor-mediated regulation of epithelial transport? The potential for cellular signalling along the length of the nephron via ECVs in the ultrafiltrate certainly seems plausible and may indeed be of great relevance.

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Stressing out the immune system

Many systems in the human body are impacted by stress, among these the immune system is particularly sensitive

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Stress can get under our skin. It can influence each and every physiological system, and all of the major contemporary diseases in the UK, including cardiovascular disease, inflammatory disorders, metabolic syndrome, infectious diseases and cancer, have been associated with stress. Stress affects everyone, and levels of anxiety and mental health disorders are increasing with work-related stress now being the second most commonly reported illness in the UK workforce. Over the last four decades, research in the area of psychoneuroimmunology (PNI) has identified stress-induced immune alterations as a potential mediator between chronic stress and ill-health.

In the 1970s, Holmes and Rahe developed a scale to subjectively grade stress. They ranked over 40 different types of life stressors, such as the death of someone close to you, changes in relationship status, work-related stress, even Christmas, and they assigned each stressor a score. The total tally of stress scores that a person had experienced in the last year could accurately predict the likeliness of future illness. This demonstrated that stress and illness were closely related. In the 1990s, Cohen *et al.* eloquently demonstrated that psychological stress increased the rates of respiratory infections and clinical symptoms in participants inoculated with the common cold (Cohen *et al.*, 1993). Subsequent studies revealed that every organ, tissue and cell of the immune system could be altered by psychological stress. The involvement of immune alterations in stress-induced diseases was recognised and the field of psychroneuroimmunology (PNI) was born.

Defining stress

Stress is highly subjective. Something that I may class as stressful (watching Arsenal this season), may not be stressful to other people (Tottenham supporters). So how can we define stress? In the 1960s, the psychologist Richard Lazarus introduced the concept that stress is a process consisting of three distinct steps. First, a stimulus (i.e. the stressor) has to be present and perceived. Second, the stimulus initiates a conscious or sub-conscious appraisal whereby the stressor is evaluated in relation to available coping options. If the demands of the situation outstrip the ability to cope then the situation is perceived as stressful. Third, this results in a stress response involving emotional (e.g. anxiety, embarrassment) and biological (e.g. autonomic-endocrine) adaptations. Put simply, stress is a situation or event that exceeds, or is perceived to exceed, the individual's ability to cope, that then triggers an emotional and biological response.

Cortisol and adrenaline are released continuously according to a circadian rhythm, thus altering immunity on a daily cycle

Image credit: Darryl Leja, NHGRI

The stress adaptation response and immunity

The biological adaptation to stress is activation of the sympathetic nervous system (SNS). The same biological response is induced whether the stressor is psychological, such as anxiety or embarrassment, or physical, for example, exercise, trauma or fever. In the case of psychological stress, the individual perceives an inability to cope and this results in the amygdala, a part of the brain that contributes to emotion processing, sending a distress signal to the hypothalamus. The hypothalamus can communicate with the periphery via the two arms of the autonomic nervous system: the parasympathetic 'rest and digest' arm and the sympathetic 'fight or flight' arm. During stress the SNS is triggered and various physiological changes occur, including an increase in heart rate, respiration and energy production. This promotes survival of the individual by maximising physical capacity to cope with the stressor.

The SNS innervates many organs and tissues throughout the body including the adrenal gland. During stress, sympathetic signalling causes the adrenal gland to secrete the two main stress hormones: adrenaline and cortisol. These hormones can spread and act throughout the body via the circulation. The SNS innervates all of the organs of the immune system, and individual immune cells also express adrenergic and glucocorticoid receptors, so can directly respond to changes in circulating levels of adrenaline and cortisol. Stress is therefore able to alter every process of immunity, from the initial development of stem cells into early immune progenitor cells in the bone marrow, through to the instigation of programmed immune responses to specific antigens in the lymph nodes. Even when in the peripheral tissues, such as the skin or gut, where mature immune cells are most likely to encounter infections, the cells can be regulated by stress hormones. It is therefore unsurprising that the immune system is a modifiable target of stress.

Acute stress and immunity

Research often focuses on chronic psychological stress. However, one of the most comprehensive meta-analyses on stress and immunity in humans to date found that the most robust and replicable findings in PNI are associated with stress responses lasting just minutes or hours rather than months or years (Segerstrom and Miller, 2004). A key phenomenon during acute stress is the rapid and transient movement of immune cells into the peripheral blood. But not all immune cells are mobilised; only cells which display immediate effector functions are involved, such as cytotoxic cells and cells with the potential to migrate into inflamed tissues. Therefore, acute stress not only increases the number of immune cells in the blood, but it also changes the composition of the blood. The upshot is an increase in the circulating 'soldiers' of the immune system, which is proposed to increase immune surveillance and thus enhance immunity during times of stress when, historically at least, injury and infection were more likely (Dhabhar, 2009).

'Subsequent studies revealed that every organ, tissue and cell of the immune system could be altered by psychological stress'

‘Stress is therefore able to alter every process of immunity, from the initial development of stem cells … through to the instigation of programmed immune responses’

It is indeed unlikely that the evolution of stress adaption would select for a cardiovascular and metabolic system that helps the organism to rapidly escape a predator, only for it to later succumb to an infection.

Indicative of an evolved ability to rapidly adapt to danger, all vertebrates, including humans, have the remarkable capacity to swiftly alter the immune cell composition in peripheral blood and tissues in response to acute stress. Furthermore, experimental animal studies have confirmed that acute stress, and the accompanied cell redistribution, predicts stronger delayed-type hypersensitivity responses, enhanced vaccine responses, an increased migration of leukocytes into wounded tissue, and faster wound healing. In humans, brief psychological stressors and exercise prior to vaccination have also demonstrate the ability to increase vaccination-induced antibody responses (Dhabhar, 2009).

But how do the physiological effects of acute stress manifest now in the modern era, when stress does not usually come with a physical or immunological challenge? Imagine increasing immune-surveillance in an individual who has an underlying inflammatory or autoimmune disorder, such as atherosclerosis. The promotion of immunity in these circumstances could be seen as a negative outcome that would aggravate the condition.

Chronically stressing a caveman

What if the stress lasts for weeks, months or years? The stress adaptation response did not evolve to last for extended periods and, consequently, it cannot. This was first recognised in the 1930s by Hans Selye who described the three stages of the General Adaptation or Stress Syndrome. First there is the acute stress response in which the body prepares for fight or flight. But this level of excitement cannot be maintained so a second stage of adaptation occurs where the body becomes resistant to the stress. Finally, in chronic stress, the system enters a state of exhaustion and this fatigue of the immune system results in illness.

One theory in evolutionary psychology is that we have a Stone Age brain. This does not mean the brain has not evolved since the Stone Age, but that the brain has not evolved quickly enough for the modern world.

Our response to stress may reflect that we have a so-called Stone Age brain, meaning that it hasn’t evolved quickly enough to adapt to modern day stressors

This may be true for the response to present-day stress. Many of today's life stressors that cause an emotion response in the amygdala do not require a physiological response to ensure survival of the individual. Considering this, it is not surprising that the stress adaptation response to chronic stress may not serve us well.

Chronic stress and immunity

The immune system is delicately balanced between immune activation, which will clear infections and malignancies, and immune regulation which prevents self-harm that could otherwise result in autoimmunity and inflammatory disorders. Chronic stress appears to disrupt this balance. It causes the worst of both worlds: lower immune protection and greater inflammation. Cross-sectional studies of dementia caregivers versus age-matched non-caregiver controls demonstrate that chronic stress clinically reduces humoral (B-cell and IgG antibody) and cell-mediated (T-cell) immune responses to vaccination (Gouin *et al.,* 2008). Caregivers also report more days of illness and upper respiratory tract infections. Together, this suggests that stress causes a decrease in immunity to novel infections. Chronically stressed individuals also show slower wound healing, latent virus reactivation, shortened leukocyte telomere lengths, greater oxidative stress and increased low-grade systemic inflammation, including increased IL-6. These effects can be seen in both young and old caregivers, individuals effected by major life events, and from individuals self-reporting high levels of stress.

Stress, immunosenescence and age-related diseases

The similarities of immune dysfunction brought about by ageing and chronic psychological stress are striking and include increased inflammation, reduced vaccination responses, decreased cell telomere lengths and increased inflammation (Gouin *et al.,* 2008). Moreover, like stress, these features of immunosenescence have been associated with an increased risk of morbidity and mortality. It is possible that chronic stress may exert its negative impact on health through the induction of immunosenescence. High levels of work-related stress have been associated with rudimentary signs of immune ageing (Bosch, Fischer *et al.,* 2009). Further, the impact of stress on immune function is reported to be worse in older individuals suggesting that the elderly are susceptible to a cumulative immune deterioration brought about by age and stress. Considering that 25% of the of the UK population is predicted to be over 65 years of age by 2030, a large number of people may be subjected to ill-health by means of stress- and age-induced immune decline.

Stress and circadian rhythms

Cortisol and adrenaline are not only released in response to stress – they are released continuously and have circadian rhythms, their diurnal fluctuations altering levels of immunity dependent on the time of day.

For example, the number of effector T-cells with immediate protective capacity in the circulation peak during active hours whilst naïve cell numbers are greater nocturnally. This rhythmicity is thought to promote immediate immune protection during the day, and tissue repair and initiation of adaptive immune responses at night. Immune circadian rhythmicity has clinical implication as demonstrated by a greater risk of death from sepsis in the early hours of the day, and the recent finding that vaccinations given during morning clinics may produce better antibody responses (Long *et al.,* 2016). These observations signify the importance of the immune system's circadian rhythm. One of the negative consequences of stress is that it may alter the typical daily perturbations of cortisol and adrenaline, and therefore alter normal immune homeostasis. This will particularly effect the health of individuals working night-shifts or travelling between different time zones on a regular basis.

Managing stress

Even if we could stop it, preventing the stress adaptation response from occurring during a true physical threat to a person could be dangerous and leave them vulnerable to infection. But as stress only occurs when a person believes they cannot cope, we can teach stress management and resilience. Social support is essential for good psychological health and resilience. Caregivers with greater support demonstrate better immune outcomes, and stress management interventions with caregivers can raises vaccination responses to the levels seen in aged-matched non-caregivers (Gouin *et al.,* 2008). Further, in older adults, relaxation techniques and stress management interventions can reduce the signs of herpes virus reactivation. These results demonstrate that social intervention and stress management techniques can buffer the negative impact of stress on immune outcomes. Preventing stress may therefore be an easy and affordable way, compared to most medical interventions, to improve immune function and thereby improve the general health of the population and avert disease.

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The dangers of careless press releases

The Science Media Centre may help minimise faulty reporting

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You open the morning paper and are excited to find an article about a newly published study in your area of interest. You start reading it and quickly realise that the journalist has completely taken the press release out of context. What was originally some preliminary cell culture work has turned into a front page splash solving an age-old problem or heralding a new cure. Sound familiar?

We live in a world of 24-hour rolling news coverage. The necessity to write punchy news headlines and be the first to break stories has never been greater. Because of this, it's very easy for journalists to take press releases out of their original scientific context, and 'sex' them up in a way that sells. This is particularly the case for my own area of research, obesity.

The world is suffering from an obesity epidemic especially (but not exclusively) in the Western world. Reports suggest around two-thirds of people are dieting at any one time, and most of these diets don't work. This is why stories about miracle weight loss cures and therapies are cat nip to journalists and readers alike.

Frustrated by the misrepresentation of obesity in the press, I decided to sign up to the Science Media Centre (SMC), not knowing it would lead to my television debut.

The remit of the SMC is to provide journalists with expert quotes on scientific studies that are likely to garner media attention. In the world of obesity and diabetes, this usually involves studies showing that eating too much of X will lead to diabetes, or that cutting Y out of your diet reduces body weight.

I recently commented on a new study, which had followed approximately 20,000 children over a 10-year period, some born via caesarean and some born naturally, and found that those who were born via caesarean were more likely to be obese in later life. I was asked to comment whether or not the conclusions of the study were sound, and offer a possible explanation for the findings. In fact, this study adds to other literature supporting this relationship, and the most likely cause is exposure to different microbes when born naturally versus via caesarean, although the link hasn't fully been proven.

Image credit: Jeff Eaton (CC BY-SA 2.0)

Since the study used a large cohort, the results were more statistically significant. However, since it was an observational study there isn't a causative link.

My comments were picked up by a number of news agencies, including *The Guardian, Daily Mail* and the BBC News website. Nerve-rackingly, I even got a call from the producer of BBC Radio 4's Today Programme, who was interested in picking this piece up and wondered if I would pop into the studio the next morning. This was swiftly followed by Sky News, Jeremy Vine and BBC News.

Now all of this was a far cry from the ELISA that I was planning on carrying out that day, but was an interesting insight into the angle journalists take on scientific stories. Having received the call asking if I'd like to go on the Today programme at 11 pm the previous evening, I spent a number of hours doing a comprehensive PubMed search of all the most recent meta-analysis studies investigating caesarean births and obesity risk. Turns out all they're really interested in is why. If the Brexit debate has taught us anything, it's that the public switch-off at the sight of a percentage symbol or talk of numbers. What people want to know is why and how it affects them. So my interviews mostly revolved around why caesarean births seem to increase the risk of obesity and whether there is anything we can do to mitigate the risk. That and trying to politely convince a caller to the Jeremy Vine Show that her child's obesity was probably more the result of her confessed feeding of copious amounts of chocolate to him, rather than his method of birth.

If, like me, you find yourself at odds with journalistic reporting of science stories, I would urge you to join the database at the Science Media Centre. You're not guaranteed to get TV time, but you might get your name in the paper. Just make sure that you at least know enough about whatever it is you're commenting on to make it through a 30-minute conversation with Jeremy Vine and John Humphrys!

The Society welcomes our new Treasurer, Frank Sengpiel

Frank Sengpiel

Cardiff University, UK

Although I describe myself as a neuroscientist now, this job description did not even exist when I started studying for a Diploma in Biology at the Ruhr University in Bochum (Germany) in the mid-1980s. Instead, for 2 years I learned about zoology and botany, about statistics and organic chemistry. A module on animal physiology (in those days involving actual frogs rather than computer simulations) kindled my interest in how the body works, which was soon narrowed down to how the brain works when Klaus-Peter Hoffmann was appointed the first professor of neurobiology. In 1990, I moved to the UK for the first time, to study for a DPhil with Colin Blakemore at the University of Oxford. My focus on mechanisms of binocular integration and plasticity of the visual cortex started at this time and has stayed with me ever since. Following nearly 3 years as a Junior Research Fellow at Magdalen College I left Oxford in 1996 to become a research associate in the group of Tobias Bonhoeffer at the Max Planck Institute of Neurobiology near Munich.

In 2000 I was lured back to the UK to take up a senior lecturer position at Cardiff University. Seventeen years later I am still at Cardiff, by now Professor of Neuroscience and Head of the Neuroscience Division in the School of Biosciences.

My first encounter with The Physiological Society was as a PhD student, at meetings which, in those days, were held at university physiology departments. I remember them as quite intimidating affairs, because of the voting by members on whether the communication was to be published or not. I later became an Associate Member, benefiting from generous travel grants, and then a Full Member in 2001. I soon took over from Kevin Fox as convenor of the Development & Plasticity Special Interest Group. This was followed by a term as Theme Lead for Cellular & Integrative Neuroscience from 2009 to 2014. In 2015 I was elected as a Trustee, and I joined the Finance Committee last year.

I have a long-standing interest in financial matters, which may be rooted in family history, since my grandfather, my father, and my brother have all worked in the financial sector. However, my practical experience so far has been limited to dabbling in investment funds and reading the money pages in the newspaper that everyone else discards! I am very glad to say that I did not receive a note from Anne King saying there is no money left; on the contrary, the balance sheet is looking very healthy, with a successful property strategy and an excellent publishing deal as major contributing factors. My aspiration is of course to build on this, although 'past performance is no guarantee of future results'! The biggest threat, which I do not need a crystal ball to see, is Brexit and the uncertainty in the financial markets that it has already started to cause. But, in partnership with our COO and finance committee, I am confident that we will steer The Society through the next 4 years without suffering shipwreck.

How many Members of The Society have won the Nobel Prize?

Tilli Tansey

Honorary Archivist, The Physiological Society & Professor of the History of Modern Medical Sciences, QMUL, UK

All academic organisations do it nowadays: claim numerous luminaries, Nobel laureates and Fellows of this, that or the other, as staff, former staff or students, to enhance the perception of their lecture theatres and labs as portals to great distinctions and honours. For example, those walking along the Strand in London are assailed by photographs of the Great and Good alumni of Kings College that include many familiar names from St Thomas, Guys, Queen Elizabeth College, etc, all institutions now absorbed under the banner of KCL (**www.kcl.ac.uk/aboutkings/history/nobellaureates.aspx**). My own University, QMUL (Queen Mary University of London), lays claim to Nobel Prize winning physiologists Henry Dale and Edgar Adrian, on the grounds that although ultimately Cambridge medical graduates, both were clinical students at Barts Hospital, now a constituent part of the medical faculty of QMUL. Additionally, QMUL lays claim to John Vane, who joined Barts Medical College after getting the Nobel Prize in Physiology or Medicine in 1982. Dale, Adrian and Vane also belong to a small, select sub-group of laureates: they were Members of the Physiological Society.

How big is that group? The question is not as straightforward as it might seem. Does one count only Ordinary Members? What about Honorary Members or former Members who then win the Prize? And non-Member Nobel laureates who are then offered Honorary Membership, do they register? And how does one find all the relevant names since 1901 when the Nobel prizes were first awarded. Surely there must be a 'List' somewhere? Well if there is, I haven't found it, at The Society's headquarters, in the Archives nor in the memories of senior Members of The Society.

A recent press release asserted 'Since its foundation in 1876, [The Society] has boasted 20 Nobel Prize winners' (**www.physoc.org/news/2016/physiological-society-announces-new-chief-executive**), but in a quick back-of-the-envelope calculation I produced over 30 names without really trying. So to arrive at some definitive number, and to answer those related questions: 'How many Members of The Society have won the Nobel Prize?' and 'How many Nobel laureates have been Members of The Society?' I took myself off to the Archives, with lists of all Nobel Prize winners to date (**www.nobelprize.org/nobel_prizes/lists/all**). I have searched through more than a century's worth of Grey Books (the much valued membership lists of The Society), a sample of Committee minutes, several Secretaries' correspondence files, usually incomplete, various candidates' books, and numerous boxes and folders dating from 1901. None of these is completely reliable: the Grey Books never appeared on a regular annual basis and the archival collection of what was published is partial; Committee minutes, especially until comparatively recent times, are infuriatingly inconsistent: events and decisions are not always recorded, and the enactment of recorded decisions are not always reported; the Secretary's correspondence is astonishingly varied – some files contain extensive and animated correspondence about the price of dinner, but there is little consistent correspondence with Members who had won the Nobel Prize.

Searching through all these sources, there appear to be at least 61 Nobel laureates, in Physiology or Medicine (n=55), Chemistry (n=5) or Peace (n=1), who have been Members of the Physiological Society. They divide, as expected, into two broad categories: those who were Members of The Society before winning the Nobel Prize (n=31), and Nobel laureates who were elected to The Society, principally as Honorary Members (n=30).

Both groups contain interesting anomalies and some unexpected names.

Members of The Society who won the Nobel Prize

These are predominantly Ordinary Members of the Society, those elected at a comparatively young age, regularly attending scientific meetings, presenting Communications and Demonstrations to

Table 1. Ordinary Members of The Physiological Society who won the Nobel Prize
PoM = Physiology or Medicine; Chem = Chemistry; (a) = Affiliate

Year	Prize	Winner	Member	Hon. Mem.
1920	PoM	August Krogh (1874–1949)	1913	1938
1922	PoM	Archibald Hill (1886–1977)	1912	1960
1923	PoM	John Macleod (1876–1935)	1912	
1929	PoM	Frederick Gowland Hopkins (1861–1947)	1892	
1929	Chem	Arthur Harden (1865–1940)	1904	
1932	PoM	Charles Sherrington (1857–1952)	1885	1935
1932	PoM	Edgar Adrian (1889–1977)	1917	1960
1936	PoM	Henry Dale (1875–1968)	1900	1951
1937	PoM	Albert Szent-Gyorgyi (1893–1986)	1929	
1938	PoM	Corneille Heymans (1892–1968)	1931	1967
1944	PoM	Herbert Gasser (1888–1963)	1924	1949
1945	PoM	Howard Florey (1898–1968)	1925	1965
1949	Peace	John Boyd Orr (1880–1971)	1918	
1953	PoM	Hans Krebs (1900–1981)	1948	
1959	PoM	Peter Medawar (1915–1987)	1941	1975
1963	PoM	Alan Hodgkin (1914–1998)	1938	1979
1963	PoM	Andrew Huxley (1917–2012)	1942	1979
1963	PoM	John Eccles (1903–1997)	1929	1982
1967	PoM	Ragnar Granit (1900–1991)	1932	1968
1970	PoM	Bernard Katz (1911–2003)	1940	1979
1970	PoM	Ulf Von Euler (1905–1983)	1937	1972
1982	PoM	John Vane (1927–2004)	1953	1988
1988	PoM	James Black (1924–2010)	1962	1989
1991	PoM	Erwin Neher (b.1944)	1981 (a)	1997
1991	PoM	Bert Sakmann (b.1942)	1990 (a)	1997
2008	Chem	Roger Tsien (1952–2016)	1974 (a)	2011

‘There appear to be at least 61 Nobel laureates, in Physiology or Medicine (n=55), Chemistry (n=5), or Peace (n=1), who have been Members of The Physiological Society’

the Society, and often serving on Society committees and editorial boards. Table 1 lists all the names in this category, in order of the year of Nobel Prize – it contains some of the best-known names in modern physiology.

Whilst space precludes describing each laureate and his work (and yes, they are all men), some general themes and specific illustrations are instructive. Intriguingly, for example, the first Ordinary Member to win was a foreign physiologist, August Krogh from Denmark, and several other foreign Ordinary Members of The Society became Nobel laureates. They include the Hungarian Albert Szent-Gyorgyi; the Belgian Corneille Heymans, and the Swedes Ragnar Granit and Ulf von Euler; John Eccles and Howard Florey from Australia; Erwin Neher and Bert Sakmann from Germany; and Herbert Gasser and Roger Tsien from the USA. In total, there are 11 foreign physiologists, most of whom having joined The Society when they were students, fellows or visitors working in the UK, and many continuing to attend Society meetings whenever in the UK.

The first 'home-grown' laureate was AV Hill who shared the 1922 prize (awarded in 1923) with Otto Meyerhof (of whom more later) for his work on heat production by muscle fibres, followed by Scotsman John Macleod who controversially shared the 1923 prize with Frederick Banting (of whom, likewise, more later) for their discovery of insulin. Since then, a further 13 (including the German-born, British-naturalised Sir Hans Krebs and Sir Bernard Katz, both of whom did most of their Nobel winning work in the UK) British Members of The Society have been so honoured. From the 1920s onwards, not a decade of the twentieth century passed without one or more Ordinary Members of The Society travelling to Stockholm. Many also received high civic Honours, such as knighthoods and peerages, and served in some of the most important offices in British science, including the Presidency of the Royal Society: Hopkins, Sherrington, Dale, Adrian, Florey, Hodgkin and Huxley, each of whom also received the Order of Merit.

Although the majority of these awards were in Physiology or Medicine, there were three in other categories. In 1929, Sir Arthur Harden (member 1904) won the Chemistry Prize for his work on fermentation, and almost 80 years later in 2008, Roger Tsien (Affiliate Member 1974) won the same Prize for his work on Green Fluorescent Protein. More unusual, however, is the award of the 1949 Peace Prize to the nutritionist Sir John (later Lord) Boyd Orr for his work as Director-General of the United Nations Food and Agriculture Organization. Strictly speaking, he was no longer a Member of The Society, having resigned just a few months before being awarded the Prize, apparently because his career was moving away from science. As he had been a Member for over 30 years, and his physiological background contributed much to his Nobel-winning work, I consider he is rightly included in this category.

Tsien, like Neher and Sakmann, was an 'Affiliate', a class of Ordinary membership for foreign physiologists. Throughout the history of The Society, there have been several types of membership available, but from the very beginning, in 1876, there has been a category of Honorary membership, for distinguished service to The Society or the subject. Strangely, especially in light of modern practice, some laureates became Honorary Members many years after their awards; and more surprisingly, not all the Members listed in Table 1 were offered the accolade. Perhaps the most glaring exception is that of Sir Frederick Gowland Hopkins, elected in 1892, knighted in 1925, the recipient of the Royal and Copley medals of the Royal Society (1918 and 1926) and its President 1930–1935. Hopkins was co-Nobel winner in 1929 for his discovery of vitamins, but I can find no evidence that he was ever proposed for Honorary membership.

However, for many years there was a restriction on the number of Honorary Members, as will be discussed below, which may account for some of these lapses. And the delay in Nobel laureates being offered Honorary membership was sometimes due to the individual concerned: Sir Henry Dale (NP 1936) was first proposed for Honorary status in 1942, although some colleagues suggested that he would not appreciate the honour, seeing it as acknowledgement of his retirement from active science and involvement in The Society (Dale holds the record for serving on the Committee for 24 years, for most of which he was Chairman). Discrete enquiries confirmed this suspicion and it was only in 1951 that he eventually accepted, 15 years after his Nobel Prize. Others had even longer delays, although whether through choice cannot be determined without more research.

Honorary Members who won the Nobel Prize

A small, even more select group of Society Members who won the Nobel Prize (all for Physiology or Medicine) are five foreign physiologist whose work and contributions were recognised by election to Honorary membership, *before* their Nobel awards (Table 2). The first in this category was the bacteriologist Paul Ehrlich in 1903, and he went on to win a Nobel in 1908. Next came Otto Loewi who shared the 1936 Prize with Henry Dale for their work on elucidating chemical neurotransmission; the Argentinian Bernardo Houssay; the Swiss Walter Hess; and in 1966, the American Peyton Rous. Rous, then aged 87 and the oldest person to ever receive a Nobel Prize in Physiology of Medicine, had been an Honorary Member for 22 years. His win came 3 years after that of his son-in-law Alan Hodgkin and 40 years after his first nomination.

Nobel laureates who became Members of The Society

In recent years, Nobel prizes in Physiology or Medicine have frequently been awarded in areas far removed from 'traditional' physiology, and recognising this, The Society's Executive Committee agreed in May 2003 to award Honorary membership to those not already members, noting 'there are currently four scientists who should receive this honour'. Since then, most British laureates (but not all), and several of the more physiological foreign laureates (but not all) have routinely been offered Honorary membership. The practice of awarding such honours to foreign physiologists does, however, have a longer history and goes back over 100 years.

In 1909, the very first Nobel laureate non-Member to be elected to Honorary membership was the Russian physiologist Ivan Pavlov (NP 1905 for his work on gastric secretion), and he was followed in 1918 by Charles Richet (NP 1913), Willem Einthoven in 1924 (laureate the same year) and Ramon Y Cajal in 1931, 25 years after his Nobel award in 1906. Only 12 Honorary Members were then allowed at any one time, a maximum of six of whom could be resident in the UK. That restriction had been lifted, however, when nearly 60 years later, an occasion arose when there were Nobel laureates in what might be termed 'mainstream physiology' who were not already Members or Honorary Members of The Society. Thus in 1983, both David Hubel and Torsten Wiesel were elected 2 years after their Nobel awards. A curious situation, however, relates to one physiological laureate. Paul Greengard (b. 1925), who was co-laureate with Eric Kandel and Arvid Carlsson in 2000 for their discoveries concerning signal transduction in the nervous system. Kandel was elected an Honorary Member in 2008, and Carlsson the following year. Committee minutes clearly record Greengard being nominated in 2009 (along with laureates Carlsson, Hunt, Axel and Evans) but he was never elected. Why? What happened? Did he not get the invitation, or did he refuse? One former Society President recalled:

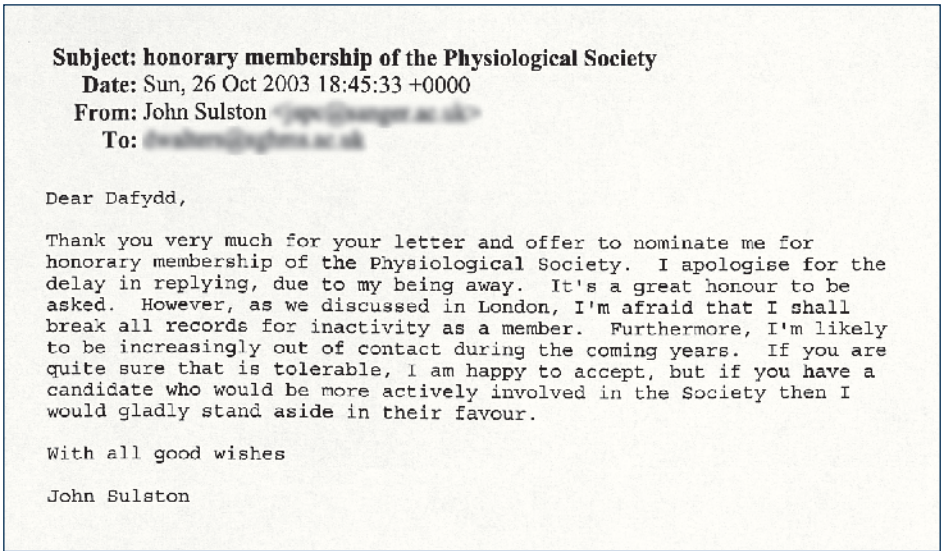
'I cannot remember any actually turning offers down – but then these people are so shell-shocked that it is harder to decline a Physiological Society Honorary Membership offer ('What's that?') than just lay back and accept all accolades' (Jonathan Ashmore, President of Council, 2012–2014, personal communication).

Even after that 2003 decision, there have been some strange inconsistencies: the expression 'four scientists' suggests the four living British Nobel laureates: Paul Nurse, John Sulston, Sydney Brenner and Tim Hunt; and indeed the first three were all elected that year. For some reason, not yet elucidated, Hunt did not join their ranks until 2009. Certainly, some recent non-physiological laureates have seemed somewhat bemused to receive such an invitation, as Sir John Sulston's reply indicates. Refreshingly he admits he will 'break all records for inactivity as a member' (Fig. 1).

Intriguingly, I have come across one early nomination of a 'non-physiological' Nobel laureate, the geneticist TH Morgan (NP 1933). In 1936, the Committee decided to offer him Honorary membership, but he appears not to have been elected, and as yet I have been unable to ascertain what happened. There may well be similar examples in the records awaiting discovery. Seeking information about more recent practice I contacted previous chairmen, one of whom recalled:

Table 2. Honorary Members who received the Nobel Prize

Year	Prize	Winner	Hon. Member
1908	PoM	Paul Ehrlich (1854–1915)	1903
1936	PoM	Otto Loewi (1873–1961)	1934
1947	PoM	Bernardo Houssay (1887–1972)	1935
1949	PoM	Walter Hess (1881–1973)	1936
1908	Chem	Peyton Rous (1879–1970)	1936



Subject: honorary membership of the Physiological Society
Date: Sun, 26 Oct 2003 18:45:33 +0000
From: John Sulston
To:

Dear Dafydd,

Thank you very much for your letter and offer to nominate me for honorary membership of the Physiological Society. I apologise for the delay in replying, due to my being away. It's a great honour to be asked. However, as we discussed in London, I'm afraid that I shall break all records for inactivity as a member. Furthermore, I'm likely to be increasingly out of contact during the coming years. If you are quite sure that is tolerable, I am happy to accept, but if you have a candidate who would be more actively involved in the Society then I would gladly stand aside in their favour.

With all good wishes

John Sulston

Figure 1. Email from Sir John Sulston to Professor Dafydd Walters. Physiological Society Archives

'I cannot remember any actually turning offers down – but then these people are so shell-shocked that it is harder to decline a Physiological Society Honorary Membership offer than just lay back and accept all accolades'

'Re discussions on the committee in the period 1988–1994 regarding Honorary membership for Nobel laureates. I am pretty sure that this was in the context of people who were close to physiology and there was little or no discussion of winners of the Physiology or Medicine prize who were from more distant specialities. I don't recall that we had any specific procedures – it was pretty ad hoc with committee Members simply suggesting names of possible candidates… I cannot recall any specific examples! I certainly cannot recall anyone who refused us – I think I would remember that.'
(Graham Dockray, Committee Chairman 1991–1994, personal communication).

Finally, in this category there is an extremely unusual group of just two Nobel laureates, both of whom became Ordinary Members of The Society *after* their Nobel Prizes. Neither became Honorary Members. Both men, Frederick Banting, the co-laureate with John Macleod of the 1922 Prize, and the youngest winner of a PoM Prize, and Otto Meyerhof, co –laureate with AV Hill in 1923, were elected in the then conventional way: proposed by a Member of The Society, their names entered in a Candidates' book which was then circulated at scientific meetings for other Members to sign in support, before being subjected to the annual ballot at an AGM.

It is not possible to determine when their names were entered, but from close examination of the Candidate's page for Banting it is clear that he had already been proposed before his Nobel Prize was announced, by Lawrence Henderson of Harvard, not by his then boss and co-laureate John Macleod (see Fig. 2). Banting's nomination page is adjacent to that of another future Nobel laureate, Herbert Gasser (NP 1944). Otto Meyerhof's situation is extremely curious (see Fig. 3). He was nominated by AV Hill in 1930, 7 years after they shared the Nobel Prize (modestly that award is not recorded as a 'qualification' on the nomination form). As yet I can find no explanation for the timing of this nomination, 7 years after the Nobel Prize. This was not the occasion when Meyerhof visited London to sign the Charter Book of the Royal Society (he was elected FRS in 1937), nor was it associated with his later flight from Nazi Germany.

The questions surrounding Meyerhof's election epitomise several of the curiosities and inconsistencies I have unearthed in trying to answer an apparently straightforward question. I have identified 61 Members of The Society who won Nobel Prizes, but in doing so have raised more questions about some of the individuals concerned, and about the role, strategies and activities of The Society. And I'm not entirely convinced that '61' is the current definitive number. It is possible that even after intense scrutiny one or two names have slipped through the net, and I would welcome further comments or suggestions.

Acknowleldgements

Many Members and staff of The Society have helped with the research for this article: Jonathan Ashmore, Jane Coppe, Graham Dockray, Casey Early, David Eisner, David Miller and Ann Silver. Unless otherwise noted, all information comes from records in The Society's achives, held in the Wellcome Library, London. I would also like to thank Adam Wilkinson for assistance. I am supported by the Wellcome Trust.

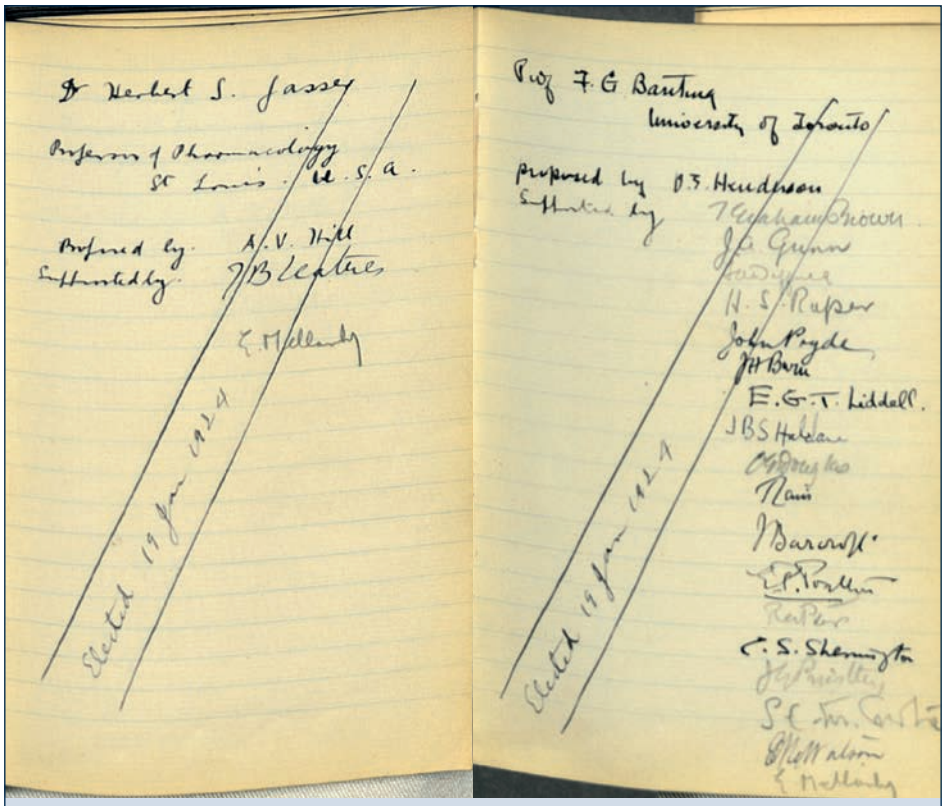


Figure 2. Candidates' Book entries, on adjacent pages, for FG Banting and HS Gasser. The Physiological Society Archives

'I'm not entirely convinced that '61' is the current definitive number'

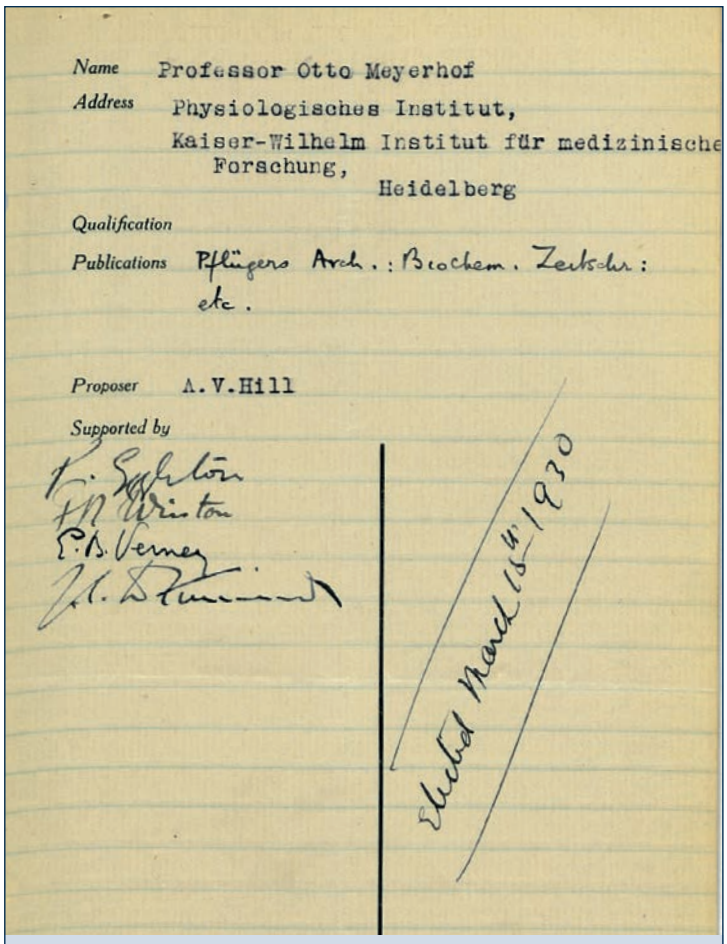
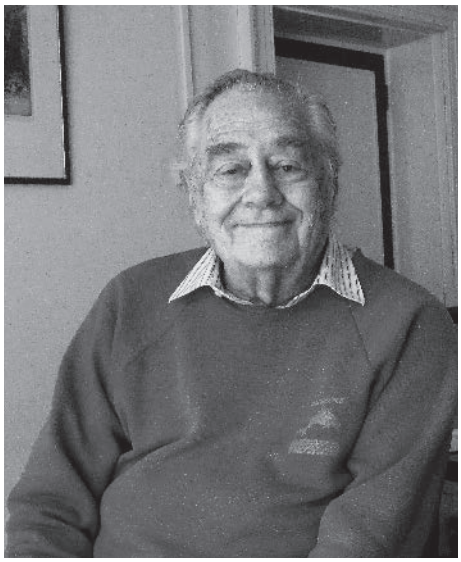


Figure 3. Candidates' book entry for Otto Meyerhof. The Physiological Society Archives

Obituaries



Olof Conrad John Lippold 1923 – 2016

In 1960, I started my PhD with Olof, studying neuronal activity in the cerebral cortex of anaesthetised rats. At that time he was sub-Dean and Tutor to the medical students and I was struck by how very kind and patient he was with them. He didn't have an office separate from the lab, and I was experimenting behind a partition wall. Sometimes the medical students had some serious things they wanted to discuss with Olof. One of the foreign students was pregnant, far from her family, and the baby was illegitimate, a difficult situation in those days. I was taken by Olof to visit her and the newborn baby, with a large parcel from Kay and himself as a gift.

It was also a revelation to me that neither Olof, nor our part-time colleague Dr Joe Redfearn, ever got cross or irritable with me when I did something stupid in the lab – a useful life skill for me to learn.

Although we were very serious about our experiments and Physiological Society activities, life at UCL was great fun in the 1960s and '70s. As well as sports at Shenley, there was time for staff/student Christmas parties, an annual childrens' fun fair in the cloisters and communal lunches before lunch-hour lectures. Olof participated fully in everything.

We wrote up papers together, with Joe while picnicking on Winterfold Hill, or on an island in the river at Walton-on-Thames, chaperoned by Olof's parents. I loved that place, and when Olof told my husband Geoffrey and me in 1970 that the hut next to his had become free, we moved with our three young children into the holiday hut next door (no running water except for the river, no electricity then and no sanitation).

Olof and I collaborated again in the late 1970s, experimenting on pyramidal tract neurones with Alex Milne, and writing a book on the cerebral cortex. Meanwhile, the children were growing up; at the island Olof supervised my tar papering of the leaking hut roof, advised our boys how to service the motor mower and build up the river bank, and of course we all rowed, canoed and swam in the Thames. Olof was a wonderful mentor and friend to us all.

Lynn Bindman
Honorary Reader, Department of Neuroscience, Pharmacology and Physiology, University College London, UK

Olof Conrad John Lippold was born on 13 February 1923 in London to a school master father and a Swedish mother. Olof trained to be a medical doctor at University College Hospital (UCH) during the Second World War, when the preclinical medical school was evacuated to Leatherhead. The clinical training at UCH remained in London, with bombs falling nearby. Olof remembered in particular a V2 landing next to Goodge St. station and being knee-deep in glass helping the wounded. He qualified in 1946, and did his army service as a regimental medical officer in the Royal Engineers, then at the Army Operational Research Group, before returning to spend most of his career working in the Physiology Department at University College London.

Olof was passionate both about his research and his teaching. He particularly liked the fact that in the '50s and '60s, if you wanted to do research then you had to be prepared to build your own equipment. He enjoyed doing that almost as much as carrying out the actual experiments. His main research interests were in the areas of muscle units, tremor and long-term changes in neural activity in the cerebral cortex following weak electrical stimulation. This latter area has recently become at hot topic, and one of Olof's papers from 1964 was remarkably cited more than 50 times just this last year! Indeed, his work on humans and animals from the 1960s has been more heavily cited these past 4 years than ever before. How many of us will have that accolade? Olof enjoyed teaching both medical and science students. He was often dissatisfied with the available textbooks and so sat down and wrote his own.

He had, very importantly, a strong influence on the recruitment of medical students at UCL where he championed not only admitting more female students but also more people with non-standard backgrounds.

Olof retired from UCL and then became Head of Department of Physiology at Royal Holloway College where he continued to research and teach. When he finally retired he built a lab in his own house and continued with his experiments. Indeed, he published his last paper in 2000 and only stopped publishing when he could no longer afford the journal page charges.

Olof was very committed to his family. He was married to his wife Kay, who he met as a nurse in UCH, for more than 60 years. He was very proud of all of their six children and foster son, as well as their many grandchildren and great grandchildren. He loved to travel for both work and pleasure. He had long-standing collaborations in the US, New Zealand and Australia. For one sabbatical in New Zealand he and Kay took several of their children and travelled overland as far as India before flying on to New Zealand. Their epic trek through countries such as Iran and Afghanistan would sadly not now be possible.

Olof was also a keen sportsman. He played cricket and tennis at UCL and in later life took up swimming very seriously. He and Kay loved competing in Masters' competitions all round the world, often both winning gold medals. Olof died peacefully on 7 December 2016, aged 93.

Richard Cogdell (Olof's son-in-law)
Hooker Professor of Botany,
University of Glasgow, UK

Michael John Rennie
1946 – 2017

Michael John Rennie, Symers Professor of Physiology at the University of Dundee, who died aged 70 on 9 January 2017, was described by his colleagues and friends as a force of nature, larger than life and a bit like Marmite: you either liked him or you didn't. His key character traits were loyalty, generosity, both intellectual and material, and how well he engaged with the non-academic staff in his department and throughout the University. The technical staff and Jannies (janitors) referred to him simply as Mike (partly because of his habit of working late and on weekends) and were readily offered any help whether for professional or personal matters.

Born in Newcastle upon Tyne, he was a proud alumnus of The Royal Grammar School where he entered as an Ochiltree Scholar. Mike charted his scientific path from the Universities of Hull (BSc, Hons), Manchester (MSc), Glasgow (PhD), Washington, St Louis (MRC Travelling Fellow), University College London (Lecturer and Wellcome Senior Lecturer) to Dundee where, at a relatively young age of 37 years, he was appointed as the Chair and 2 years later the Symers Professor of Physiology in 1985.

In 2003, he joined the University of Nottingham as Professor of Clinical Physiology, where he remained until his retirement in 2011; more recently, he taught at the Open University.

Mike's lifelong research interest was in amino acid metabolism and transport particularly in skeletal muscle. He was an early adopter of the use of stable isotopes in man in conjunction with mass spectrometry to investigate metabolism in health, exercise and disease. His research on muscle protein turnover, hormonal changes during exercise and his early work on the effects of exercise on Duchenne muscular dystrophy, sarcopenia and atrophy remain significant landmarks in the field of muscle physiology. At Nottingham, he applied these to muscle wasting conditions and the relationship of muscle wasting to ageing.

Mike was Head of the Physiology department at Dundee from 1983 to 1988 and again from 1991 to 1997, and also of the Division of Biological Sciences from 1997 to 1998. Despite obtaining a diploma in management, his management style was unconventional and often abrupt; he later recognised a lack of nuance in his repertoire of professional interactions as a missed virtue. However, the intention in the abruptness borne of frustration was always for the recipient to achieve excellence, realise potential with a relentless, almost obsessive, pursuit of attention to detail. For postgraduate students this training was invaluable but others of senior vintage did not always see this approach as necessary or productive. Mike was always one of the hardest-working staff members in the department with a record to prove it: in terms of receiving grant awards or publishing high-quality research papers, there were few in his department, or in the institutions where he worked, that could match his scientific output.

The undergraduate students approached Mike's lectures and tutorials with apprehension but enjoyed the intellectual and social engagement. One Red Nose day Mike raised money for charity after being challenged by the first year medical students to deliver his lecture wearing long johns and in boots filled with cold porridge after having half his moustache shaved on stage. Incidentally, he then changed into a suit and proceeded, nonchalantly, with only half a moustache, for a meeting with the University Principal and other Heads of department.

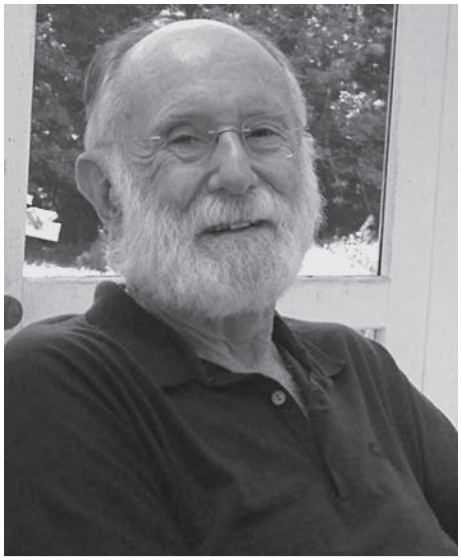
Mike's PhD and clinical MD students also appreciated his style of mentorship that was non-officious and cultivated independence. Most of his PhD students would see him for one-to-one meetings perhaps three times during their 3 years; this was partly due to extensive administrative duties as the Head of Department. This did not mean that he did not take interest in one's research or did not insist on a high quality of work both experimental and written, far from it.

Mike's favourite mode of discussing research with his students was not to have meetings but to come into the laboratory at the end of each day and holler 'what's the answer?' Many lived in the dread of this, until one audacious customer piped back Bob Dylan's words to him: 'the answer my friend is blowing in the wind'. A haughty Professor may have taken offence at such impudence, but after being left momentarily speechless (perhaps for the first time in his life), Mike cracked an embarrassed grin followed by his signature belly laugh. The refrain, however, was changed to 'what new have you found today?' but failed to carry the same foreboding in the questioned.

Mike never appeared lithe despite cycling 4 miles every day from Invergowrie to Dundee, going for a run, regularly, during lunch time (not a pretty picture upon return) and being a keen hill walker. This was perhaps because the calorie burn was compensated with time spent in local watering holes located a short walk from the Physiology Department in the Old Medical School building. An inebriated bet with a rival laboratory about running up the Arthur's Seat at the Edinburgh Physiological Society meeting was a consequence of this indulgence. The next morning the esteemed Symers Professor of Physiology was seen lumbering half way up Arthur's seat and then heaving over a boulder; arriving half an hour late for a conference session because, despite losing the bet badly, he had to complete the task. An enthusiastic participant in other departmental social and sporting activities some will recall the vibrant departmental Christmas parties, summer tennis outings or cricket matches when the sun shone in Dundee. The work hard, play harder lifestyle was not without consequences, and it is difficult to judge what role this may have played in a relatively early demise.

Mike mentored over 25 postgraduate students and numerous postdoctoral fellows (most pursued careers in research related to human physiology and remain indebted to his contribution in initiating their careers) and published over 350 peer-reviewed articles. A keen supporter of scientific societies (The Physiological Society, the American Physiological Society, European Society of Parenteral and Enteral Nutrition, amongst others), he published many of his papers in Society journals and also served on the editorial boards of numerous journals. Mike was elected a Fellow of the Royal Society of Edinburgh in 1995. He was the GL Brown prize lecturer (2004/2005) and served as the interim editor of *The Journal of Physiology* (2009–2010). Mike is survived by his wife Anne, daughters Louise and Eleanor, son Andrew and five grandchildren.

Aamir Ahmed (PhD student 1987–1990)
Centre for Stem Cell and Regenerative Medicine, King' s College London, UK



William Knox Chandler
1933 – 2017

William Knox Chandler, an eminent American physiologist, died on 20 March 2017, at the age of 83 of a haemorrhagic stroke. He was a member of the Yale University Department of Physiology from 1966 until his retirement in 2010, and a leading figure in the fields of nerve and muscle physiology.

Chandler's work was recognised by his election to the US National Academy of Sciences in 1990. The citation described him as 'the world's leading investigator of excitation-contraction coupling' (ECC), also noting that he 'opened new areas of research in the cellular physiology of nerve and muscle.' His 1973 article (with Martin F Schneider) reported the first measurement of muscle 'charge movement', a small non-linear membrane current of a skeletal muscle cell marking a voltage-dependent rearrangement of a protein known as the 'dihydropyridine receptor', which serves as the voltage-sensor of ECC. As suggested in that article, this protein rearrangement is an essential link in the chain of events that allows a muscle cell to contract in response to an action potential on its surface membrane.

Chandler was born on 13 October 1933 in Chicago. His father was a faculty member in the English Departments at Harvard University and Vanderbilt University prior to joining the US government in the early 1940s as an intelligence analyst. Following his father's death during World War II, Knox (still a child) moved with his mother and brother Colston to Brownwood, Texas. At age 16, Knox graduated from Brownwood High School, where he showed exceptional promise in quantitative subjects. He attended college at Washington and Lee and then the University of Louisville, graduating in 1953 with a major in pre-medical sciences. He received the MD degree from Louisville in 1959.

While in medical school, he realised that he was not attracted to clinical practice but rather to the experiments that he carried out in the basement laboratory of Warren Rehm, a membrane transport physiologist. After medical school, Chandler worked at the National Institutes of Health in the laboratory of KS Cole, an inventor of the voltage-clamp technique. This was followed by a year-long fellowship at Brown University, where he studied mathematical methods of science. He then moved with his family to Cambridge, England, for 3 years to work in the laboratory of Nobel laureate Sir Alan Hodgkin. During that time, he was involved in ground-breaking experiments on the electrical properties of nerve axons (with Hans Meves) and of muscle cells (with Hodgkin and Richard Adrian). The muscle experiments employed the first use of a three-micro-electrode technique that permitted measurements of currents across the surface and transverse-tubular membranes of a muscle cell. This technique was then adapted at Yale University by Chandler and Schneider to make the first measurements of muscle charge movement. In this work – indeed, in all of Chandler's work – a strong quantitative understanding was coupled with sophisticated experimental techniques to unravel an important problem in cell physiology.

In 1977, Chandler turned his attention from events on the exterior membranes of a muscle cell to those within the cell's interior, i.e. to later steps in the ECC process. Chandler, with a number of co-workers, developed and extended methods for using indicator dyes to measure accurately the rise and fall of the cytoplasmic calcium concentration in a muscle cell in response to membrane depolarisation. These signals serve to trigger muscle contraction and relaxation, respectively. In the 1990s, Chandler returned to the measurement of muscle charge movement, which by then was known to involve two kinetic components (Q-beta and Q-gamma), the puzzle being which component was most directly related to initiating the release of calcium ions from the sarcoplasmic reticulum (SR, the interior membrane compartment that is the source of the calcium that initiates muscle contraction). Chandler's laboratory showed that there is a complex kinetic relationship between SR calcium release and the charge-movement components. A key finding was that, even in the virtual absence of SR calcium release, a Q-gamma component could be clearly measured; hence this component was likely not caused by calcium release but rather was essential in triggering release.

Knox's scientific trainees at Yale all knew their good fortune in having him as their mentor. He set the example of how to do rigorous cell physiology while having much enjoyment in the process.

In 1998, Chandler joined forces with Stephen Hollingworth and Stephen Baylor in Baylor's laboratory at the University of Pennsylvania to study 'calcium sparks' (a novel ECC calcium signal first discovered in heart muscle cells and thought to reflect the coordinated release of calcium from a small number of SR release channels). These experiments and analyses revealed that, during a typical spark in a frog twitch fibre under physiological conditions, about 20,000 calcium ions are released in about 4 ms, probably from 2–4 active channels (16 °C).

Knox had many notable non-scientific interests, most related to family life with Caroline, his wife of almost 60 years, their four children (Knox Jr, Janet, Cara, and Margi), and family travels to exotic places. They entertained generously at their home in North Guilford, CT, where friends – and friends of friends – were always welcome. There, Knox and Caroline pursued projects that included home movies, an organic garden, restoration of an historic barn, the creation of a pond in their back meadow, and, in collaboration with the Guilford Land Trust, the preservation of nearby land as open space. Knox's Texas roots were often on display, including his fondness for down-home barbecue and country music. Knox also had a mischievous and unique sense of humour, which combined the cerebral with the ordinary, and included a wardrobe of T-shirts printed with ironic comments on life, politics and the state of the world.

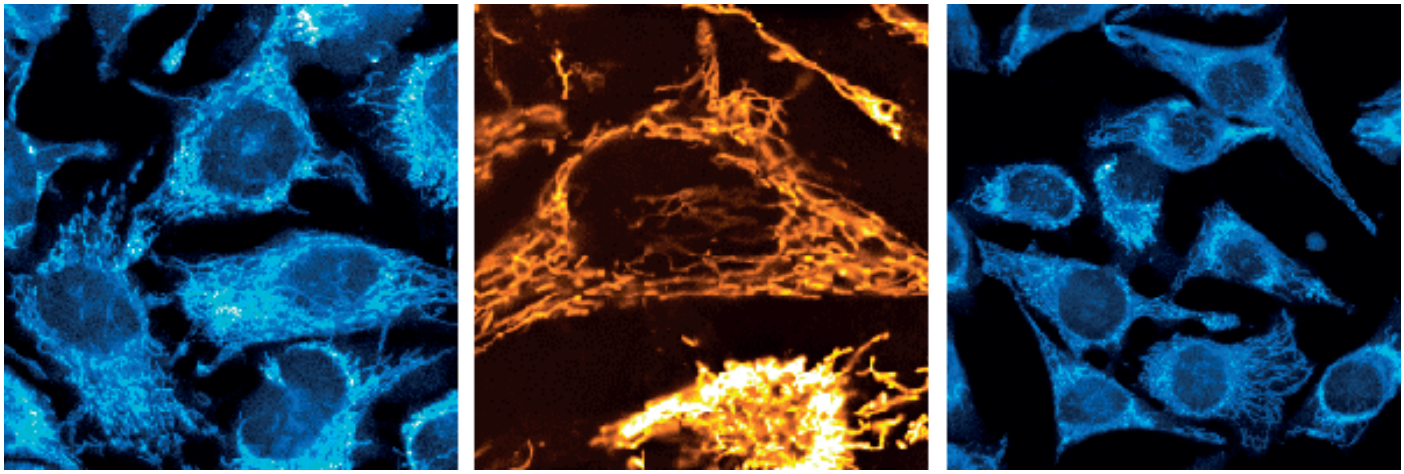
In retirement, Knox returned to his first passion and 'read physics', with a particular interest in quantum phenomena.

Stephen Baylor,
Department of Physiology,
University of Pennsylvania, USA

Mitochondria: Form and Function

14–15 September 2017

Mary Ward House, London, UK



Abstract submission closes Monday, 10 July

This Topic Meeting explores recent developments in mitochondrial biology, developments in understanding fundamental biological processes, and the way that these impact on cell health and function.

Scientific Organisers

Sean Davidson, University College London, UK
Michael Duchen, University College London, UK
Beatrice Fillipi, University of Leeds, UK
Andy Philp, University of Birmingham, UK

Confirmed speakers

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Robert Balaban, National Institutes of Health, USA
Diego De Stefani, University of Padova, Italy
Verónica Eisner, Catholic University of Chile, Chile
Beatrice Filippi, University of Leeds, UK
Ian Ganley, University of Dundee, UK
Valentina Giorgio, University of Padova, Italy
Josef Kittler, University College London, UK
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