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PN Physiology News

The ageing issue

The Physiological Society

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www.physiology2015.org

The Physiological Society

Physiology News

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

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

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Scan to view *PN* online

Cover image credits: NASA astronaut Nicole Stott, Expedition 20/21 flight engineer, equipped with a bungee harness, exercises on the Combined Operational Load Bearing External Resistance Treadmill (COLBERT) in the Harmony node of the International Space Station © NASA

Women in physiology

poster competition

Open to 11–16 year–olds

To celebrate 100 years of women's membership of The Physiological Society, we are inviting you to produce a poster on the achievements of women who have won the Nobel Prize for Physiology or Medicine.

Winners will receive a visit from a prominent female physiologist to their school, a certificate and £50 Amazon gift voucher.

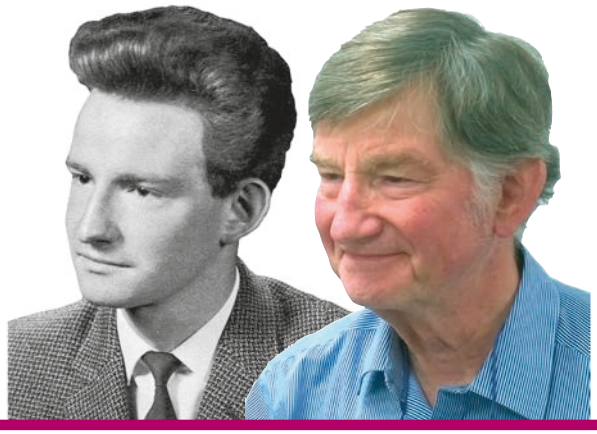
The deadline for entries is **30 April 2015**

www.understanding-life.org

2015 The Physiological Society

Celebrating 100 years of women in The Society

An ageing new editor



Roger Thomas

Editor, *Physiology News*

This issue is my first as Editor, and is coincidentally focused on ageing. The photographs above show the effects of the passage of 50 years on my own appearance. The black and white photo is from 1964, the colour one from 2015. I myself remain impressed and surprised at my appointment. Although I have been a contributor to *The Physiological Society Magazine* and its successor, *Physiology News*, since the first number, I believe it could be improved going forward. Or perhaps backwards. I told the appointment panel when they interviewed me on 4 February that my intention was, with the help of the Editorial Board and the Managing Editor (Helen Burgess) to make the magazine essential reading for all members of the Society.

I suggested that *PN* needs more about the various HHH staff members' activities, what was discussed at committee meetings etc. Meeting Notes should be expanded. Research reports should be addressed more clearly at a wide readership and should have more subheadings and fewer histograms. Teachers should be able to update their lectures with help from experts. Readers who want more should be directed more clearly to the key papers. Theme leads should be asked to suggest or provide material. I now ask all members to please contact me at **magazine@physoc.org** with any ideas for articles they might write, cartoons they might draw, and jokes they might pass on. I plan to have 'Letters to the Editor' as in the past. Perhaps departmental profiles or news of moves by members.

So how did I start on a career which has, I hope, been crowned by this Editorship? I was first attracted to a research career by a visit in about 1955 to an open day at the local University's physics department. I still remember the infectious enthusiasm of the research students operating a cloud chamber detecting subatomic particles. My own first steps on a physiological career started when I was an undergraduate at Southampton University reading Zoology. (I was rejected by Bristol, and could only go to Cambridge if I did two years' military service first. But it was soon to be abolished.) As I recall we had to take two other 'subsidiary' subjects in our first year, Chemistry and one other. I chose 'Physiology and Biochemistry' as taught by a new department with only four academic staff, headed by Ken Munday.

I found this subject to be far the most interesting of the three, particularly the witty lectures given by Gerald Kerkut. As an Honours Zoologist, I had to plead to be allowed to change subjects. I was allowed to switch as long as I performed well in the end of year exams. I was not influenced by the fact that the four female P and B students were much more attractive than the Zoologists. So I ended up in 1961 with a BSc and a determination to be a research student. Having been rejected by labs in Australia and the USA, I accepted a NATO research studentship to work under Kerkut's supervision. Three years later my thesis on acetylcholine and IPSPs in snail neurones was accepted; I married my fiancée, and obtained a post-doc position in New York, salary $7,000.

I obtained this thanks entirely to a letter Kerkut wrote to Victor Wilson, whom he had known at Cambridge. With no action on my part, not even filling in a form, I shortly received a letter from the Rockefeller Institute offering me a job in Wilson's lab with a requirement to teach a short course in neurobiology, including two lab classes. Most of the time I helped research into Renshaw Cells, and motoneurones in the cat CNS. Success in marking the position of the tip of an extracellular glass microelectrode with Fast Green led to our first paper in *Nature*.

After one year (on an immigrant visa) I had to register for the US draft. Very ironic. I was passed medically fit, but if called up I resolved to depart for Canada immediately. After two years we decided to return to the UK, and after some letter-writing I became a post-doc in EJ Harris's lab at UCL. This was in the Biophysics Department, chaired by Bernard Katz, who had been the external examiner for my PhD. After two years working on snail neurone sodium pumps essentially by myself, and not assisting EJ at all, Katz told me I really had to do what EJ wanted. I must have been a dreadful post-doc. For my last year I worked on calcium uptake by rat liver mitochondria, using pH and potassium-sensitive mini-electrodes and the calcium dye murexide. During that last year I was appointed to a lectureship in Physiology at the University of Bristol and also became a member of the Physiological Society. In 1996 I moved to Cambridge, where I am still involved in the department of PDN. I have plenty of spare time for editing.

Physiologist's family favourite recipe #1

This recipe hits two physiological targets. Carrots supply vital beta-carotene which is converted to Vitamin A, important in vision, and capsaicin in the chillies to stimulate TRPV1 receptors, which gives the dish that extra zing. The induced salivary secretion seems mainly to be mediated via parasympathetic, cholinergic reflex mechanisms. Note that painful exposures to capsaicin-containing peppers are among the most common plant-related exposures presented to poison centres.

Carrot Chilli for the Discerning Vegetarian Physiologist – by Rachel Tribe

Feeds six hungry people (plus leftovers). Preparation time 20 minutes, cooking time 30 minutes.

Ingredients

- 1 tablespoon of olive oil
- 2 medium onions (chopped)
- 2 cloves of garlic -crushed
- 2 teaspoons of grated fresh ginger
- 1 teaspoon of cumin
- 1 teaspoon of ground coriander
- 1 kg of carrots (grated using food processor - coarse setting)
- 1-2 small green chillies (seeds removed, finely diced)
- 2 x 400g tins of kidney beans in chilli sauce
- 2 x 400g tins of chopped tomatoes
- 1 tablespoon of tomato puree
- 50g bunch of fresh coriander (chopped, with one third of leaves set aside as garish when serving)
- 1 small packet (25g) of cashew nuts -crushed (optional)
- 1 lime (optional)

- Steamed basmati rice, quantity depending on appetite

Technique

1. In a large wok, heat up oil and gently fry the chopped onion until translucent and soft, add the garlic, cumin, ground coriander and ginger and cook until fragrant (~ two minutes).

2. Add green chilli and grated carrots, followed by tinned tomatoes, tomato puree and kidney beans in chilli sauce.

3. Then add ~ two thirds of the chopped coriander to the wok.

4. Simmer carrot chilli for ~ 30 minutes so the grated carrot is cooked (should still have some bite to the carrot strands).

5. Cashew nuts and lime juice (plus remains of the coriander) can be added to top of dish, 2-3 minutes before end of cooking time if serving from the wok, or provided as a garnish on the table.

6. Serve generous portions in bowls with steamed basmati rice.

2015 Honorary Members: call for proposals

We are now seeking nominations for Honorary Membership of The Society. Honorary Membership may be awarded to any eminent physiologist, and the privilege is not just limited to current Members of The Society.

If you know of any physiologists who can be considered 'persons of distinction in science who have contributed to the advancement of physiology or to the work of The Society', please send us their name and your statement of support. Your proposals will be considered by the Nominations Committee who will advise Council on formal nomination.

The new Honorary Members will be announced at the 2015 Annual General Meeting.

Honorary Members have the same rights and benefits as Members of The Society, but are not called upon to pay annual subscriptions. In addition, Honorary Members are also eligible to receive a print subscription to *The Journal of Physiology* free of charge as well as free attendance at Society meetings.

Please submit your proposals at **www.physoc.org/honorary-membership** by 30 April 2015.

SET for Britain 2015 – Students and early career researchers take their research to Parliament

On 9 March 2015, students and early career researchers ventured to the House of Commons to present their research to dozens of politicians and a panel of expert judges, as part of the poster competition 'SET for Britain'.

To encourage and support Britain's early-stage and early-career research scientists, Dr Eric Wharton established SET for Britain in 1997. Following his untimely death in 2007, the Parliamentary and Scientific Committee, with support from The Royal Academy of Engineering, The Institute of Physics, the Society of Biology, The Royal Society of Chemistry, The Physiological Society and the Society of Chemical Industry decided to continue his legacy. The competition is divided into five subject areas – Biological and Biomedical Science, Chemistry, Engineering, Mathematics and Physics.

Andrew Miller MP, Chairman of the Parliamentary and Scientific Committee, said, 'This annual competition is an important date in the parliamentary calendar because it gives MPs an opportunity to speak to a wide range of the country's best young researchers.

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

Dr Fiona Hatch, a research fellow at the University of Surrey, who is an affiliate representative on the council of The Physiological Society, as well as an affiliate member of the Education and Outreach and Policy committee of The Society, took part in this year's competition.

She says, 'SET for Britain 2015 was a great event to attend and showcase my research on Atrial Fibrillation. I met numerous parliamentarians including my own MP - Anne Milton. I was honoured to have been selected to present my physiology-based research, and also found it a worthwhile networking opportunity. I encourage future early career researchers to apply next year.'

SET for Britain aims to help politicians understand more about the UK's thriving science and engineering base and rewards some of the strongest scientific and engineering research being undertaken in the UK.

Philip Wright, CEO of The Physiological Society, says, 'The UK has an excellent biomedical research base that is underpinned by our strength in physiology. SET for Britain provides a unique opportunity for our representatives in parliament to see the fruits of the UK's research spend first hand, and the enthusiasm and drive of these up-coming scientists.'

For more information go to **http://www.setforbritain.org.uk/index.asp**

Physiology Feed

Bringing you snippets of the latest intriguing research

Cycling is good for you

A study of amateur older cyclists found that many had levels of physiological function that would place them at a much younger age compared to the general population; debunking the common assumption that ageing automatically makes you frailer.

DOI: 10.1113/jphysiol.2014.282863

Telomere lengthening

A new technique can increase the length of human telomeres quickly and efficiently, promising to reverse the ageing process in human skin cells and paving the way for treatment of highly debilitating genetic diseases.

DOI: 10.1096/fj.14-259531

Nematode ageing

A new path that could lead to drugs to slow ageing and associated chronic diseases has been identified in *C. elegans*.

DOI: 10.1038/nature14021

Memory banks

Researchers identified specific locations involved in the formation of long-term memories. New information strongly activates the hippocampus (HC) and entorhinal cortex (EC) input structures (superficial EC and dentate gyrus DG/CA2–3), while subsequent memory depends more on activation of output regions (deep EC and pyramidal CA1).

DOI: 10.1038/ncomms6547

Increasing cancer rates

A new study reveals that one in two people will develop cancer at some point in their lives. Age is the biggest risk factor for most cancers, and the increase in lifetime risk is primarily because more people are surviving into old age, when cancer is more common.

DOI: 10.1038/bjc.2014.606

Long life in whales

A gene sequencing study on the bowhead whale may be key to study longevity. The whale species is believed to live over 200 years and may hold clues to protective molecular adaptations relevant to age-related diseases.

DOI: 10.1016/j.celrep.2014.12.008

continues overleaf

Physiology Feed

Bringing you snippets of the latest intriguing research

Popeye was wrong?

Research in *C. elegans* shows that iron accumulation itself may be a significant contributor to the aging process causing dysfunction and malfolding of proteins already implicated in the aging process.

2014 Nov; *Aging* **6(11)**, 975–988.

Markers

New research has identified 107 new potential markers of senescence and validated 10 of them (DEP1, NTAL, EBP50, STX4, VAMP3, ARMX3, B2MG, LANCL1, VPS26A and PLD3). Expression of several of these markers correlated with increased survival in different tumours, especially in breast cancer.

DOI: 10.1038/cddis.2014.489

Fruit fly ageing

Immunosenescence in the *Drosophila* fat body promotes constants inflammation due to lamin-B loss. This leads to deregulation of immune deficiency (IMD) signalling in the midgut of old animals.

DOI: 10.1016/j.cell.2014.10.028

Molecule could protect against Alzheimer's

A newly discovered 'chaperone' molecule Brichos helped preventing clumping of proteins, which usually leads to the death of neurons. More research is needed to explore its full potential.

DOI: 10.1038/nsmb.2971

Men age less well – at least when it comes to brains

Researchers found that cognitive performance and hippocampal volume was reduced in older men. Amyloid accumulation increased from the age of 70.

DOI: 10.1001/jamaneurol.2014.4821

Skin tests to detect Alzheimer's and Parkinson's?

A study showed that skin biopsies may in future be used to detect elevated levels of abnormal proteins found in the two diseases. AAN Annual Meeting, April 2015

DOI: 10.1016/j.cell.2014.10.028

If you spot some interesting research that you'd like to share with your fellow Members, please send it to us at **magazine@physoc.org**

Policy Focus

Give your view

UK Knowledge Landscape – please help inform future government science policy

The Prime Minister's Council for Science and Technology (**www.gov.uk/cst**) has launched a project to better understand the UK Science Landscape (his term). The aim of this project is apparently to build a picture of the whole research landscape in the UK and to develop an evidence base to help inform future strategic decision-making.

The online 'landscape' tool seeks to find out more about how disciplines interact with each other; understand collaborations between researchers both nationally and internationally; how research is funded; and the identification of key infrastructure. The Society would strongly encourage all those active in physiological research to take part in this project. The online tool can be accessed directly via - **https://www.ukknowledgelandscape.co.uk/welcome** or via a link on the Society's policy homepage - **http://www.physoc.org/policy**

Sir Paul Nurse to review Research Councils

The Government has asked Sir Paul Nurse, outgoing President of the Royal Society, to review the Research Councils. The Society will seek to provide evidence to the review and would especially welcome members' views on the following three questions: do the research councils adequately support interdisciplinary research? Are the right arrangements in place to ensure optimal funding for research that crosses disciplinary boundaries? And what are the gaps or holes in the funded portfolios of the research councils?

For further information please contact us - **policy@physoc.org** or visit The Society's policy webpages.

News

Autumn Statement and Science and Innovation Strategy

In December 2014 the Chancellor presented his Autumn Statement to Parliament. There were three significant announcements from a science perspective. First, the details of how the new £5.9 billion Science Capital budget (2016-21) would be allocated were announced. A total of £3 billion would be available to 'support individual research projects and our institutions' world-class laboratories, and £2.9 billion for scientific Grand Challenges'. Second, the launch of postgraduate loans for under 30's, and finally, £67 million of funding to increase the number of specialist maths and physics teachers.

Later in December the Government launched its long awaited Science and Innovation Strategy 'Our plan for growth: Science and Innovation'. A more detailed review of the strategy can be read in news in depth.

CaSE Cross-Party Science and Engineering Debate, 14 January 2015

The Campaign for Science and Engineering (CaSE) arranged a 'Question Time' style debate between the science spokespeople from the three main Westminster parties, namely the Minister for Science, Greg Clarke MP, the Labour shadow minister Liam Byrne MP and Liberal Democrat MP Julian Huppert.

All three party spokespeople spoke positively about science, agreeing the need for long term, stable funding but neither Greg Clarke or Liam Byrne was willing to make any firm pledges on funding for science resource. Julian Huppert reiterated the Lib Dem pledge for inflation linked increases to both the capital and resource science budgets. The main difference between the parties was Liam Byrne again raising the possibility that Labour would introduce a graduate tax.

The Society writes to Secretary of State

The Society wrote to Eric Pickles MP, the Secretary of State for Communities and Local Government, following his decision to review a planning appeal for a dog and ferret breeding facility. We highlighted the need for planning decisions for animal research and breeding facilities to be based on planning criteria, and not be swayed by anti-animal research groups. We have now received a response stating that the decision has been deferred until after the general election.

Interested in these or any other policy related issues? Please contact us via **policy@physoc.org**

The UK Government's science and innovation strategy review

Ed Hayes
Policy Officer,
The Physiological Society

'This strategy is reassuring, but falls short on a number of specific commitments, such as a commitment to ring-fence the science budget or to set long-term goals for science investment'

On 17 December 2014, the Government launched its long awaited, and somewhat delayed, science and innovation strategy. The strategy, entitled 'Our plan for growth: science and innovation', sets out the Governments overarching plans to make the UK the best place in the world for science. This, as defined in the strategy, includes 'the natural, physical and social sciences, engineering, technology, the arts and humanities'. The inclusion of the arts and humanities within the definition of science came as a considerable surprise to the members of the House of Commons Science and Technology select committee, who recently held an evidentiary hearing on the strategy.

Reassuring but lacking specific commitments

The strategy was summed up perfectly by the Director of the Campaign for Science and Engineering, Dr Sarah Main – 'At best, I was hoping for a visionary ten year strategy with the authority and support of all of government. This strategy is reassuring, but falls short on a number of specific commitments, such as a commitment to ring-fence the science budget or to set long-term goals for science investment.'

The document pulls together a number of separate policy initiatives, many of which had been previously announced, to provide an overarching strategy to support science in the UK. However, it is worth noting that there were two potentially important announcements made within the strategy.

Research councils to be reviewed

The most significant new announcement made in the Strategy was that Sir Paul Nurse, the outgoing President of the Royal Society, would be leading on a review on the Research Councils, which is due to report in summer 2015. The Government has asked Sir Paul to consider a number of questions, which include whether the balance of funding between the Research Councils is 'optimal' and whether appropriate measures are in place for research that crosses disciplinary borders.

Review of STEM degree accreditation

Another announcement that might be of significant interest was that the government will be funding independent reviews of STEM degree accreditation arrangements to 'improve quality and graduate employability'. The review will begin with Computer Science accreditation, with no details provided on whether or when the Society of Biology degree accreditation programme would be reviewed.

Other announcements

The Government also declared that it will provide support for a dedicated platform to help STEM trained women return to industry after a career break.

Major financial commitments announced in the Chancellor's Autumn Statement early in December were reiterated in the strategy, including £5.9 billion of funding for science capital over a 5 year period from 2016 to 2021 (first announced in the 2013 spending review); the introduction of postgraduate loans of up to £10,000 (for under 30s); and £67 million of funding to increase the number of specialist maths and physics teachers.

However, no decision on the annual £4.6 billion science resource budget was announced, which will be reviewed in the post-election spending review in 2015.

Healthy ageing

Mark Downs

Chief Executive, Society of Biology

Our *Biology: Changing the World* project has recently installed 10 new blue plaques around the UK to celebrate the eminent but sometimes unsung heroes of biology; Richard Owen, founder of the NHM is remembered at his old school in Lancaster, Dolly the Sheep and the team who created her are commemorated at their lab in Edinburgh, and Steptoe, Edwards and Purdy, IVF pioneers are honoured at their old clinic in Oldham. The project also includes a free app, website and teaching resources, to celebrate great biologists of the past in order to inspire the next generation: biologyheritage.societyofbiology.org

The longest known human lifespan was that of Jeanne Calment who lived to well over 122 in the city of Arles, France. She survived not only time but the World Wars and pandemics that swept through Europe in her lifetime. The contenders for her title are internationally spread but predominantly female. Many suggestions are made about what longevity could be attributed to, but as yet there is nothing definitive or easily applied.

The pursuit of long life has recently made significant headway with worldwide average life-expectancy showing a marked increase from 1960 to the present. The developed world has had higher life expectancies throughout that period, but the gap is narrowing. Reductions in childhood mortality, accidental deaths and early mortality are a welcome contribution to this, giving more people the opportunity to live well into adulthood. But the increased proportion of the population that are ageing brings new challenges. Extended lifespan is not attractive without extended 'health span', and as we increasingly see, the combination of physical and cognitive health is essential.

So how do we achieve this without relying on pharmaceutical cocktails with all the harm-benefit dilemmas that these raise? In times of limited resources should the public purse focus on long-term understanding of the biology of ageing and the hope of insight that this might bring, or serve the care needs of an already ageing and infirm population?

Recently there has been a lot of excitement about dietary restriction and its effect on lifespan. In a recent interview in *The Biologist*, Dame Linda Partridge, director of UCL's Institute of Healthy Ageing explained some of her research:

'Dietary restriction to extend lifetime is one of the oldest models, dating back to the 1930s. It is no small effect, either. In mice you can extend lifespan by about 50%. … 'There are people who do dietary restriction – strangely it's almost all men – and were they to suffer from a car accident or trauma, they would probably be less able to cope with that. And, when they do get something like the flu, they have to eat up to shift it, so it is not without its downsides. …

'The idea is that we develop a pill that has this effect without any of the downsides and without people actually having to restrict their diet in that way, which realistically is off limits to most people. … 'We are well aware of the demographics and economics of ageing but we are not trying to make people live longer. We want people to be healthier for longer, ideally healthy right up until they die in their sleep. Lifespan has been increasing for 2.5 years per decade since the 1900s and that is set to continue. Ageing is a risk factor in many of the long-term chronic illnesses that we are seeing more of, such as Alzheimer's and heart disease.'

A recent study by the Royal Academy of Engineering summarised the size of this challenge. Currently, 16% of the population is over the age of 65, with just 19% under the age of 16. By 2034, it is projected that 23% of the population will be over the age of 65 with 18% under the age of 16. The fastest growing age group is those over the age of 85. Currently there are 1.4 million in this bracket, but this is forecast to increase to 3.5 million by 2034.

An ageing population will lead to an increase in illnesses such as dementia and diabetes. In the UK today, 700,000 people are affected by dementia. This number is expected to double within a generation. Dementia currently costs the UK economy £20 billion per annum and a 2008 King's Fund study projected a rise to £50 billion by 2038. There are 2.6 million people in the UK with Type 2 diabetes and this is expected to increase to 4 million by 2025. The costs of diabetes are high because of associated complications such as heart disease, stroke, kidney disease, visual impairment, nerve damage and amputations. Other major illnesses that affect older people include cancer, Parkinson's disease and strokes.

The ageing population is going to raise many challenges over the next few decades and the UK life sciences sector will have a critical role to play in tackling many of these issues.

The Society's ageing outreach activities

Anisha Tailor
Outreach Officer,
The Physiological Society

'Researchers are now looking into how they can slow the process of ageing, putting diseases at bay and keeping the population healthier for longer'

Members of the Physiological Society can join the Society of Biology at a discounted rate: www.societyofbiology.org

Life expectancy has seen a steady increase with no signs of levelling off, and according to a report by the World Health Organisation, 'we will soon have more older people than children and more people at extreme old age than ever before'. Ageing is a fact of life. It is a process which we are all continually experiencing; however as life expectancy has increased so has the occurrence of age associated diseases such as cardiovascular disease, cancer, Alzheimer's, Parkinson's, Type II diabetes and osteoporosis to name a few. Researchers are now looking into how they can slow the process of ageing, putting diseases at bay and keeping the population healthier for longer. The Society's 2015 public engagement and school activities will explore some of this research as part of our themed year of 'Understanding Ageing'. Our talks and activities will not only discuss how we can keep ageing at bay, but will also take a closer look at the physiology of why we age, and what changes our bodies experience from the first moments of life to the last.

Our festival programme begins in March, at **Brighton Science Festival**. The Society will be joining the activities of Big Science Weekend, a jam-packed weekend of fascinating science talks, debates, and hands on activities in Brighton's Sallis Benney Theatre. The Society's talk, 'Eat Less, Live Longer' will take a closer look at the diet which has been sweeping the nation, the 5:2 diet. With media claims stating that diets involving intermittent fasting and calorie restrictions could be the route to a longer healthier life, The Society's event will present research from Matt Piper, expert in calorie restriction at UCL Institute of Healthy Ageing and Anthony Howell, one of one of the authors of 'The 2 day diet' and Professor of Medical Oncology at The University of Manchester. The event will be kept lively by Chair Richard Faragher, expert in the biology of ageing at The University of Brighton.

In mid-march, The Society will be at **The Big Bang Fair** with our hands-on stand The Age Experiments. Our stand will set up shop in the National Exhibition Centre for four days discussing how our muscle strength, reactions and memory change as we get older. Participants will be invited to test their grip strength, and reaction speeds helping us to plot a giant graph of their results.

In April, The Society will be up in Scotland for **Edinburgh International Science Festival**. We have co-organised a panel discussion with The British Pharmacological Society discussing the reality of banishing the ills of old age through pharmaceutical therapies. Our Chair, Glenda Watt, Trustee at Age Scotland, will be joined by Tom Kirkwood Associate Dean of Ageing at The University of Newcastle, Richard Barrett Jolley, Senior Lecturer at the Institute of Ageing and Chronic diseases at the University of Liverpool and Lynne Cox Associate Professor at the University of Oxford as they discuss the reality of a pill to 'cure' ageing.

Later in the festival The Society have also supported an evening event presented by The University of Edinburgh, The Living Brain. Hear how Edinburgh scientists are leading the way in understanding the ageing brain. Test your own brain, quiz the experts and hear from some of the research participants themselves. There will be an exclusive showing of the short film The Living Brain by Anne Milne, which tells the inspiring story of William and Jean and their involvement unique studies of the ageing brain.

The Society would like to thank The University of Edinburgh and Stirling University in supporting the development of our outreach and public engagement activities as part of our year of Understanding Ageing.

Physiological Reports: Beyond the cascade

Sue Wray & Tom Kleyman

Editors of *Physiological Reports*

Fiona Seymour

Managing Editor at Wiley

'We can all take pride in the success of *Physiological Reports*, as its concept is very much based on prioritizing the needs of our international research community '

It may come as a surprise to you that *Physiological Reports* has been publishing physiology articles across a broad range of areas for more than two years. Since the journal's beginnings back in March 2013 with one transfer and 10 direct submissions in its first month, total submissions have now risen to more than 800, with 200 of those received as direct submissions. We may still be the new kid on the block but we are now jettisoning the trainer wheels.

To what do we owe this success? Without doubt there seems to be a real appetite for an open access physiology journal and, when combined with a quality peer review and support from two esteemed Physiological Societies – ours and the American Physiological Society – the formula appears to be a winning one (Wray, 2013). The good news is that we can all take pride in the success of *Physiological Reports*, as its concept is very much based on prioritizing the needs of our international research community, and ensuring that profits are returned to our society, as the world of academic publishing diversifies.

But before we get too ahead of ourselves: we cannot understate the tremendous support we have had from the editors of the societies' sister journals, to help cascade selected manuscripts. There has been a consistent determination since the launch, and still is, to transfer appropriate manuscripts to *Physiological Reports*. We can get articles published which otherwise would not have been able to 'squeeze' into those journals. With so much useful and insightful data available, it was a shame the other journals previously had to return many of these papers to authors without any message other than rejection. We hope that the sister journals will continue to see *Physiological Reports* as a service to their authors, offering a rapid decision without the need for a further round of reviews, followed by a streamlined publishing process. As you may know, our criterion for acceptance does not include a judgement on the papers' anticipated impact. We are not simply chasing an impact factor. In addition we welcome absolutely every corner of physiological research; we have no subject bias.

We have worked hard to develop our niche beyond being a great place to publish conventional papers. We have for example championed the need to publish negative findings and replication studies, as described in an editorial outlining our initiative, 'At the risk of repeating ourselves' by Associate Editor Meena Rao (Rao, 2014). More recently we have helped lead the debate on open data and physiological research. We held a well-attended session on this subject at Physiology 2014, where views from scientists, publishers and managers were shared. *Physiological Reports* wants to be the home for open data in our field, and in October we published an original paper 'Discharge patterning in rat olfactory bulb mitral cells *in vivo*' by Associate Editor Gareth Leng (Leng, 2014). This coincided with us accepting and having commentary on Excel data spread sheets accompanying the published article to further this goal. We are also open to suggestions from The Society's members – what else could we be doing to support physiological research and publishing?

Another example of our success is the Virtual Issues we have put together from our published content in *Physiological Reports* over the last year. These compilations have highlighted selected papers on 'Gender and Age', 'New directions in muscle research', 'Obesity', 'Neuroscience' and 'New directions in biophysics'. They showcase new techniques, approaches and insights that are changing the landscape of physiological research and reflect scientific advances across the spectrum of physiology.

General feedback to date suggests that our readers enjoy the variety and timeliness of articles being published. To understand what appeals to our readers, Altmetrics was rolled out a few months ago as a service to authors and readers. Altmetrics tracks the broader impact that scholarly articles can have across

social media, mainstream media and public policy documents. It monitors the wider reach of research through these online sources for mentions of scholarly articles, and scores the article, indicating the quality and quantity of attention that it has received. The score is derived from three main factors – volume, sources and authors.

Cardiovascular research and exercise lead the way in terms of papers received but there is steady growth in neuroscience, respiratory, endocrine and renal papers. Further, the journal is experiencing an increase in article distribution by country. We are pleased to see our reach beyond the USA and Europe growing, and part of our strategy for the journal is to further encourage this growth. Our editorial board has a global profile, reflecting the international support and confidence in *Physiological Reports* from the outset. As we hoped for an open access journal, downloads of our papers come from across the globe and from all sorts of institutions. We are proud to see that the wealth of physiological information we have published is of interest on a global basis. The ability to provide open data surely provides additional inspiration and opportunities for any researcher wishing to solve today's questions.

Given the journal's impressive progress over the last year, eyes are undoubtedly on our next moves as we look to venture into new territory for open access and physiological research. The editorial team is looking to see if the Virtual Issues concept can be further developed to enable guest editor choices or indeed reader custodianship of topics. Open access to additional data will continue to be expanded. We will be increasing our podcasts and examining other ways of adding value to the papers we publish. Excitingly, we are now having our first Call for Papers in the field of Translational Physiology. Please use this opportunity to submit your original research to *Physiological Reports*, and be part of the success of this initiative. Details of the call can be found on our webpage.

Give us your ideas and your papers and help shape the future of *Physiological Reports*.

Finally thanks to all the physiologists, acting as editors, reviewers and authors of our papers, who have fuelled our success and keep us so enthused about *Physiological Reports*.

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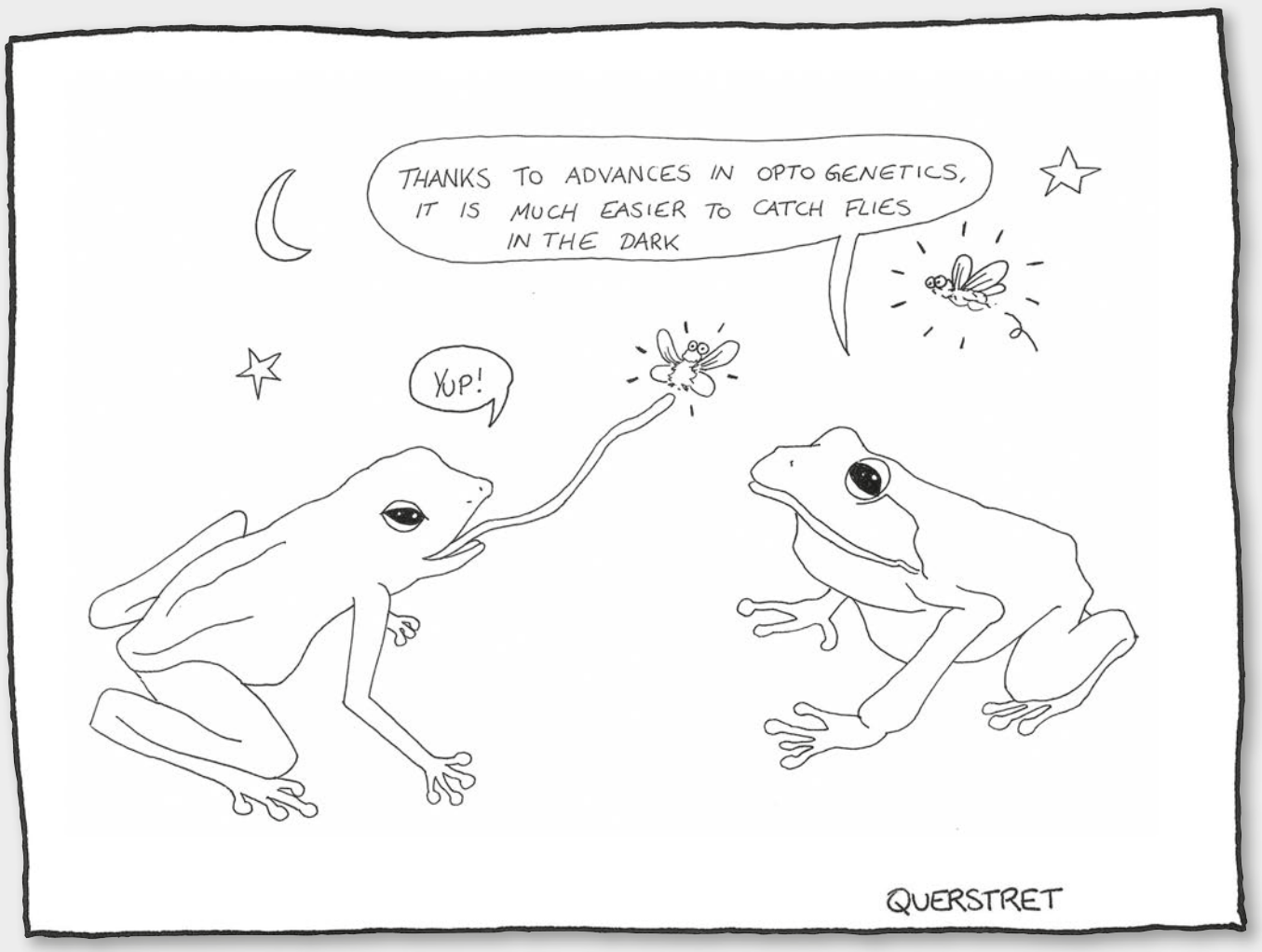

Drawn after a discussion with RCT by Elizabeth Querstret. For more examples of her work see **http://querstret.co.uk/**

2015 *Forthcoming events*

10–12 Apr

Ageing and Degeneration: A Physiological Perspective
Royal College of Physicians, Edinburgh, UK

www.physoc.org/ageingtopic

6–8 July

Physiology 2015
Motorpoint Arena, Cardiff, UK

www.physiology2015.org

3 September

Translational Electrophysiology in Neuroscience
Hodgkin Huxley House (H³), London, UK

2016

29–31 July

Physiology 2016
Dublin Convention Centre, Dublin, Republic of Ireland

Meeting Notes

The Biophysical Society's 59th annual meeting

7–11 February 2015,
Baltimore Convention Center
Baltimore, USA

Sally Howells

Managing Editor,
The Journal of Physiology

We had been warned to wrap up warm for our trip to the east coast of the USA in February, and we did just that, and were very lucky to have avoided the record-breaking snowfall that had caused havoc around the Boston area. We were quite pleased that the temperature was a positively balmy 2 degrees!

As with all our meetings we book our stand to ensure we have a prime location to attract passing would-be authors. This year was no exception, with the stand being situated by a busy thoroughfare and interesting posters.

Our main aim when attending conferences is to attract authors and top-quality submissions. In fact, one delegate even asked me why we were exhibiting. When I told him, he said 'But you're *The Journal of Physiology*, you don't need to advertise!' Nice words indeed, but with the growing number of journals available from which authors can pick, we cannot rest on our laurels and hope that *The Journal*'s past prestige will mean that we remain as well-known as we have been to date. It is highly important that we target the next generation of physiologist to ensure continued success.

A steady stream of scientists came to chat to us about the benefits of submitting to *The Journal*, and how their research might fit within our scope. As with past years we were able to highlight our best biophysics content by way of a virtual issue. Also of great interest was the 15 January issue which was dedicated to commemorating 100 years since the first female members were accepted into The Society. This issue also featured a Topical Review article by Consulting Editor Carol Robinson, which also provided us with a very appropriate cover image for display at this biophysics meeting.

Delegates were also interested to see some of our historical content on show. Information sheets on Nobel Prize winners and links to our Historical Interviews complemented our display of three top papers from our past – notably the Fatt and Katz paper from 1952 – it seemed that every delegate had read that paper!

The Journal's exhibition stand

Several of our loyal reviewers and authors stopped by the stand to say hello, as did some of The Journal's Reviewing and Senior Editors. It was nice to catch up over dinner and discuss future plans for development in this very important research area for *The Journal*.

All in all, Biophysics 2014 was a great success and we are certainly becoming a familiar face at this well-attended meeting. It's nice to hear that we are continuing to fulfil our reputation as the natural home of biophysics.

Next year we are looking forward to taking slightly fewer layers with us to Los Angeles for the 60th Annual meeting.

Meeting Notes

H³ Symposium – Public Engagement as a pathway to impact

19 September 2014,
Hodgkin Huxley House, London, UK

Charlotte Haigh

University of Leeds, UK

Charlotte Haigh welcomed everyone to the event. There were over 40 attendees and at least 50 people watching via live streaming of the event through The Physiological Society website. The first speaker was Sophie Duncan, deputy director of the National Co-ordinating Centre for Public Engagement (NCCPE), UK, who gave a presentation about how the concept of pathways to impact is your friend! She discussed the public attitudes to science survey, reflecting how we might use this information in our engagement activities and discussed the purposes and motivations for engagement. She also discussed what quality engagement looks like and showed some examples of established projects that have won awards from the NCCPE. She described the way all pathway to impact plans have a purpose, engaging the right people and having an appropriate process including an evaluation plan.

Lewis Hou (University of Edinburgh, UK) was the next speaker. He gave an insight into his science ceilidh event by playing the fiddle to the song 'She'll be coming round the mountain when she comes' but changing to lyrics so the chorus began 'I'll be using my frontal cortex for this song'! He even managed to get the audience to sing along. This demonstrated how he breaks down the barrier between science and music. He also told us about a project supported by funding from The Physiological Society entitled 'Deadinburgh' where he worked with LAS theatre and other scientists to create a debate about the fate of Zombies. Davis Lewis (University of Leeds, UK) lead us through why, and how, he embeds public engagement in to the curriculum at Leeds and what the skills were that the students came out with which could directly lead to employment. He also discussed another project where students act as volunteers but run stalls at fetes to reach typically hard-to-reach audiences.

After lunch, Chloe Sheppard from the Wellcome Trust explained why public engagement is a core function of their work. She depicted engagement as : must do, smart to do and, wise to do. She talked through the different grant funding available at the Wellcome Trust for engagement work, through engaging science grants, or existing research grants. Chloe explained how each proposal had to have a programme of action that the engagement should take place throughout the grant period not just at the end, and that training should be involved and should always include some evaluation. We then moved to short presentations section from those that had submitted short abstracts. We heard from Helal Ahmed (Imperial College London, UK) talking about metaphors, similes and analogies and the importance of relating your research to the audience.

We next heard David Colquhoun (University College London, UK) talking about the thin line between public engagement and public relations. Bryony Frost (Queen Mary, University of London, UK) shared with us developments from her institution and how they work collaboratively between different engagement groups to support overall impact. Finally Harry Witchel (Brighton and Sussex Medical School, UK) showed us some fascinating data about how we can measure engagement of individuals whilst they are watching a computer screen. The next keynote speaker was Katherine Mathieson from the British Science Association who talked us through how we could easily get involved with working with the public through opportunities at the British Science Association. She explained the local branches, British Science Week (previously known as National Science Week), the British Science Festival, working with the sections, the CREST awards, the Science communication conference and the media fellowships scheme.

After the coffee break, we heard from Lizzy Baddeley (University College London, UK) and how the public engagement unit at UCL encourages researchers in providing support, training and funding for them to get involved in engagement with the public. She highlighted in more detail a project which now runs nationally known as 'Bright Club' which supports researchers to get involved in a comedy night discussion of their research in a slightly humorous way for 8 minutes to a public audience. Finally we heard from Anisha Tailor, Outreach Officer from The Physiological Society who highlighted opportunities for funding for outreach and public engagement events from The Society, and Charlotte Haigh who highlighted her project based around 'Physiology Friday' in 2014. The symposium finished with a rapid fire round giving the audience a chance to share their projects in 2 minutes. The event allowed time for networking between sessions and many people shared their thoughts and ideas about engagement hopefully promoting successful collaborations in the future.

Meeting Notes

H³ Symposium – Microvascular physiology: implications for understanding intravenous fluid therapy

28 November 2014,
Hodgkin Huxley House, London, UK

Geraldine Clough

University of Southampton, UK

By 9.00, people were queuing at the door to gain entry to this oversubscribed one day symposium that aimed at going 'back to basics' on the physiological principles underlying intravenous fluid therapy. The meeting was organised by Geraldine Clough (University of Southampton, UK) and Tom Woodcock (University Hospitals Southampton, UK) with indispensable support from Sarah Bundock the Physiological Society's Events & Marketing Manager. It was jointly funded by the Physiological Society and the Association of Anaesthetists of Great Britain and Ireland. The aim was to bring together basic and clinical researchers, practitioners and educators to address some of the thorny issues around the use of crystalloids and colloids for fluid resuscitation and the mechanisms by which they may have their advantageous and sometimes disadvantageous effects. This aim was achieved, with a full house of 57 delegates attending the meeting on the day, more than half of whom were clinicians. Many more dropped in on our live stream of the event (https://www.youtube.com/user/PhysocTV) which also generated some discussion on The Society's social media channels.

Geraldine Clough opened the meeting by reminding the audience that during the Great War of 1914-18, the eminent physiologists William Bayliss and Ernest Starling (along with Charles Sherrington and Henry Dale) served on the first Special Investigation Committee of the Medical Research Committee to find a treatment for wound shock. Based on earlier work by Bayliss on the use of gum acacia to sustain circulating fluid volume and restore blood pressure communicated to the Physiological Society in March 1916 (Bayliss, 1916) and on Starling's seminal work on the heart and on fluid exchange across the capillary wall, they introduced the use of intravenous colloid therapy. In his talk on the 'Revised

Starling Hypothesis', Charles Michel (Imperial College London, UK) went on to review the physiological forces and nature of the barrier that determine fluid and solute exchange. He described evidence showing that microvascular absorption is transient in most tissues and that slight filtration prevails in the steady state, even in venules; attributable in part to the presence of the endothelial cell glycocalyx (Levick & Michel, 2010).

Professor Michel then presented new modelling studies exploring the effects of progressively reducing plasma colloid osmotic pressure on fluid filtration and their implications for efficacy of intravenous fluid therapy. The basic science theme was continued by Kenton Arkill (University of Bristol, UK) who showed us how to assess the permeability parameters of the blood vessel wall using 3D electron microscopy of LaDy GAGa stained glycocalyx. While high resolution transmission electron microscopy revealed individual fibres and their organisation, the highlight was the dancing bacteriophage. The morning session was concluded by Tom Woodcock whose 2012 paper (Woodcock & Woodcock, 2012) was the original impetus for the symposium. Tom challenged the tenet that the patient will benefit from therapy to restore or expand the plasma volume while minimising the interstitial fluid space; and that this could be achieved by infusion of colloid solutions. Through a series of clinical vignettes and reminiscences he reminded us that the rationale for fluid prescribing requires a physiological paradigm that explains what is seen in experiment and practice. As the previous speakers had done, he concluded by arguing for the potential of the glycocalyx to provide such a paradigm. Advised that we needed to keep 'roughly' to time because of our live streamed audience, discussions went on unrecorded over lunch and poster viewing.

We regrouped after an excellent lunch with lovely chocolate desserts (and fresh fruit) for a series of presentations from clinical researchers. The use of colloids has been justified by the belief that an infused colloid solution should preferentially resuscitate the intravascular fraction of the extracellular fluid volume through an enhanced oncotic gradient across the capillary wall. Weighed in the balance by Matthias Jacob (University of Munich, Germany) were the pharmacokinetics of colloids and crystalloids at the capillary wall. He argued for the importance of the avoidance of volume overloading beyond the needs of the patient and presented evidence for the 'volume effects' of colloids vs crystalloids and the markedly higher intravascular persistence of iso-oncotic colloids (80-100%) versus crystalloids (around 20%); at least while the glycocalyx was intact.

In recent years the beneficial effects of colloids have been challenged. Christiane Hartog (University of Jena, Germany) provided a comprehensive overview of these concerns. She presented data from clinical trials of the use of semisynthetic colloids during surgery and in the treatment of hypovolaemia after trauma, burns and in sepsis. A lively debate followed around the evidence of the clinical benefit of semisynthetic colloids compared with fluids containing albumin and crystalloids. After replenishment of our own circulating volumes, Monty Mythen (University College London, UK) continued the clinical theme, presenting evidence for the importance of fluid management. He then pointed out that the evidence base supporting practice in this area is lacking answers to a number of important questions. He advised the pragmatic 'What?', 'Why?', 'How?', 'How much?' and 'If at all?' when it came to the prescribing of intravenous fluids.

Towards the close of the afternoon, Gordon Drummond (University of Edinburgh, UK) reminded us that coverage of fluid therapy in medical textbooks and in physiology teaching is patchy and lacks rigour. He argued that while knowledge moves on, the innate conservatism of many authors of textbooks results in simplified 'explanations' of the topic that fail to take account of the challenges to current understanding engendered by recent research progress. The poster prize was presented by Mike Grocott (University of Southampton, UK) to David Read, Royal Derby Hospital and University of Nottingham, UK for his poster on 'Change in blood pressure and cardiac output show poor correlation with Contrast Enhanced Ultrasound assessed visceral blood flow'.

Over yet further volume expansion, the consensus of the assembled researchers, clinicians, teachers and opinion holders was that the joint meeting was a great success and that we had managed to address some of the omissions in vital knowledge in the field and produce an improved paradigm for improved prescribing of intravenous fluid therapy. How to get it into the textbooks before the next century was another matter!

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Funding available for focussed symposia @H³

Funding of up to £5000 is available for Members, including Affiliates, who wish to hold small, novel, one day focused meetings at Hodgkin Huxley House. The venue, audio visual equipment, event administrative support and technical on the day support is provided free of charge.

To make an application please submit the following information (in MS WORD format) to events@physoc.org

- Name and of organiser(s)
- Institution
- Contact email and telephone number
- Title of proposed focused symposium
- Summary of symposium (including scientific justification, main aims) - *500 words max*
- Preliminary programme and speaker line-up (including name, institution, gender and suggested title) - *10 speakers max*

Physiology 2015: What I am most looking forward to

Ahead of The Society's annual conference in Cardiff, Physiology 2015, Sarah Bundock asks The Society's members for their personal highlights.

Education and teaching sessions

Physiology 2015 is a great way for our students to find out about physiology and this year I am looking forward to teaching sessions as part of my new role in the undergraduate teaching course.

Mary J Morrell
Chair, Policy Committee, The Physiological Society

Community

Starting with my first trip to present a communication in Cambridge in 1988, my formative years in science were regularly punctuated by trips to some of the six (or occasionally more) Society meetings held each year (I think I managed to present at every meeting in 1995, good for my brain but perhaps not my liver). I cherish very fond memories of these times and the bond these regular gatherings represented for the UK and Ireland physiology communities. There was of course the cut and thrust of quality scientific debate, but also some memorable social interludes. The world is clearly a different place these days, and The Society has evolved in many ways, but I still relish the opportunity the annual meeting provides to catch up with those careers have developed in a multitude of ways, and in so doing scattering them to the four corners of the globe.

As always these is much to see in the programme this year, and some tantalising "to be confirmed slots". Personally, and perhaps selfishly so, I am most looking forward to the symposium I am chairing. It is dedicated to discussing the physiological credibility of human neural cells produced by reprogramming donor skin or blood, certainly a topic that most of us 30 years ago could not have imagined appearing on a 2015 Society meeting programme.

Andrew Randall
Professor of Applied Neurophysiology, University of Exeter Medical School, UK
Theme Lead – Neuroscience

Publishing for beginners

For the third year in a row, we will be hosting the popular 'Publishing for beginners' general interest session. Although this session is aimed at students and junior researchers to help them better understand the mysterious world of journal publishing and publication ethics, it is also an excellent refresher for more experienced researchers.

Topics will cover how to write your articles so that they will get noticed and positively reviewed by the journal of your choice, the nuts and bolts of the peer review process and will explore some infamous cases of ethical misconduct; addressing how they were discovered, handled and resolved.

Many of the publication ethics misconduct cases encountered at The Journal of Physiology are due to poor author education and ignorance, rather than deliberate deception or fraud. The session will help researchers to ensure that they adhere to the basic principles of best practice and to avoid their paper being flagged as suspicious. We want to make sure your papers get noticed for the right reasons!

There will be ample time for a panel discussion at the end of the talk, so please do come armed to the session with any questions you have about journal publishing or publication ethics.

Sally Howells
Managing Editor, *The Journal of Physiology*

Oral communications

This is my indulgence: The Physiological Society annual meeting, Physiology. Every year, I look forward to recharging my batteries... physiologically and networking speaking!

I will explain: I spend the year, giving (teaching, supervising student projects). However come the annual conference, I feel I am learning something at every session, this, in a mutually supportive environment. This is true of poster presentations through to prize lectures. In particular, one of my roles as Theme Lead is to appraise oral communications for prizes. It is especially a pleasure to see junior physiologists doing their best to communicate often complex and always novel findings to a well-informed audience. In fact, the standards are such that it is extremely difficult to pick out single winners. There has not been a year when this has not been the case. I am sure that 'Physiology 2015 in Cardiff' will deliver, even exceed my expectations!

In addition, the prospect of putting faces to the names that I refer to in my own work and teaching, gives learning, that personal feel that somehow allows me to retain the information even better than I would otherwise. Not to forget, the location of the meeting itself is something that I look forward to... it feels like a staycation: ... What more could one wish? It truly is a case of 'I cannot wait'!

Gladys Onambele-Pearson
Manchester Metropolitan University, UK
Theme Lead – Human & Exercise Physiology

Education and teaching sessions

I'm very much looking forward to attending the Physiology 2015 Education and Teaching Symposium, which will focus on the important topic of undergraduate physiology practical teaching.

It will include discussions of the relative merits (or otherwise) of traditional hands-on and 'wet' lab-based teaching compared with simulations and 'virtual' practicals that can be accessed online.

Practical teaching is an integral, but also resource-intensive, aspect of physiology and other medical science undergraduate degrees so I'm anticipating some interesting presentations on innovative educational approaches and I'm sure that these will also generate some stimulating debate.

Judy Harris
University of Bristol, UK

Prize lectures

The Annual Meeting is a great opportunity to meet many members (and prospective members!) and, most importantly hear some great speakers. I always think the Annual Review Prize Lecture and the Public Lecture are of exceptionally high class and, if you look back at who has given them over the years, you can see a long-list of stellar speakers. This year's will, I am sure, continue this rich vein.

The Annual Meeting also represents a time when the Council and staff report back to Members at the AGM. I do hope you can find time to attend it – it is your chance to hear about how we are using The Society's money and more importantly, your chance to ask questions. I look forward to seeing you in Cardiff!

Philip Wright
Chief Executive, The Physiological Society

Workshop and career development sessions

I'm looking forward to the great workshops that are being organised for Physiology 2015. In particular I'm excited about organising the Networking and mentoring skills workshop which I hope will be bigger and better than last year's debut. On that note I also invite Affiliate members to attend the pre - meeting social to get the networking underway. There are many symposia to attend that I'm also keen to attend and eagerly await the programme to outline which talks to attend. Physiology 2015 in Cardiff is set to be a packed conference with plenty for an Affiliate to do.

Fiona Hatch
Affiliate Representative, The Physiological Society

Trade exhibition

I always spend some time going around the trade exhibits. They provide a chance to see new equipment up close and to discuss relevant problems and issues with expert staff. It's worth picking a quiet time in addition to the crowded peak times with beer and wine.

Michael Evans
Chair, Membership & Grants Committee,
The Physiological Society

Kick start collaboration

As I still class myself as an early career researcher Physiology 2015 will be a great opportunity to network and develop ideas with other more established physiologists. This year has a more personal touch for me as I am organising a symposium. The session brings together 2 distinct groups of physiologists, those interested in calcium signalling and those interested in hydrogen sulfide. This exciting session will hopefully bring new ideas, new voices and new collaborations to the ever expanding field of calcium physiology. Outside of this symposium the meeting has all the regular ingredients of a Physiological Society Meeting and so will be the place to be in July 2015.

Mark Dallas
University of Reading, UK
Theme Lead, Neuroscience

Annual General Meeting

I went to my first Physiological Society meeting in 1977 and can still remember the abject sense of fear while giving a communication. Would it be accepted or rejected by the members? This adversarial element has disappeared but the collegial nature of the meeting remains.

I particularly enjoy the chance to meet up with old friends from all parts of the world. I also very much appreciate the mixture of sessions. I can get my teeth into a symposium in my own area and learn about things of more peripheral interest. Perhaps the main highlight is the outstanding collection of Prize Lectures.

As Deputy President, I encourage all members to come to the AGM and tell us what you want from the Society.

David Eisner
Manchester University, UK
Deputy President, The Physiological Society

Old friends and new collaborations

I attended my first Society meeting in 1993, about 2 weeks after moving to London to start my PhD. These meetings helped me to develop as a research scientist and twenty-odd years later, main meeting is "blocked" in my diary at the start of each academic year: and we build our other conference plans around that. Of course the high quality of sciences is very important. For Physiology 2015, I'm particularly excited by the symposia on "Extracellular vesicles, exosomes and micro particles" as we have an active research programme in this emerging area of physiology. In recent years, I've attended more symposia outside my direct research interest and this year, I'm looking forward to learning more about non-coding RNAs. The meeting also gives me a chance to catch up with old friends and develop new collaborations. Indeed, several such projects trace their origins back to a chat at one of the Society's meetings and for this reason I always enjoy the poster sessions.

Matthew Bailey
University of Edinburgh, UK
Theme Lead, Epithelia & Membrane Transport

Education and teaching sessions

I'm looking forward to an exciting day of education focused sessions throughout Tuesday, from the symposium on undergraduate practicals in a digital age, Judy Harris' Otto Hutter Teaching Prize lecture on "Engaging students and rewarding teachers", to colleagues sharing their latest student education interventions and experiences in the E&T oral and poster communications sessions. Something for everyone, whether you are a student, a teaching-focused colleague or combine teaching with research.

Dave Lewis
University of Leeds, UK
Theme Lead, Education & Teaching

Rob Clarke Awards

I went to my first Physiological Society meeting in 1977 and can still remember the abject sense of fear while giving a communication. Would it be accepted or rejected by the members? This adversarial element has disappeared but the collegial nature of the meeting remains.

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As Deputy President, I encourage all members to come to the AGM and tell us what you want from the Society.

Lucy Donaldson
University of Nottingham, UK
Chair, *in vivo* Committee, The Physiological Society

Physiology 2015

6–8 July 2015

Motorpoint Arena, Cardiff, UK
www.physiology2015.org

Ageing in the amateur athelete – a personal view

Choosing the right training regime can make a big difference.

Christof Schwiening
Department of PDN,
University of Cambridge, UK

Age affects how our physiology adapts to stresses. As we become older the balance between the rate of accumulation and retention of knowledge, skill and physical damage changes. Ageing is often characterised by the shift in balance between the damage accrued from training and any potentially beneficial gain of function by physiological adaptations and hypertrophy. This damage, the slow recovery and the associated pain is often used as an 'excuse' for poor performance amongst the over 40s.

'Correcting performance for age plays a critical role in encouraging mass participation in athletics events'

There is a tendency to accept declining mental and physical performance as an inevitable consequence of growing old. But, it is worth considering how much of the decline in physiological function actually results from true time-dependent biochemical ageing and how much is the result of changing behaviour or inappropriate stresses to our physiological systems. There is a general presumption that making life easy for the elderly is a good thing. Whilst in the short term this may well be true, from a physiological feedback perspective there is the possibility that by removing too many training stresses, life ultimately remains just as hard but with an atrophied physiology. There are few better ways to illustrate the critical nature of imposed stresses than to consider athletic performance.

The very fastest are usually young

World Record athletic performance has always been the preserve of the relatively young although how young depends upon the nature of the event. At the age of 40 Elena Zvereva became the oldest World Champion (discus) [1] in athletics and continued competing at World Championship events until the age of 49. World Records at running events are typically set by younger athletes (25-35 years) with peak performance declining [2] in a smooth but not linear age-related fashion (Figure 1).

Age-grading: a fairer form of competition

The recent explosion of interest in competitive amateur running has, in part, encouraged the use of normative tables to compare athletes – not just of different ages, but men and women too[4]. In 1989 The World Association of Veteran Athletes (WAVA) first published age-graded performance tables for athletics events allowing men and women of all ages to compete on a 'physiologically' level playing field. Such tables are currently maintained by World Masters Athletics (WMA)[5] and form the basis for calculating age and sex-graded performance. Such correction factors play a critical role in encouraging mass participation in athletics events not just because they allow competition between the generations, but also because they reveal elite-level performances (optimization of physiology) that would otherwise go largely unrecognized.

‘The parkrun movement provides age and sex graded data from each event, posted online’

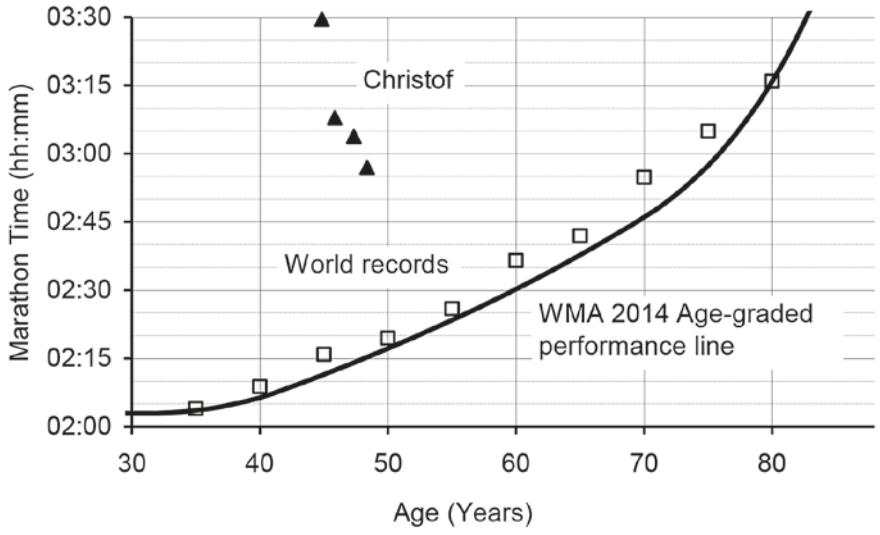

Figure 1. World Masters Athletics age-graded performance (thick line) for men of different ages running a marathon. Also plotted are the male World Record finishing times in 5 year age-groups (open squares). The author’s best marathon performance in each of the past four years are also shown (filled triangles; data from British Athletics official records [3]).

Engaging the ageing in exercise

A good example of this is the parkrun[6] movement – a 5km timed run that takes place at 9 am every Saturday morning at 309 locations across the UK involving nearly 50,000 runners each week with ~1% of the UK population having taken part in at least one event. The results from each event are posted online together with the age (and sex)-graded performance expressed as a percentage of the appropriate World Record performance. Using my local parkrun as an example we have one athlete[7] who has posted a 95.8% age-graded performance and regularly achieves over 90% on a course that is far from optimal. Despite these near World Record performances (~27 mins) she rarely finishes higher than 200th place (she runs in the 75-79 age group) although she easily beats the average female time of ~29.5 mins. Whilst Mary represents the extreme end of athletic performance and has clearly been able to optimize her gradually declining ability to adapt, it is worth considering to what extent the general population is actually limited by biochemical age. The first example that springs to mind is Steve Way. In 2007, aged 33, he was in slightly worse state than the ‘average’ man: he weighed 105 kg and smoked 20 cigarettes a day[8]. However, by the age of 40, through simple training, he had worked his way to finishing 15th at the London Marathon albeit still 12 min behind the absolute World Record time. Whilst it must be the case that to some extent Steve has been lucky in terms of his genetics and biomechanics it is worth looking at what it takes, in terms of training load, to produce a fast marathon time regardless of age.

How the amateur can run a fast marathon

Those of you engaged in running will know about the many and varied training loads that are used to force the adaptations necessary for a fast marathon. The list includes; the long run, tempo running, interval training, speed work, hill work, core exercises, dynamic and static flexibility and easy runs. For the novice the complexity often obscures what is actually important. For most amateur runners marathon racing does not involve running particularly quickly – it is just requires that the pace can be maintained without any dramatic decline, i.e. not hitting “the wall” (Rapoport, 2010). Tanda (2011) provides some insight into what elements of training are important for determining marathon performance and therefore also for how to approach, but not hit, the wall. His rather simple analysis correlated training data with marathon performance times. His conclusion was that marathon finishing times could be predicted, with reasonable accuracy (SEE ~4 mins), by knowing how far someone has run over an 8 week period and how long it took. The precise make-up of the training seemed to play only a minor role. I was surprised by this – could it really be so simple? Re-plotting my own training data[9] I found that the predictive equation correlated well with my own race performances (Figure 2) with similar

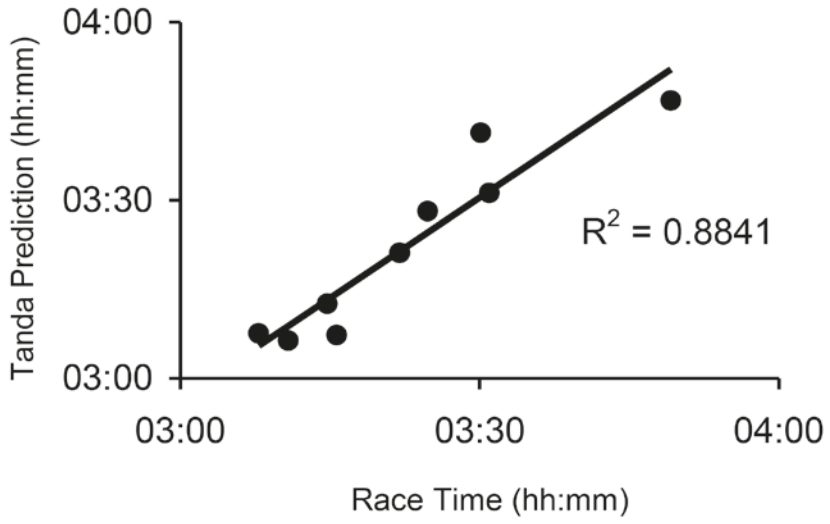

Figure 2. Tanda (2011) predictions from training data[9] for all nine of the author's marathons[3] over a two year period from May 2011 (before he became aware of the Tanda paper).

scatter to that reported by Tanda (2011).

Do more and get faster: correlation and causation

It would thus appear, to a first approximation, that athletes are a product of the training loads that they are either willing to apply or can tolerate. The problem with ageing may therefore be one of finding methods that produce appropriate training loads and making them acceptable. Certainly the parkrun begins to fill that gap by providing an accessible acceptable event on a regular basis. However, those wishing to achieve their optimal performance may well be able to do better by looking at what we now refer to as the Tanda parameter space. The Tanda equation predicts equal performance for runners who train in different fashions: fast and short or long and slow. The performance differences are dependent on just how short and fast or how long and slow. A little knowledge of physics (kinetic energy is proportional to speed squared) and experience is sufficient to suggest that these two diametrically opposed training strategies are not equally accessible to the older athlete: training fast may cause more damage (Hespanhol Jr, 2013) than benefit. It is likely that by running slower damage may be reduced allowing a greater training stimulus to occur, through an increase in distance, resulting in better performances predictions (Tanda, 2011) regardless of sex or age. Certainly my own personal experience suggests that there may be some mileage in this approach (Figure 1).

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A man is as old as his arteries: a scientific journey of ageing and aortic function

Arterial elasticity declines with age.

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As the old adage goes; 'there is more than meets the eye'. To put a spin on that; 'there is more to the function of the aorta than meets the Heart'. As we age, our cardiac cells shrink in number but expand in size, which makes the heart wall thicker. Similarly, our arteries stiffen and this is associated with adverse conditions like hypertension, stroke, renal failure and heart disease. In this review, we aim to take the reader on a journey through the aorta's multifaceted role and subsequently explore the degenerative effects of biological ageing on this organ.

'The aorta acts as a cushioning chamber for the heart, supporting the perfusion of organs'

The aorta serves an important function as a conduit circulating blood to the peripheral organs from the left ventricle. A less recognized but equally fundamental function of the aorta is to act as a 'cushioning' chamber for the heart, dampening the high-energy pulsations generated by the heart beats and supporting the perfusion of organs. These functions have been traditionally exemplified by the *Windkessel* model, which was developed by the quantitative physiologist Otto Frank in 1899. The origin of the term comes from the German word for 'air-chamber'. This was a water reservoir half-filed with air positioned behind the pumps of old fire hoses, which transformed the pulsing water output into a continuous stream (Fig. 1, Westerhof *et al.*, 2009). With this picture in mind, it is easy to appreciate how the *Windkessel* model of the arterial system allows for an unremitting blood flow to the periphery by storing 50% of the stroke volume during the systolic phase of the heart beat and propelling it to the peripheral circulation during diastole, thus ensuring sustained perfusion of organs throughout the cardiac cycle.

The function of the aorta, and its dysfunction, can further be illustrated by the aortic pressure waveform model. When the heart contracts, the pulse of blood ejected is accompanied by a pressure wave that originates from the ventricle walls. This pressure is transmitted in the forward direction, travelling away from the heart in waves at a speed known as the pulse wave velocity (PWV). The journey that the forward wave takes through the circulation is far from a straightforward one, as the propagating wave confronts many points of 'mismatch' along its path. The bifurcations and taperings of the circulatory system result in wave reflections that travel in an opposing direction to that of the forward wave, in other words, towards the heart and against the direction of blood flow (Fig. 2). In a healthy, compliant system where both cardiac and vascular events are meticulously synchronised, the reflected wave returns to the central aorta during late systole and early diastole giving rise to a secondary augmentation pressure at the aortic root (Shirwany and Zou, 2010). The precise timing of the return of the reflected wave with respect to the cardiac cycle is critical for the efficiency of the cardiovascular system. It allows for the augmentation of diastolic blood pressure, thereby enhancing coronary blood flow whilst ensuring that no additional pressure is produced during systole (O'Rourke, 2007).

Pulse wave velocity is related to arterial elasticity

PWV was recognised in 1922 as a marker of arterial elasticity and a fundamental index of 'circulatory efficiency' by Bramwell and Hill (Bramwell and Hill, 1922) but the notion of arterial wave analysis and the assessment of arterial pulse has been known since the late Han dynasty (Parker, 2009) when one of the first books 'the Pulse Classic', was written in 220 AD. Moreover, the concept of forward pulse wave transmission was identified by Erasistratos as early as 280 BC, and he found that the pulse appeared earlier in arteries proximal to the heart than in those distal to the heart (Skalak *et al.*, 1981). The field has progressed significantly since then from being a qualitative into a quantitative discipline particularly highlighting the haemodynamic and mechanical behaviour of the circulation. Aortic PWV is the current gold standard measure of arterial stiffness, measured non-invasively between any two arterial sites (i.e. carotid and femoral arteries or carotid and radial arteries). It increases with age, and typically in a 20 year old adult, it is 5m/s, whilst in an elderly person of 80 years it is 12m/s.

Role of Elastin and Collagen

The capacity of the artery to contract and expand to accommodate the cardiac cycle pressure oscillations is central to its function. The aortic wall is indeed viscoelastic in nature. This characteristic is the product of an intricate interplay of two structural proteins of the extracellular matrix, elastin and collagen. These two proteins are remarkably different. Elastin is 70-100% extensible, whilst collagen is only 2-4%; the latter is 1000 times stiffer than the former when both are stretched (Dobrin, 2000). The distinct contribution of these proteins to the mechanical behaviour of the aortic wall was initially demonstrated in the mid 1900s by Roach and Burton, in arterial samples in response to varying levels of pressure in humans. They found that elastin fibres are load-bearing at low pressures, while collagen fibres are predominantly load-bearing at high pressures. In other words, elastin is responsible for the compliance and structural integrity of arteries at low physiological pressures, whereas collagen imparts the tensile strength to arteries at higher physiological pressures. As such, any change in the collagen to elastin ratio, could detrimentally compromise the artery's ability to accommodate changes in pressure. Indeed, this by-and-large, is the hallmark of arterial ageing.

The arterial changes observed in ageing could be compared to a rubber band that has been stretched continuously for many years. Conceptually similar to the 'wear and tear' of rubber due to repetitive cycles of stretch and recoil, the cyclic stress and strain of arterial elastin leads to its 'fracture and fatigue'. This

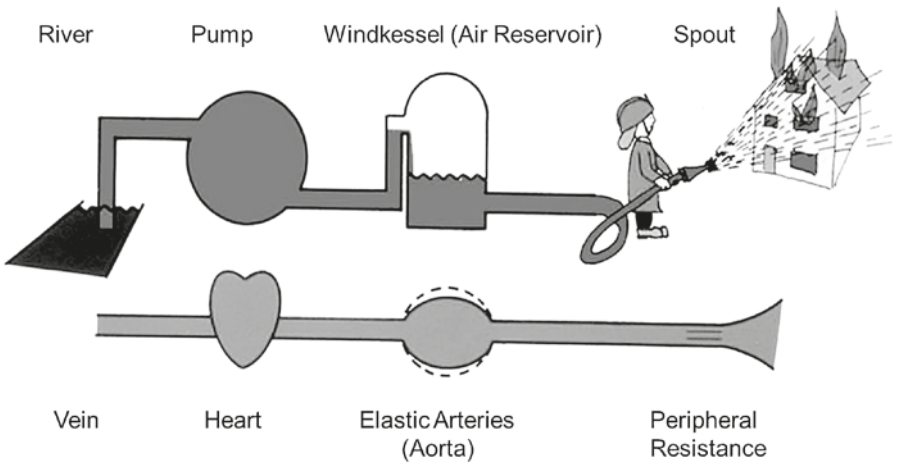

Figure 1. The aorta as a Windkessel model.

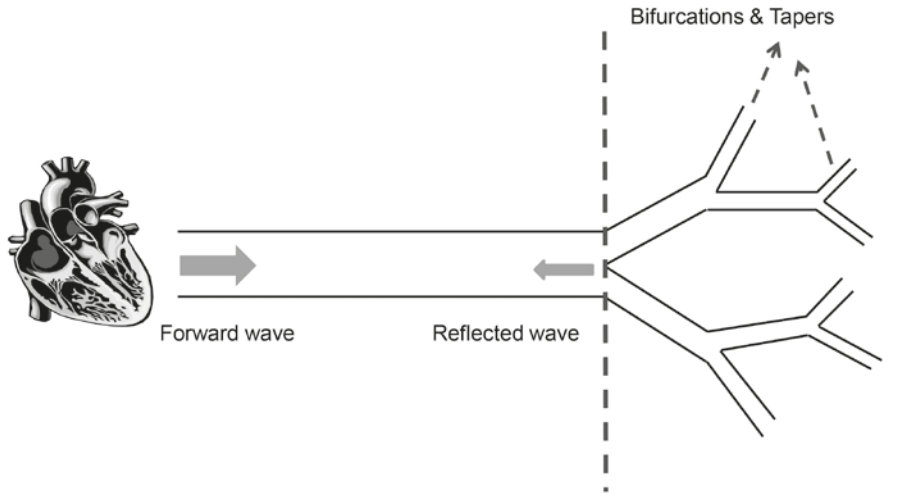

Figure 2. Arterial Wave Reflections.

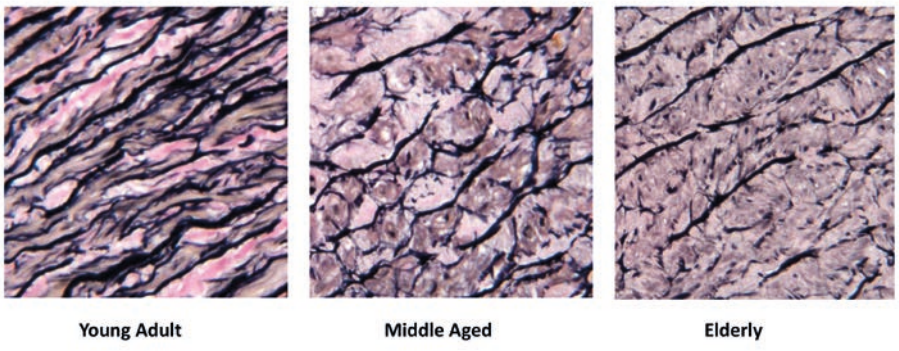

Figure 3. Verhoeff Van Gieson staining of human aortic sections showing the progressive fraying and fragmentation of elastin with age.

‘Arterial stiffening is detrimental in more ways than one, and varies from person to person’

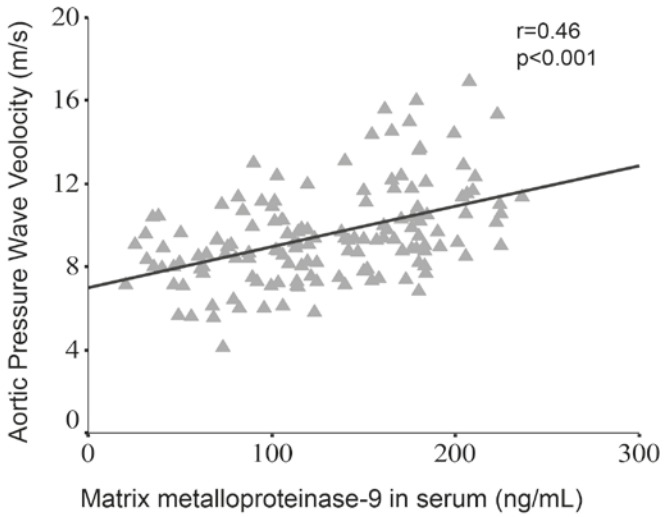

Figure 4. Scatterplot showing the correlation of aortic Pressure Wave Velocity with serum Matrix metalloproteinase-9 levels in adults aged between 58-83 years.

results in the fundamental degenerative process seen in arterial ageing: fraying and fragmentation of elastin fibres (O’Rourke, 2007). The fracturing of rubber is estimated to occur after 1 x 10^9 oscillations, in cardiac time this is equivalent to 60-70 beats per minute over the course of 25-30 years in humans (Dobrin, 2000). Theoretically, this is the age when aortic elastin fibres begin to fragment. It is for this reason that the process of arterial degeneration has been said to commence in childhood and to be ‘well developed’ by early adulthood (Nichols *et al.*, 2011). This stark difference in elastin fibre composition is clearly seen in Fig. 3. A number of structural and cellular modifications to the arterial wall further exacerbate the stiffening process. These include an increase in collagen content, calcium deposition, extracellular matrix (ECM) accumulation, increased vascular smooth muscle cell proliferation, reduced endothelial function and the intima-medial layer thickening (Park and Lakatta, 2012). Together, these lead to the dilatation, stiffening and thickening of arterial walls. The aforementioned degenerative changes are more prominent in the proximal large central arteries (i.e., aorta and its major branches) which have a higher elastin content and receive most of the impact of repeated cyclic strain and stress compared to the peripheral muscular arteries (i.e., radial).

Arterial Stiffness: The Impact

Arterial stiffening is detrimental in more ways than one. The fraying of elastin fibres means that the mechanical load is now shifted to the more rigid collagen component of the artery, compromising the cushioning function of the aorta and causing major changes to the aortic pressure waveform. When the central arteries lose cushioning efficiency the pressure pulsations travel further down the arterial tree into the vessels of the microcirculation triggering microbleeds and microinfarcts, thus increasing the risk of stroke, cognitive impairment and renal failure (O’Rourke and Hashimoto, 2007). With respect to the changes in the aortic pressure waveform, a stiffened artery causes an early return of the reflected wave such that it falls within the systolic phase instead of the diastolic phase (Fig. 4). The early return of reflected wave, coupled with a stiffened aorta, leads to a rise in systolic pressure and fall in diastolic pressure (O’Rourke and Hashimoto, 2007), giving rise to isolated systolic hypertension. The raised systolic pressure also causes an increase in left ventricular load driving left ventricular hypertrophy and increased cardiac oxygen demand (O’Rourke and Hashimoto, 2007). On the other hand, the reduced diastolic blood pressure makes the heart incapable of meeting this demand due to the compromised coronary perfusion, predisposing the heart to ischemia and, ultimately to myocardial infarction or heart disease (O’Rourke and Hashimoto, 2007).

Factors Regulating the Stiffening Process

As people age, arteries stiffen. However, it is not clear why arterial ageing and its associated complications manifest more often in some people than others. There is no straightforward answer to this question, as the mechanisms underlying age-related arterial stiffness are complex. Other than age, mean arterial pressure and smooth muscle tone regulate stiffness, whilst conditions such as diabetes, hypertension, high cholesterol and inflammation accelerate its progression (Horvath *et al.*, 2014), thus accounting for some of the variability. The pathogenesis and

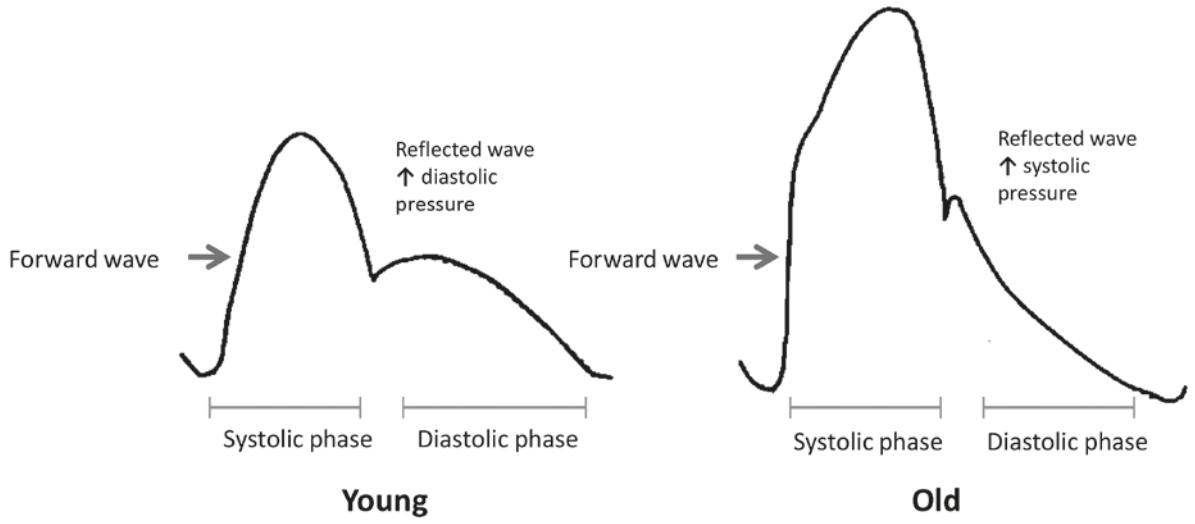

Figure 5. Pressure wave forms in conduit arteries.

progression of arterial stiffness is further governed by a complex network of molecular (e.g. gene expression), cellular (e.g. telomeres), biochemical and enzymatic pathways (e.g. matrix metalloproteinases) which alter the arteries capacity to adapt and repair in the face of the ageing process. Here, we focus briefly on one of the most important biomarkers, matrix metalloproteinase-9 (MMP-9), that is involved with elastin and collagen break down, and is associated with cardiovascular conditions and arterial stiffness.

Matrix metalloproteinases (MMPs) are a group of proteolytic enzymes that have the capacity to catalyse the normal turnover of extracellular matrix (ECM) and also degrade its components like elastin and collagen.

Although the balance between the matrix protein synthesis and degradation is tightly controlled by their inhibitors, as arteries age or undergo pathological changes, this balance is lost and MMP enzyme activity increases. We have previously demonstrated an association between serum MMP-9 levels and aortic stiffness in healthy individuals, and in isolated systolic hypertensives, indicating their role in aortic stiffness (Fig. 5, Yasmin *et al.*, 2005). The exact role of MMPs in the stiffening process remains elusive, although current clinical and experimental data suggest an inflammatory mediated pathway, the discussion of which is beyond the scope of this article, but is well reviewed by Galis and Khatri, 2002.

Summary

The degenerative effect of ageing on the aorta is marked: structurally, it is manifested as fragmentation of elastin fibres rendering the aorta prone to remodelling and stiffening. Functionally, it is apparent as an increase in aortic PWV, which is a strong and independent predictor of cardiovascular events and all-cause mortality. Indeed, aortic stiffness underlies isolated systolic hypertension and contributes to the pathogenesis of stroke, dementia, left ventricular hypertrophy, renal damage and heart failure. Better elucidation of the mechanisms that drive the stiffening process could help to generate therapeutic targets that reverse or slow the impact of aging on aortic function.

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Space flight and ageing – final frontiers of human physiology?

Zero gravity mimics some of the effects of ageing

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This year sees the first UK member of the European Astronaut Corps, Major Tim Peake, undertake a mission aboard the International Space Station (ISS). The ISS is an international collaborative research laboratory in low earth orbit and Tim is due to stay aboard for 6 months. He follows in the footsteps of Helen Sharman, who became the first Briton in space and British-born American astronaut Mike Foale, who has had extended stays on both the ISS and the Mir station. There will no doubt be a great deal of public interest in Tim's exploits as he undertakes a wide range of experiments in this unique microgravity (μG) environment.

'Long-term space flight may be viewed as a model of accelerated human ageing'

The costs of launching a manned or unmanned vehicle into space are vast, but so are the economic benefits of possessing a space sector. UK space-related revenues were over £9.1 billion in 2010–11 even without a UK Space Agency (UKSA), only formed in 2010 to assist further growth. The UKSA now contributes on average around £240 million annually to the European Space Agency's (ESA's) programmes. Whilst the UK space industry is heavily active in satellite telecommunications and robotics, historically there has been less governmental enthusiasm for human space flight. As a consequence, the UK, despite being a major player in biomedical sciences, has been somewhat side-lined in the space life sciences. However, a big step forward was taken with the formation of the UK Space Biomedical Consortium (recently expanded to become UK Space Labs). This was followed by an unprecedented shift in UK government policy when it signed up not only to ESA's European Life and Physical Sciences programme (ELIPS) and earth bound μG analogues (e.g. bed rest), but also to ISS utilisation.

Many physiological problems in space

Previously the ISS, Skylab and Mir missions have identified significant multi-faceted physiological de-conditioning in the astronauts and cosmonauts during these prolonged periods in microgravity (μG), leading to the suggestion that long-term space flight might be viewed as model of accelerated human ageing. This is despite the effects of orbital velocity induction of time dilatation, which means that on the ISS, an astronaut will have aged less than those of us will on Earth – albeit by only about 0.005 s with a 6 months stay!

The longest single stay in space by a human is 437 days undertaken by Russian cosmonaut (and physician) Valeri Polyakov. Yet a manned mission to Mars – the long-term goal of NASA – is likely to involve a round trip of at least 500 days. Beyond the Van Allen belt, the μG environment is coupled with increased exposure to solar and galactic cosmic radiation as well as the psychological challenges of isolation, confinement and boredom. Indeed, the challenges of such a

‘Human physiology is not well-equipped for the unloading that results from zero gravity’

mission are orders of magnitude greater than the relatively short duration trips to the moon (~8 days) pioneered by NASA’s Apollo programme in the late 1960s and early 1970s. For NASA, the European Space Agency (ESA) and other space agencies, these challenges require more research into the physiological effects of long-term human space flight and the development of methodologies to counteract them. In this brave new world, the BBSRC also recently committed funding to space-related research as part of its ageing strategy.

So, what are the key physiological effects of prolonged exposure to the µG environment that cause these comparisons between space flight and ageing on earth? The gravitational force of the Earth has shaped our anatomy and physiology for millions of years. When humans are exposed to a prolonged period in space, they are faced with both confinement-enforced inactivity and the continuous gravitational unloading on the body because of the µG environment. Few physiological systems escape unaffected. For example, bones that are no longer required to support body weight lose mass at around 1% per month. This occurs especially in the weight bearing lower limbs, resulting in astronauts developing symptoms similar to osteoporosis (Vico *et al.*, 2000). Skeletal muscles in the limbs and trunk, which are adapted to counteract the effects of gravity, reduce in size, or show signs of atrophy (Narici & de Boer, 2011) – a phenomenon similar in some respects to age-related sarcopenia. In addition, the immune system appears suppressed, often leading to skin infections, and whilst no serious incidents have occurred, some viruses become more virulent. The cardiovascular system adapts to µG by redistribution of body fluids from the lower to the upper body by decreasing plasma volume, red blood cell count (space anaemia) and heart size. Thus an astronaut phenotype develops, characterised by a ‘puffy face’ due to fluid redistribution (cephalic shift), and ‘skinny legs’ due to fluid shift compounded by lower limb muscle atrophy. Unsurprisingly, physical fitness, as determined by the maximal rate of oxygen consumption (VO_2max), also falls markedly due to cardiovascular de-conditioning. At first glance, these changes appear to mimic a number of the physiological characteristics of older people. However, this is a probably a highly simplistic view of the physiology human ageing process.

Whilst in space astronauts undergo numerous countermeasures designed to try to mitigate against the effects of µG. In particular, exercise training regimens now form part of the daily routine for astronauts on the ISS. Specialised exercise equipment designed to allow astronauts to run on treadmills, pedal on cycle ergometers or perform weight, or more appropriately given the µG environment, ‘resistance’ training. A number of platforms for exercise countermeasures thus exist. For example vibrating plates are used to reduce bone loss, which may also help counteract muscle atrophy (Salanova *et al.*, 2014).

However, despite astronauts exercising for at least 2 hours a day, these countermeasures are not completely effective across all systems in counterbalancing the negative effects of µG. This suggests that the two interacting processes of inactivity and unloading require further refined strategies. Furthermore, the challenges faced by astronauts do not end in space.

Problems readapting to normal gravity

On return to Earth, the µG-induced deconditioning persists in 1G and requires appropriate rehabilitation. Orthostatic intolerance is commonplace in the first few days back on Earth, particularly in women, possibly by virtue of greater increments in vascular compliance. However, over time astronauts are able to rehabilitate themselves to pre-flight levels in almost all systems, although bone may be a notable exception. These observations make clear that our physiology is not well equipped for the unloading that results from µG. But then neither is it well equipped to deal with physical inactivity on Earth. Frank Booth put forward the contention that from an evolutionary biological perspective our genes evolved with the expectation of requiring a certain threshold of physical activity (Booth *et al.*, 2002). In this context, exercise must be seen as fundamental to human health; and it is becoming clear that this must extend throughout our lifespan.

Human ageing itself is in some ways, like space, another frontier in which exploration of the effects of inactivity has only just started. As the ageing demographic in Western societies continues to increase, it is becoming increasingly important from economic, health care and quality of life perspectives that this population remains healthy during their increasing working life and throughout the life course. Maximising the ‘health span’ is increasingly replacing longevity or ‘lifespan’ as the prime targets of ageing research.

Crucial importance of exercise in all situations

Unfortunately, too many studies purporting to study the physiology of human ageing have given insufficient attention, or ignored altogether, the influence of physical activity and exercise. In an attempt to define the effects of human ageing free from the

confounding effects of inactivity, focus has recently been shifting to older people who undertake high levels of exercise. This population, according to the hypothesis, should maintain an optimum physiology and therefore age optimally because they should be relatively free from the documented complications of inactivity as well as from the negative influences of smoking, poor nutrition and excessive alcohol consumption.

A recent study which undertook a comprehensive physiological analysis of male and female amateur master road cyclists showed that whilst these active individuals have superior level of physiological function compared to their sedentary counterparts (such as in VO2max), the relationship between age and function is not always clear. What is highly likely is that exercise, in all individuals, results in an optimal physiology. Differences between individuals highlight a large genetic component that is likely to influence the profile of physiological function with increasing age. Interestingly, a small scale genetic study will shortly take place in space with NASA astronaut Mark Kelly (aged 51) undertaking a 12 month tour on board the ISS whilst his identical twin brother Scott (former NASA astronaut) remains on earth undergoing the same battery of tests.

Until more is known about the exact exercise regime that is necessary to counter the effects of inactivity and µG on humans in space it is perhaps not yet appropriate to carry the analogy between ageing on Earth and the effects of space too far. Yet there are some areas of clear commonality between spaceflight and ageing, the loss of bone being one. Analogous to the findings in space, not all exercise is equal when applied to bone loss. For example cycling, which has widespread positive effects on many physiological systems, seems to confer no advantage on bone loss when compared with a normal sedentary population. As far as the skeleton seems to be concerned, this type of exercise is analogous to another form of unloading. These types of observations make it clear that exercise is not a panacea and that the type and intensity of exercise both in space and on Earth are important considerations.

If not exercise, then could pills help to counteract the deleterious effects of ageing and space flight? One example is the treatment of a loss in bone mineral density with bisphosphates. A recent study by Lebanc *et al.*, (2013) concluded that the combination of exercise and bisphosphonates provide some protection to bone health for astronauts during long-duration spaceflight. However, pharmaceutical approaches also have innate problems in space. Given the marked effect that the µG environment has on normal physiology, it is more than probable that the pharmacodynamics and pharmacokinetics of drugs will also differ in space.

Indeed, in a recent study it was concluded that 8% of all therapeutic treatments used on board the ISS could be described as 'ineffective' (Putcha *et al.*, 2011). Reasons for this include the marked reduction in both gastric and intestinal motility that occur – significantly affecting drug absorption (a phenomenon compounded by space motion sickness), as well as the effects of fluid redistribution. On Earth there are no pharmaceuticals that have the range and effect of exercise in ameliorating the deleterious effects of sedentary ageing. Drugs have been used to counter the effects of the complications of an inactive lifestyle, but these do not address the fundamental problem of preventing these complications in the first place.

Additive effects of ageing and space flight

It is likely that a long-term mission to Mars will involve older astronauts. Thus, in future space exploration, both the effects of inactivity and of the inherent ageing process on physiological processes will need to be addressed. In fact, in 1998 the two issues of human space flight and ageing merged when John Glenn at the age of 77 years became the oldest person to leave the planet and undertake a mission in space. During this 8 day mission he undertook a number of experiments as a Payload Specialist. At the time, there was much debate about whether someone of his age would be able to cope with all of the physiological challenges of the mission. Part of the reason why he was cleared to fly was the remarkable physical condition he was in, having spent many years being highly physically active – in many ways John Glenn epitomises the physiological phenotype that space science must use as a template in order to have successful initial colonising missions. Whilst similarly active individuals must be studied on Earth in order to understand more of the fundamental biology underpinning human ageing. It is thus perhaps appropriate that one of Tim Peake's outreach activities on the ISS will be the promotion of exercise participation.

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What on Earth is Charcot-Marie-Tooth (CMT) disease?

Charcot-Marie-Tooth disease (CMT) is one of the most common neurological disorders and affects 1 in 2,500 people. The name originates from the three neurologists who described it in 1886: Jean-Martin Charcot (1825–1893), his pupil Pierre Marie (1853–1940) (Charcot & Marie, 1886), and Howard Henry Tooth (1856–1925) (Tooth, 1886).

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CMT also known as Charcot–Marie–Tooth neuropathy, hereditary motor and sensory neuropathy (HMSN), or peroneal muscular atrophy (PMA), is a condition characterised by nerve degeneration, which leads to failure in transmission of nerve action potentials. This could be secondary due to disruption of either the axon or the myelin sheath.

'CMT can be classified into two main subtypes: demyelinating and axonal'

The health of the neuron from the proximal to the distal end is maintained by axonal transport. In fast conducting, myelinated neurons, propagation of the action potential rely on the interaction between the nerve axon and myelin. In motor neurons, a clustering of voltage gated sodium channels occurs at the axon hillock where the initial depolarisation occurs. In sensory neurons, depolarisation occurs through stimulation of the sensory end organ. Clusters of channels also exist at the nodes of Ranvier in myelinated fibres. This allows the conduction to jump between the node of Ranvier enabling fast conduction. This process is called saltatory conduction. Action potentials are generated at the nodes by opening of the voltage gated sodium channels leading to an influx of Na^+ ions, which depolarises the membrane. Closure of the Na^+ channels and opening of addition K^+ channels restores the membrane potential.

A commonly used diagnostic tool for investigating polyneuropathy is measurement of the conduction velocity by transcutaneous electrical stimulation and recording. Slowing of conduction for example <38 m/s in the upper limbs is seen with primary demyelinating disorders. Electrical studies also allow the measurement of the amplitude of the motor response, the compound muscle action potential (CMAP), or the sensory nerve action potential (SNAP). A reduction in the amplitude of the CMAP or SNAP indicates a loss of axons. These studies help to distinguish between different types of neuropathy.

Charcot-Marie-Tooth Disease types

CMT affects about 1 in every 2,800 people. The first gene causing the CMT phenotype was identified in 1991 (1.4 Mb duplication of Chromosome 17p11.2 encoding Peripheral Myelin Protein 22 (PMP22)). To date, about 80 causative genes have been identified. The most common types of CMT show a slowly progressive distal muscle weakness and sensory loss in the upper and lower limbs in a length dependent manner. CMT can be inherited as an autosomal dominant or X-linked or autosomal recessive condition. In Northern Europe and US, the most common inheritance is autosomal dominant or X-linked. Autosomal recessive inheritance is rarer and it occurs more frequently in areas where consanguinity is prevalent. Family history is an important step in deciding if and how a neuropathy is inherited.

CMT can be classified in two main subtypes on the base of neurophysiology : CMT1, demyelinating, when nerve conduction velocities in the upper limbs are below 38m/s; and CMT2, axonal, when nerve conduction velocities in the upper limbs are above 38 m/s. More than 80% of patients with CMT1 usually receive a molecular diagnosis and

PMP22 duplication accounts for 70% of all the cases. Type 1 CMT (CMT1) presents with demyelination of the more thickly myelinated, fast conducting axons, for example the alpha motor neurons and 1a afferent sensory neurons. Axonal loss occurs with prolonged demyelination and the degree of axonal loss relates to the degree of motor-sensory impairment. In conditions with chronic axonal loss there is collateral re-innervation of the muscles, therefore the reduction of CMAP amplitude is not seen early on in the disease.

Type 2 CMT (CMT2) presents with primary degeneration of the nerve axon. The axonal forms of CMT are less common than type 1 and a molecular diagnosis is reached in more the 25% of cases, the majority caused by either Gap Junction protein Beta 1 (GJB1) or Mitofusin 2 (MFN2) mutations. The next most common type is CMTX, where there is an X-linked pattern of inheritance in the family history with no occurrences of male to male transmission.

Presentation

Muscle wasting is one of the key signs described for people with CMT with the classic 'inverted champagne bottle' appearance of the distal lower limb and 'claw hand' of the upper limbs. Magnetic resonance imaging (MRI) reveals that atrophy of the distal lower limb muscles can occur even when an individual appears unaffected on clinical examination. The distal lower and upper limb muscles tend to weaken first - showing a slow decline in strength over decades. The degree and extent of weakness has been correlated with axonal loss rather than demyelination in studies of the hand. The proximal limb muscles are less affected but some studies have found they are still weak compared to normative data (Carter *et al.*, 1995).

In addition to weakness and wasting, a length dependent gradual loss of sensation occurs. People with CMT show a principal impairment of the thickly myelinated large diameter sensory nerves that mediate the sensations of light touch and vibration. However, sensations conveyed by smaller diameter fibres, e.g. pain, temperature or pinprick, may also be reduced.

Exploration of upper limb function has revealed that people with CMT can have impaired manual dexterity and upper limb functional task that are related to muscle weakness. In the lower limb, distal weakness has been related to foot drop and failure of the plantarflexors, which influences the pattern of gait as people with CMT walk. Gait analysis has revealed primary distal gait impairments with problems with foot clearance during swing and reduced contribution of the plantarflexor muscles to progression of the trunk and swing leg (Newman *et al.*, 2007). Further exploration revealed that people with CMT utilize additional movements of the proximal joints during walking to compensate for the primary impairments of distal weakness and sensory loss.

People with CMT complain of more pain than the general population, though it is unclear whether the pain is directly due to the neuropathy or secondary musculoskeletal deformities. Some research has found increased reports of pain in people with CMT who had a pes cavus foot deformity suggesting that musculoskeletal alignment may be a cause of foot pain.

Problems with balance are reported in the clinic by people with CMT. Falls are more prevalent and investigation of balance impairments reveal a relationship between greater sensory dysfunction and increased falls plus poorer balance performance. Reduced balance scores have also been seen in children with CMT.

Investigations of quality of life for people with CMT have found lower scores than the general population and similar to those reported for people with stroke and other disabilities (Vinci *et al.*, 2005). The reason for this is multi-factorial and measures of ambulation and axonal loss correlate with quality of life measure. An interesting link has also been observed between quality of life and occupation was found in a study of 121 people. Using the Short-form 36 measure, investigators found lower scores for physical functioning, physical role, emotional role and mental health for subjects who did not work (Vinci *et al.*, 2005). It is unclear whether working improves these domains or whether the most physically, emotionally and mentally well people are able to continue to work for longer.

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Further reading

CMT United Kingdom – **http://cmt.org.uk/**

CMT on Wikipedia – **http://en.wikipedia.org/wiki/Charcot%E2%80%93Marie%E2%80%93Tooth_disease**

Prof Mary Reilly's page – **https://iris.ucl.ac.uk/iris/browse/profile?upi=MREIL38**

Living with Charcot-Marie-Tooth disease – a personal perspective

Nick Boross-Toby is a Canadian by origin and has worked for The Society for over a decade.

Nick Boross-Toby

Director of Marketing,
The Physiological Society,
and CMT sufferer

'Imagine my shame at not playing ice hockey well... particularly as a Canadian!'

'He runs like a girl!'
'Dude, are you drunk?'
'Fall over much?'

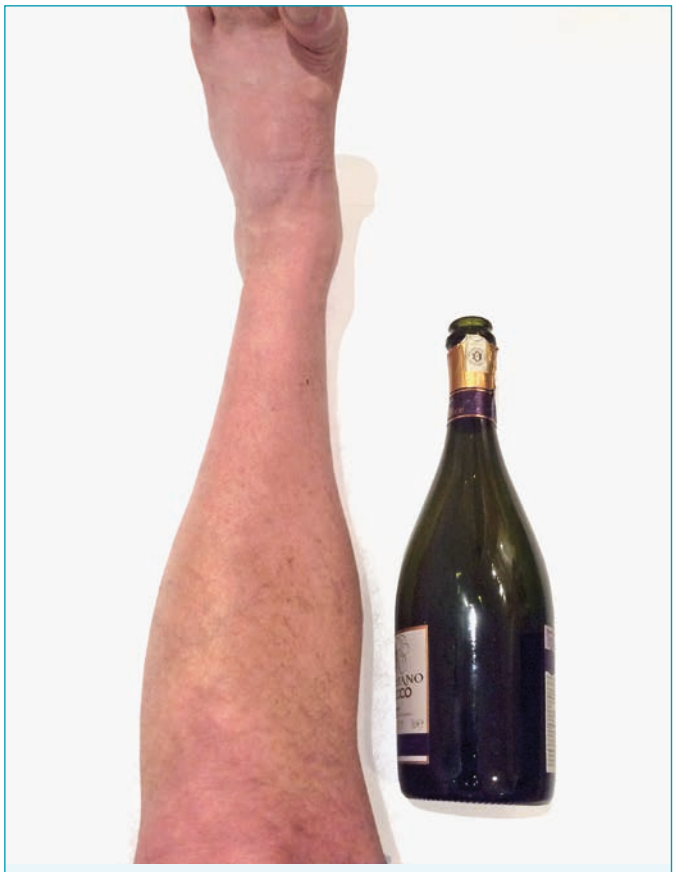
These are but a few legitimate comments/questions I have received and had to field over the years since being diagnosed with CMT at the grand old age of five. Now 44, I suppose I have grown a somewhat thicker skin over the years and I certainly have become more open with people about my condition, but every once and awhile I feel the twinge of embarrassment and still get deeply frustrated at times by my inability to do even the simplest things quickly and efficiently. Tying shoelaces, doing up buttons, getting the battery compartment open on a toy (small screwdriver and even smaller screws)! Imagine my shame at not playing ice hockey well... particularly as a Canadian! There was also no chance of pursuing a career as an airline pilot as I lack the necessary fine motor skills and coordination that would be required. I recall the day a doctor told me that; I was nine years old!

CMT is a peripheral neuropathy and is one of the most common inherited neurological disorders affecting approximately 1 in 2800 people equating to approximately 23,000 people in the United Kingdom. For the geneticists among you, CMT is a result of genetic mutations in a number of genes. Based on the affected gene, CMT can be categorised into types and subtypes. I have CMT Type 1b (1 signifying it is a demyelinating type as opposed to Type 2 which is axonal), and subtype b identifying that I have a defect in the Myelin Protein Zero gene)). It is also autosomal dominant (whatever that means). Thank you Wikipedia!

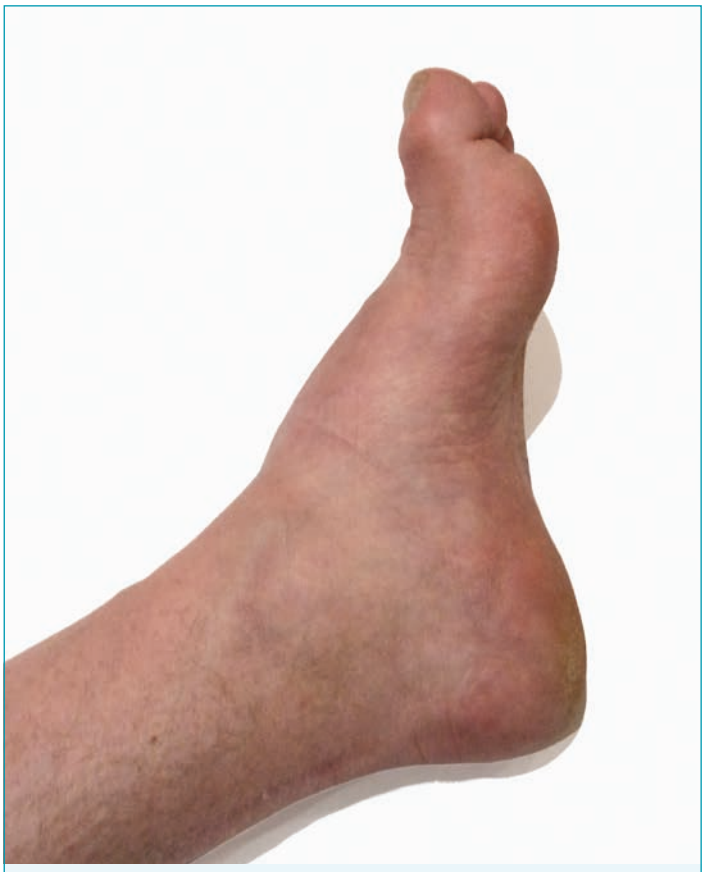
It was only in my late teens that someone explained to me that this meant not just problems with lower legs, ankles and feet, but also the arms, wrists, fingers; basically, anything outside the spinal column. It is also progressive meaning it gets worse as I get older. By the age of 16, I had lost count of the number of 'corrective' surgical procedures I had undergone on my ankles and feet. Needless to say, I am a wizard on crutches. Currently, there is no cure for CMT, but I am exceedingly lucky to be under the care of Professor Mary Reilly and her superb team at MRC Centre for Neuromuscular Diseases, Department of Molecular Neurosciences, UCL Institute of Neurology and National Hospital for Neurology and Neurosurgery. There, I am part of a number of clinical trials to assist in research and have access to world-class facilities for physiotherapy and occupational therapy, fatigue and pain management, orthotics and regular check-ups and monitoring.

It is great having a supportive and understanding family (particularly my two boys Max and Alex), who are currently showing no overt physical or physiological signs of having inherited CMT from their old man. An easy solution would be to have them genetically tested now, but we are of a view that that should be their decision when they are older.

I am philosophical about the future and manage the condition one day at a time. To be fair, I have lived with it for so long that it has all become second nature — I don't let it dictate how I live my life. This is your Captain speaking. Please fasten your seatbelts and ensure your tables and chairs are in the upright position!



Distal wasting in the legs is sometimes described as 'inverted champagne bottles'



Pes cavus is a deformity of the foot which has a very high arch and is relatively stiff and is common in those diagnosed with CMT. This deformity does not flatten on weight bearing.

Nick Boross-Toby

100 years of women members: The Society's centenary of women's admission

Helen Burgess

Membership & Marketing Manager, The Physiological Society

The Society's admission of women

The Society was famously founded in 1876 as a dining society, and although women contributed to *The Journal of Physiology* and The Society's meetings, there was a reluctance to invite them to join as members. Even after a formal resolution to admit women, accepted at the 1915 Annual General Meeting, the prevailing opinion was to not invite them to the dinners, which at the time included live demonstrations. Ernest Starling, when considering women as possible members, stated that 'it would be improper to dine with ladies smelling of dog – the men smelling of dog that is'.

Florence Buchanan, the first woman member

Florence Buchanan's grave in Oxfordshire

John Scott Haldane proposed Florence Buchanan, the former research assistant of his uncle, John Scott Burdon Sanderson, the late Professor of Physiology at Oxford, for membership of The Society in 1912, which is thought to be the call to action for The Society to consider the admission of women. The two were family friends. Florence was the first woman to attend a Society Meeting in 1896, although she did not attend the dinner. She was also the author of the first article in the first issue of what is today *Experimental Physiology*.

Florence was eventually admitted in 1915 with five other women physiologists: Winifred C. Cullis, Ruth C. Skelton, Sarah C. M. Sowton, Constance Leetham Terry and Enid M. Tribe. As candidates were voted into The Society alphabetically she is the first female member of The Society. Florence remained friends with the Haldanes, frequently joining them for lunch, and apart from a brother, Sir George S. Buchanan of the Ministry of Health, had no immediate family.

Woman bequeaths her eyes

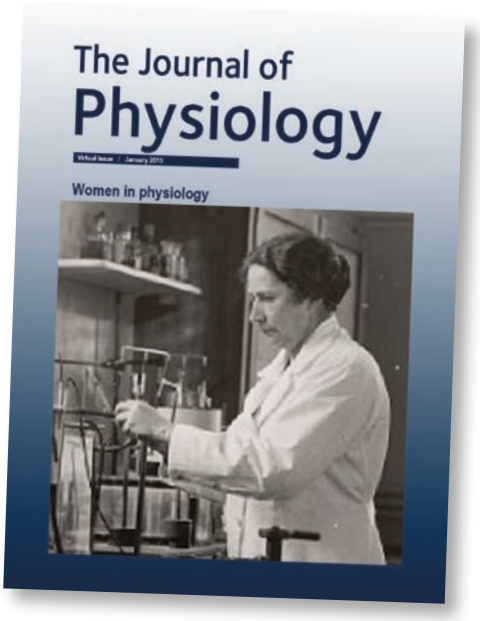
During our research on Florence Buchanan for the preparations for the centenary year; we came across a short and intriguing sentence on the internet; 'Woman bequeaths her eyes'. It turned out to be from an online transcript of a short article in the Dundee Courier from 20 June 1931. Florence herself died on 13 March 1931.

It was known that Florence suffered from poor eyesight during the final years. She actually had a detached retina, according to Naomi Mitchison (née Haldane). The Dundee Courier article tells us that Florence gave directions in her will that her eyes be removed and preserved so they could be examined. She gave £250 out of her estate, valued at £11,729, for 'the histological examination of her eyes, and publication of the findings, together with her own account of phenomena, which she had herself observed since 1922, and the preparation for publication of any other MSS she might leave concerning vision.' So far I have been unable to find anything published about the findings.

Society centenary events

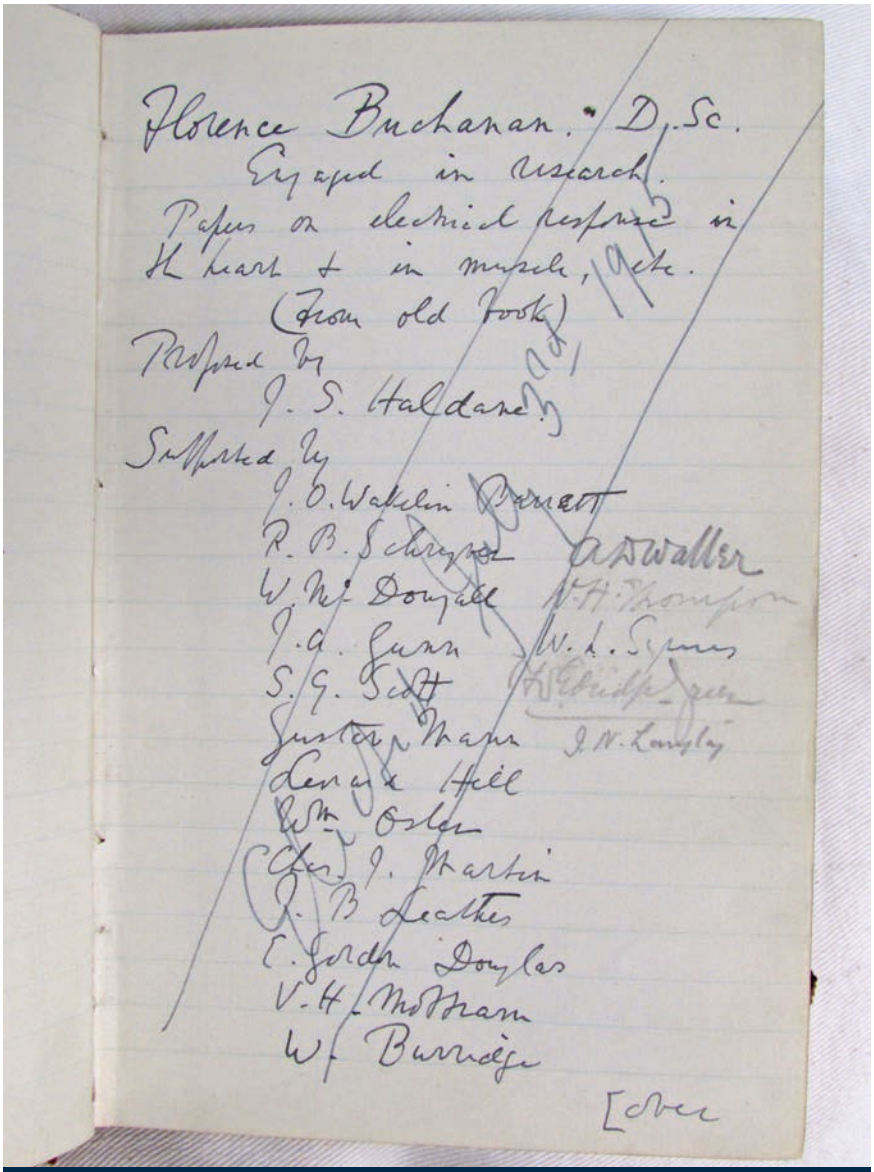
In 2015, The Society will be celebrating the first women's admittance with a series of events. These will include a symposium at Hodgkin Huxley House on the research done by The Society's first six female members in September and a National Schools Competition which was launched in March.

The Journal of Physiology celebrates centenary with virtual issue



To celebrate the centenary we have compiled a virtual issue that highlights some of the most influential and important papers authored by women and published in *The Journal of Physiology* since it was first published in 1878. This issue features papers published by four of the first female members as well as other notable female physiologists during the latter part of the 19th and early part of the 20th centuries. We hope you enjoy having a look back at our history and celebrating the impact that female physiologist have had since The Journal was first published.

The cover image of the virtual issue shows Marie Krogh in her laboratory, courtesy of The Royal Library, Denmark, The Collection of Prints and Photographs.



The entry for Florence Buchanan in The Society's Candidates' Book

Further reading

The first women members of The Physiological Society **www.physoc.org/history-physiological-society-and-its-journals-information-sheets**

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Oral history interviews – lives in physiology

David Miller

History & Archives Committee,
The Physiological Society

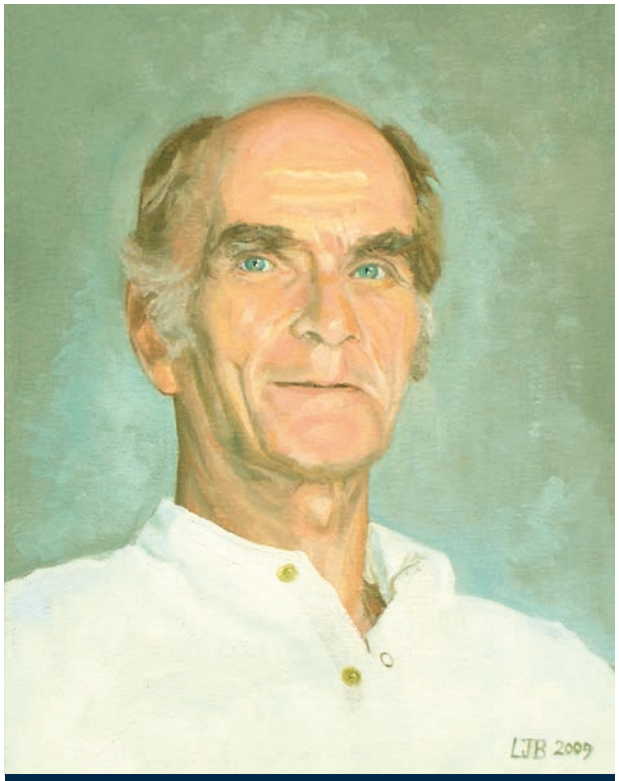
The Oral History project, conducted by History & Archives Committee, interviews senior members of The Society, generally after they have retired. The interviewee talks freely about his or her career and science, their background, collaborations, friendships, The Society and other memories. The recordings of these free-ranging interviews and full transcripts are then lodged in the Society's archive held at the Wellcome Library. In several cases there are contemporary photos lodged with the text.

To make these fascinating personal accounts of lives in physiology more accessible, we have started to place edited versions online. In a few cases some of the audio files will be accessible too. Those versions can now be accessed at www.physoc.org in the Society's History section.

Amongst recent examples, in 2013 our immediate past President, Jonathan Ashmore interviewed Paul Fatt. (Sadly, Paul died a year later). At that session, Jonathan took the photo of Paul reproduced here. Last year he also interviewed David Colquhoun. Oral Histories currently available via the website now also include Ann Silver, Sally Page, Gerta Vrbová, Andrew Huxley, Otto Hutter and others, with more in progress.

Lynn Bindman's portrait of David Colquhoun on this page is one of several she has made of her former colleagues at UCL. Lynn herself will be interviewed for the Oral History project later this year. We are indebted to David and to Lynn for permission to reproduce the image.

Paul Fatt, September 2013 by Jonathan Ashmore



David Colquhoun, portrait by Lynn Bindman

Planting the physiology family tree

David Miller

History & Archives Committee,
The Physiological Society

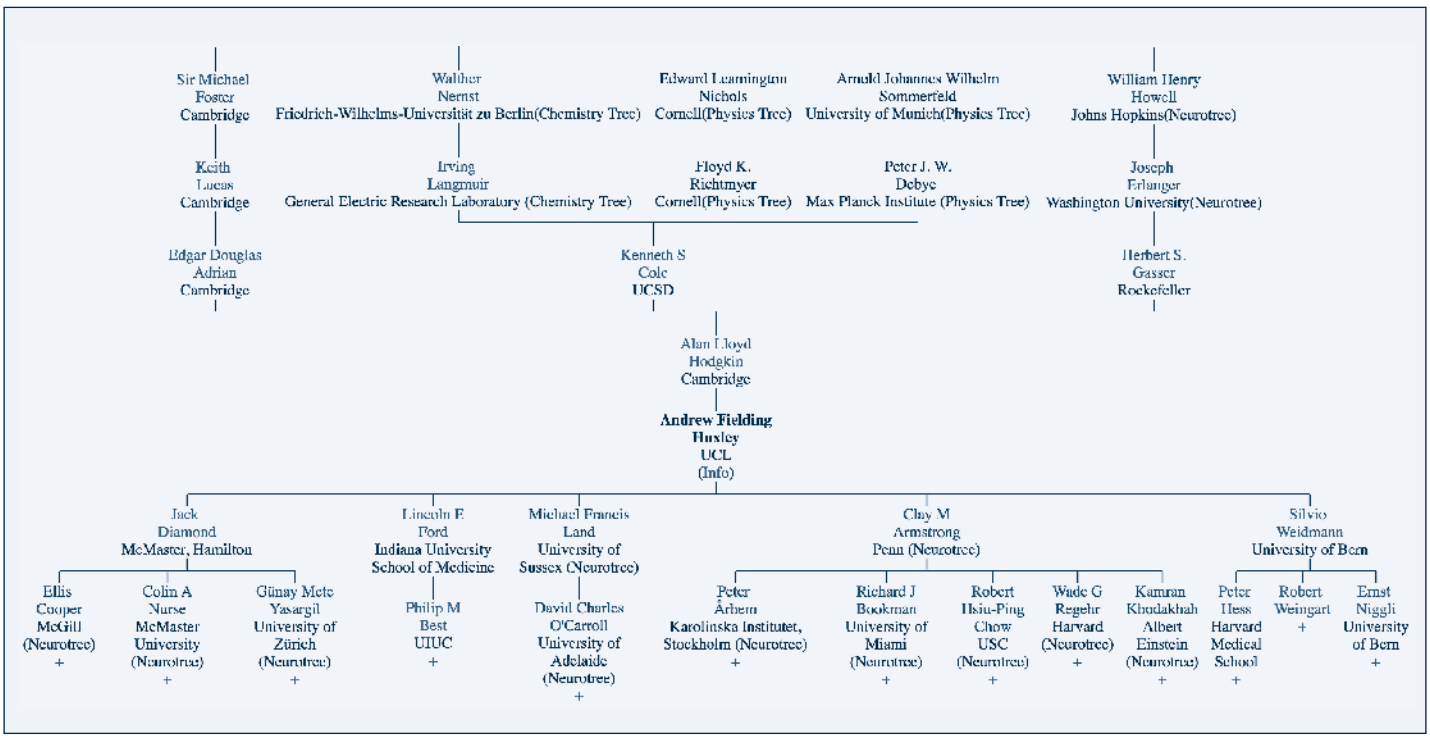
As trailed last year in Physiology News, the History & Archives Committee has initiated a Physiology Family Tree at the website academictree.org. Many will know that several academic disciplines already have trees on this website, many with roots and branches overlapping with Physiology, e.g. Neuroscience. The near-100 submissions from members received at Physiology 2014 have been entered on the website and we encourage members to now visit to add their own details. We had asked contributors at Physiology 2014, as a minimum: 'Who was your PhD supervisor? Who was their supervisor?' It was a surprise (to me) just how many colleagues were not immediately able to answer the second question. Apart from satisfying idle curiosity, these lineages certainly provide valuable insights into the spread of ideas and techniques through the linkages revealed. Below is just one version showing Andrew Huxley's lineage.

A closer look at this version of Huxley's tree (and the trees of others) shows that many have entered their details, or have been submitted by others, as 'children', even though they were actually collaborators. As a freely accessible and editable resource, Academictree.org has no firmly applied rules and the 'sociology' of this widespread approach is fascinating in itself.

As you explore the website, you will see that the information can be displayed in several different ways. Collaborations can be logged, as well as strict 'children and parent' relationships, together with photos, biographical details and links. In many cases, even the 'child-parent' relationship is complicated as a result of having multiple doctoral supervisors, or no conventional 'parents' for those who didn't take the now conventional PhD/DPhil path. Apart from the basic tree display, you can explore the Distance facility. By setting various criteria, this shows you who forms your links to anybody you specify in the tree, or even the distance to your nearest Nobel Prize winner.

The website is open-access and we warmly encourage you to register. Do ensure that you are working within the Physiology tree when you make new entries or edit existing ones. If you search for individuals, make sure you chose the 'all trees' option to avoid duplications. If you find somebody from your lineage within another tree, there are options to add them to Physiology, or from Physiology to another tree too; in that way, the roots and branches rapidly fill with little effort.

At this early stage we will be able to help with errors you might detect and to advise on problems, however the best idea is simply to explore academictree/physiology for yourself and watch the branches grow. We hope you will find this resource interesting, informative and entertaining.



Report from an undergraduate research placement

Siobhan Lister

University of Newcastle, UK

Professor Chollerton and Siobhan Lister

I am a third year undergraduate Biomedical Sciences student at Newcastle University, and decided to seek a research placement last summer. I thoroughly enjoyed my second year lectures on Cystic Fibrosis which were given by Dr Mike Gray, and realising that this life-limiting disease affects people of my age and younger, decided to approach him to see if he had a placement to offer. He agreed to supervise me, along with Dr Chris Ward and Dr Malcolm Brodlie. The Physiological Society was my main funder for this project and I received technical support from Dr Burns Verdon.

My project involved looking into the link between Gastro-oesophageal Reflux (GER from US spelling) and Cystic Fibrosis (CF) airways disease. CF patients are 6-8 times more likely to suffer from GER because of several mechanisms. A CF patient who suffers from GER will more likely require a bilateral lung transplant, but only 50-60% of patients survive 5 years post the transplant. Understanding the link between CF and GER may help prevent the need for a bilateral lung transplant and hence increase patient survival time.

To do this I studied the effects of some noxious 'reflux' agents (such as bile acids, pepsin and acid pH) on the properties of human airway epithelial cells expressing either normal CFTR or mutant CFTR, bearing the most common CF-causing mutation, F508del (CF). I then measured the effects of these reflux agents on epithelial barrier function, as well as intracellular Ca^{2+} and pH, two important intracellular parameters. Overall, my research showed the CF cells were more easily damaged by bile acids than normal cells, and the CF cells also showed different intracellular Ca^{2+} and pH responses to several of the reflux agents. As my placement only lasted 8 weeks, more research is required to fully understand the link between CF airways disease and GER, but my preliminary findings suggest further work in this area would be worthwhile.

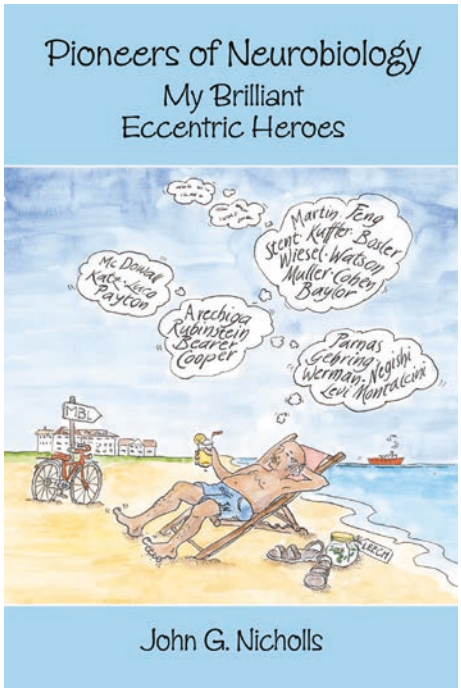
I also got the opportunity to take part in the Research Scholarships and Expeditions Poster Presentation at my university in November. With guidance from my supervisors, I produced a poster explaining my project and research findings. I presented my poster to many different people, including several 'judges', which was a really enjoyable experience. One judge commented 'I have been told to come to look at your poster as it is an example of what a poster should be', which greatly pleased me! After the poster presentation, there were 5 talks by fellow presenters and then it was time for the announcement of the winners. Out of the 112 posters to choose from, 9 commendations were read out in alphabetical order. I had hoped that my name would be read out but after it wasn't I told myself that I wasn't going to win anything. It was then that they announced the overall winner, and my name was read out. I couldn't believe they had just said my name. It wasn't until I heard a round of applause and the people next to me stood up so that I could go and receive my certificate that I realised I was the winner. I couldn't stop smiling, I was so happy, and so proud.

Undertaking this placement has confirmed that research is the career path I want to follow. I am currently applying for PhD studentships and I believe winning this competition can only stand me in good stead. I cannot thank my supervisors and The Physiological Society enough for giving me the opportunity to gain invaluable experience in research laboratory techniques.

Book review: Pioneers of Neurobiology: My Brilliant Eccentric Heroes by John G Nicholls

David Miller

History & Archives Committee,
The Physiological Society



Sinauer Associates, USA

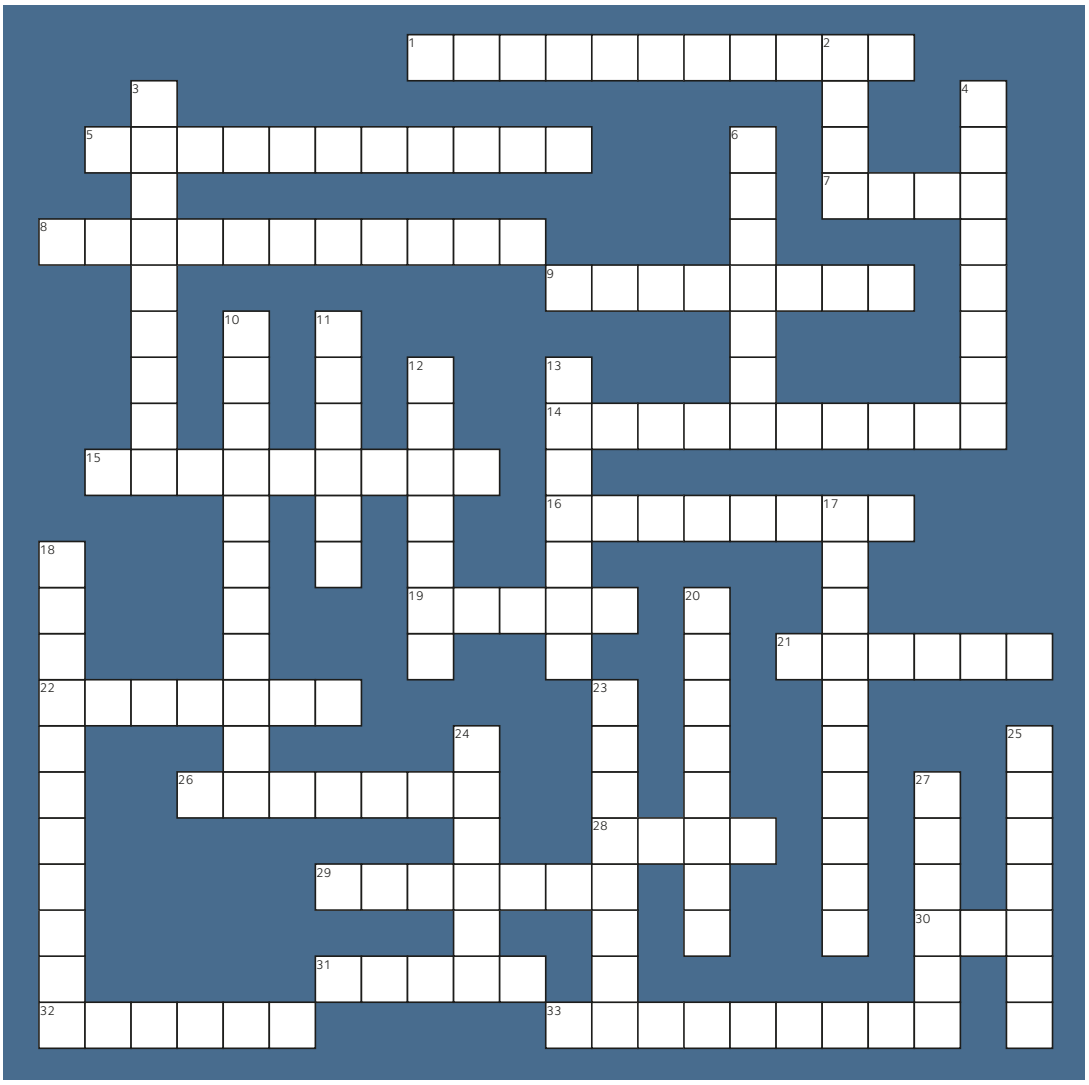
ISBN: 978-1-60535-325-8

John Nicholls' book is an unalloyed delight. It fills a niche in that it gives lay readers a great insight into the human side of science; research is done by real people, each with their own agenda, fancies and foibles. John has done a great service here in revealing the depth and breadth of 'characters' that inhabit the research world to which he himself has made such notable contributions. For those of us also in science, many will read this fine book and kick themselves for not having catalogued their own acquaintances and anecdotes. But really, John's cast of characters and stories will trump anything. He writes beautifully with a sense of wonder and pleasure at the strangeness that he has encountered in so many colleagues and collaborators, students and technicians. (Isn't it interesting that the only normal people in this mad world are John, you and me?). John's book displays his wonderful gift for writing.

Given how some folk come across, no shame or embarrassment is spared even for Nobel Prize winners, it's a relief that the characters emerge quite so well as they do. Find out about gambling in Reno with Itzhak Parnas, receiving pivotal career advice from Silke Bernhard in Basel, eating with Paul Fatt at a London 'greasy spoon' café, electronic wizardry as well as practical car mechanics with Bob Bosler, technician in Steve Kuffler's Baltimore lab, name-dropping with Hugo Arichiga in Mexico, or Pasko Rakic being car-jacked and then jailed in Boston. The sheer determination to overcome adversity, often politically imposed, displayed by the likes of Chang, Feng, Kostyuk, Vycklicky and other scientists is a lesson to all of us who enjoy the relatively 'soft' environment of an enlightened(?) western-world existence. I wonder how many of us would really stand up and 'be Charlie' if it came to it as several of John Nicholl's heroes have had to do?

All this and we find out that even Bernard Katz farted!

Easy neurophysiology crossword



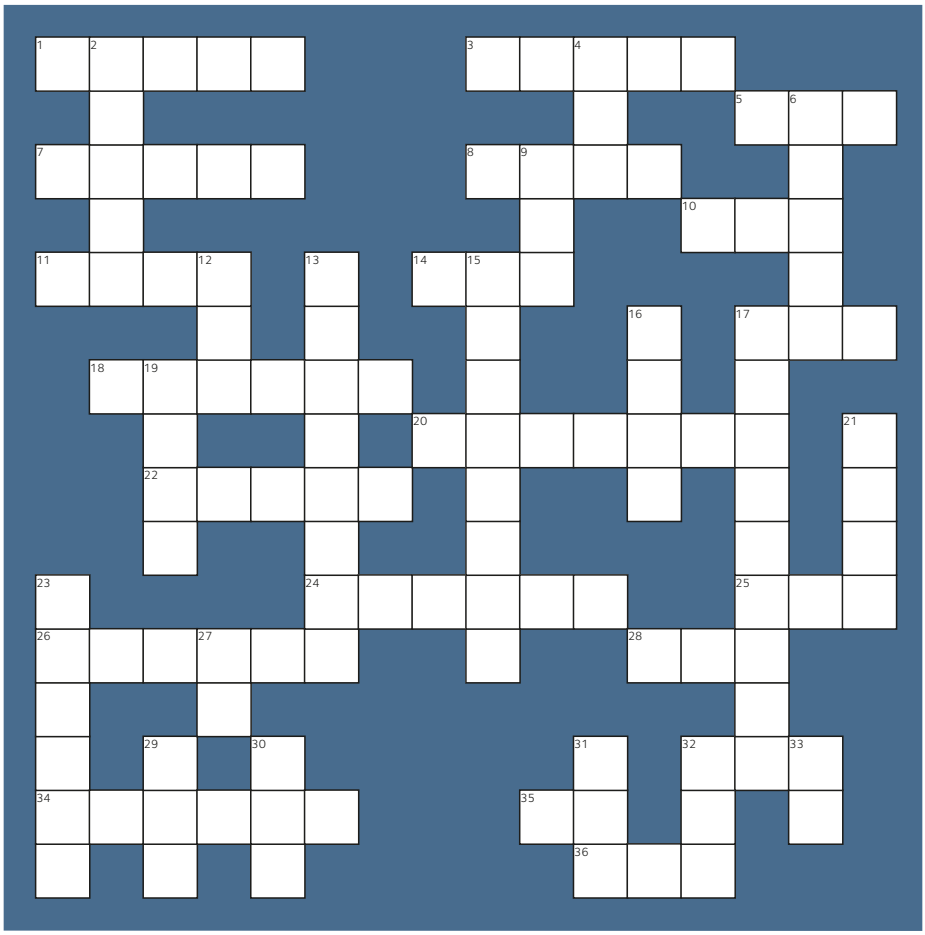
Across

1. Central concept of physiology (11)
5. Property of early tracer elements (11)
7. Primary calcium pump acronym (4)
8. Bringing together (11)
9. Low blood pH (8)
14. Fight or flight from near the kidney (10)
15. Inside cells surrounding organelles (9)
16. Has giant motor electrical synapses (8)
19. Wandering nerve (5)
21. Pumps out the blood (7)
26. Contains secretory products ((7)
28. Flow across membrane (4)
29. Suicide pill (7)
30. Chemical full of energy (3)
31. It carries blood from heart (4)
32. Nobel prize cake (6)
33. Nobel prize acetylcholine (9)

Down

2. Electrical sign of inhibition (4)
3. Conduction in fast nerves (9)
4. Period of filling (8)
5. Granules in pancreas (7)
10. large neurones studied by 32 (11)
11. Needed for fast nerves (6)
12. Downhill movement (7)
13. Bones and teeth (7)
17. Blocks glycine receptors (10)
18. Makes 30 (11)
20. Drives fluids along tubes (8)
23. Sensitises ryanodine receptors (8)
24. Devised the key equation (6)
25. Functional connection (7)
27. How Na pump is described by biochemists (6)

Expert cardiac physiology crossword



Across

1. Bump indicating atrial depolarization
3. Triangular flaps of a heart valve
5. Premature positive potential before full recovery
7. Rhythm indicating all is well
8. I came carrying blood
10. Caffeine is a pharmacological agent at these
11. Adrenoreceptor subtype
14. SCN1A encodes this
17. Elevations of this is visible in the jugular veins
18. 'Water on the lungs' is trapped by it.
20. Aminoethane sulfonic acid
22. The G form of this commonly forms filaments
24. It follows S but is before T.
25. QT interval is a measure of this
26. Also known as the Bowditch effect
28. Rare condition resulting from delayed repolarization
32. Absence of this makes the heart beat faster
34. It separates two chambers
35. Reject, not a laughing matter.
36. Liquorice is a pharmacological agent at these

Down

2. Location of Muamba's heart pain.
4. Gene encoding for natrium entry
6. The largest artery
9. Ventricular left-overs
12. Inhibitors of this are used to dilate blood vessels
13. Czech conductor
15. Ryanodine for example
16. Moving from 11 to 5 o'clock
17. Autoimmune fever causing damage to heart valves.
19. Helping hand for failling hearts
21. Latin prefex for of the heart
23. Cardiac test for athletes.
27. Loop for visualizing ventricular function
29. The fitter you are the fewer you have
30. Half moon sounds
31. Starling and Waller both used them
32. Vasodilator secreted by cardiac myocytes
33. SI scaling of Adagio, andante, vivace

Crossword solutions will be published in the next edition of *PN*

Physiological Reports

500 reports

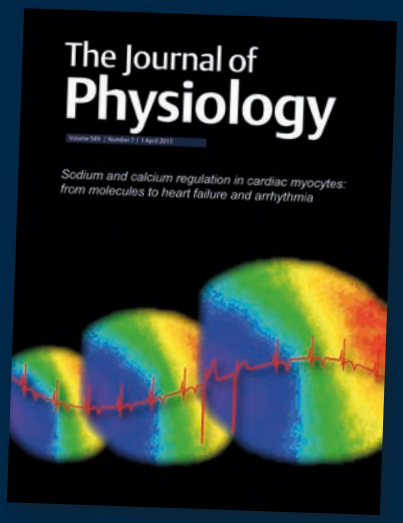
In January *Physiological Reports* (*PR*) published its 500th research paper.

As part of the commemoration of the admittance of women to The Physiological Society, *PR* produced a virtual issue highlighting articles with women authors selected by the Editor-in-Chief, Susan Wray, and the two female members of the Associate Editor team, Meena Rao and Larissa Shimoda.

To coincide with the 59th Annual Meeting of the Biophysical Society in Baltimore, *PR* produced a virtual issue entitled 'New Directions in Biophysics', highlighting articles published in this area. Deputy Editor-in-Chief, Thomas Kleyman selected the articles and also held a Meet the Editor session at the meeting itself.

The Journal of Physiology

Special issue dedicated to sodium and calcium in the heart



The 1 April issue of *The Journal of Physiology* is a special issue entitled 'Sodium and calcium regulation in cardiac myocytes: from molecules to heart failure and arrhythmia'. This issue was inspired by a very successful UC Davis Cardiovascular Symposium in February 2014. The symposium 'Systems Approach to Understanding Cardiac Excitation-Contraction Coupling and Arrhythmias - Na^+ channel and Na^+ transport' was organised by Reviewing Editor Don Bers, and provided the basis for the papers in the issue. Three positional 'White Papers' are included, as well as an In Memoriam for David Yue who sadly passed away in December 2014..

Meet the Editor – Kim Dora

To follow on from our successful series of interviews with our Consulting Editors, we are pleased to announce that more films will be coming in the near future. Our most recent film is with Reviewing Editor Kim Dora in which she talks about her research into vascular endothelial cell function. All our films are available at **www.physoc.org/journal-physiology-editor-interviews**

The Journal welcomes ideas for future filming prospects, so if you have some interesting research you'd like to feature, or a new lab technique that you'd like to share with your community, please get in touch with Managing Editor, Sally Howells **showells@physoc.org**

Experimental Physiology

PanAm-2014

Experimental Physiology supported symposia at the first Pan American conference of Physiological sciences last year in Brazil.

Reports are now published in with a video introduction by Rodigo del Rio at **ep.physoc.org**

Virtual Issues

To celebrate the centenary of Women members of the Physiological Society, *Experimental Physiology* have published two Virtual issues; *Women in Experimental Physiology 1915* & *Women in Experimental Physiology 2015*

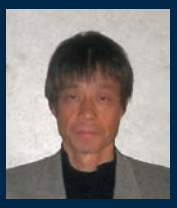
EB 2015 Boston

Experimental Physiology is supporting the following Featured topic at Experimental Biology 2015 – **Sex Hormone Effects on Autonomic and Endothelial Function** organised by Nina Stachenfeld on Tuesday 31 March 10.30-12.30 in Room 190 – And will publish Reviews following the Meeting.

An Editor's choice Virtual issue of selected articles from 2014 will be made freely accessible to EB Meeting delegates. Read it and other Virtual issues at **ep.physoc.org**

New Experimental Physiology Editors for 2015

Ken D. O'Halloran is Professor of Physiology at University College Cork, Ireland. He undertook BSc and PhD degrees in Physiology in Ireland, followed by postdoctoral training in the USA principally at the University of Wisconsin – Madison. His major research interest is the control of breathing in health and disease. The current focus of his laboratory is the study, in translational animal models, of adaptive and maladaptive processes underpinning respiratory muscle and motor neurone plasticity in the context of exposure to chronic hypoxia. Ken is a Trustee of The Physiological Society and is the current Meetings Secretary.



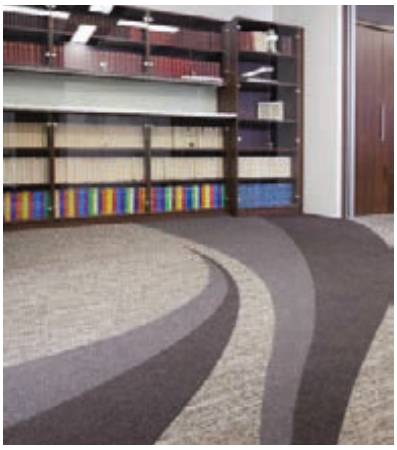
Shigehiko Ogoh is Professor in the Department of Biomedical Engineering at Toyo University, Saitama, Japan. He obtained a Ph.D. in Human and Environmental Studies from Kyoto University. Following his Ph.D., he completed a Postdoctoral Fellowship in the Department of Integrative Physiology, the University of North Texas Health Science Center in Fort Worth, Texas, USA studying the arterial and cardiopulmonary baroreflex function at rest and during exercise in humans. His current research focuses on the mechanisms of cerebrovascular regulation and the interaction between cerebral circulation, respiratory and cardiovascular systems.

Dr Thyfault received a PhD from the University of Kansas in Exercise Physiology in 2002 and then went on to postdoctoral training focused on skeletal muscle metabolism at East Carolina University from 2002-2005. Dr Thyfault has been faculty at University of Missouri in the Departments of Nutrition and Exercise Physiology and Medicine-Division of Gastroenterology and Hepatology since 2005. He also has a joint appointment at the Harry S Truman Memorial VA Hospital as a Health Scientist. The broad theme of his research is on the regulation of glucose and lipid metabolism by physical activity and fitness. More specifically his lab is focused on 3 primary areas: 1) the links between fatty liver, hepatic mitochondrial dysfunction, and low aerobic fitness and the role that PGC-1a may be playing in this process, 2) the role of physical activity and inactivity to modulate insulin stimulated blood flow and glycemic control, and 3) the impact of statins to negatively impact exercise adaptations.

Andrew Trafford is currently a British Heart Foundation Senior Non-Clinical Research Fellow at The University of Manchester and Professor of Cardiac Pathophysiology. He obtained a degree in Veterinary Science from The University of Liverpool and after a short period in equine and small animal practice in Staffordshire returned to The University of Liverpool to undertake a PhD in cardiac physiology. He moved to The University of Manchester in 1999 as a non-clinical lecturer in the then Department of Medicine. His research interests focus on excitation contraction coupling and arrhythmia mechanisms in the heart with a particular emphasis on the role of perturbed calcium homeostasis in disease settings.





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